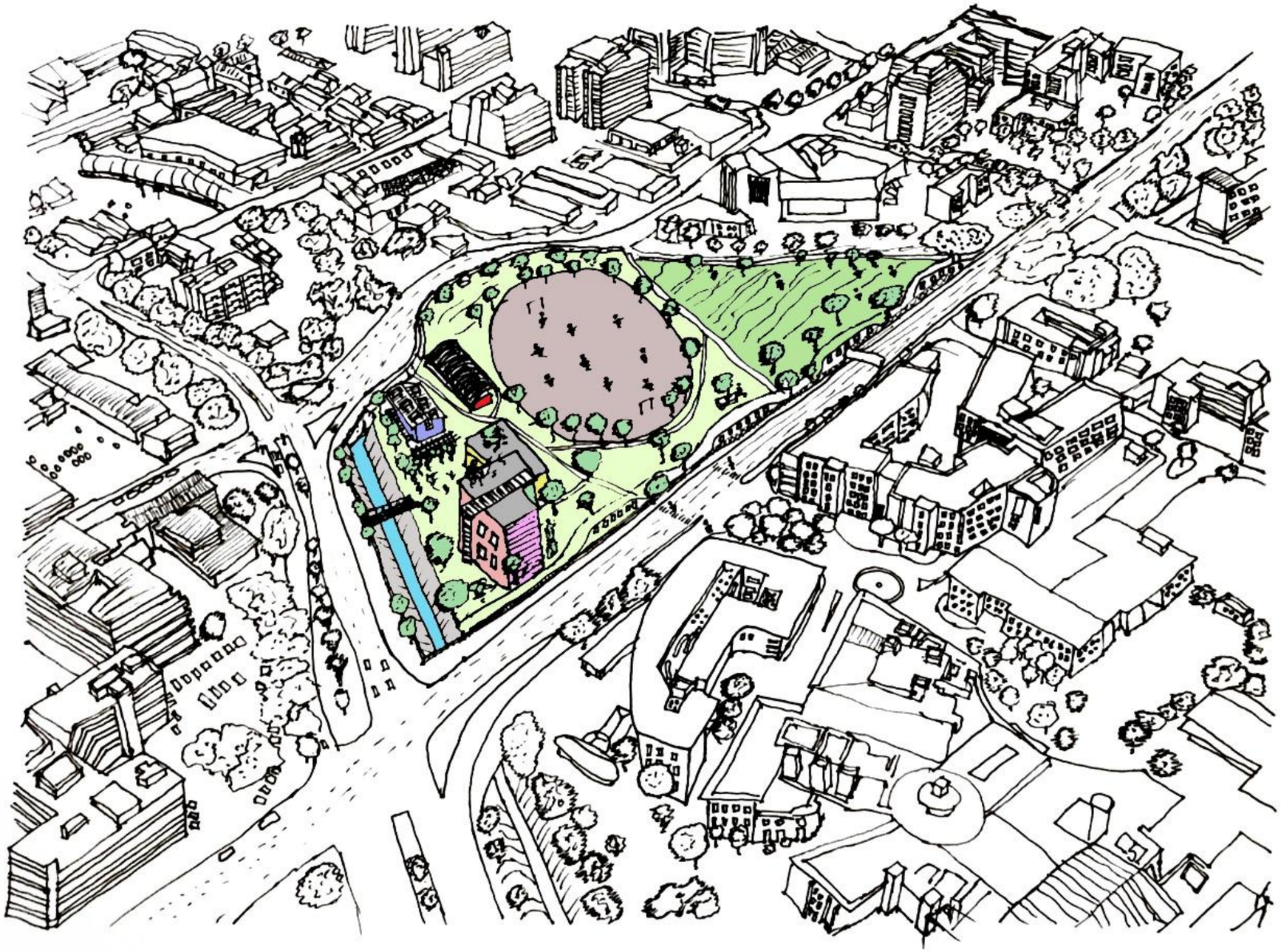
UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Revitalisation of the Caledonian Sports Ground: A Green TVET and Community Hub for Sustainable Engagement



McClay Thikusho
u24028356

Supervisor:
Abrie Vermeulen

M. Arch (Prof) 2024

DPD801

ABSTRACT

The "Revitalisation of the Caledonian Sports Ground: A Green TVET and Community Hub for Sustainable Engagement" is a versatile initiative with the primary goal of establishing a grassroots hub for community engagement and sustainable development. This project aims to breathe new life into the historic Caledonian sports ground located in Arcadia, Tshwane, South Africa, these sports grounds boast over a century of sports heritage but is currently in a state of neglect. The revitalisation proposal will feature diverse programmes, such as youth sports, the establishment of community gardens, and the development of an urban recreational park. This dissertation will focus on the development of a Green Technical and Vocational Education and Training (TVET) centre. The intention of the TVET centre is to act as the urban catalyst from which complementary programmes may be supported.

The Green TVET centre will be designed to provide practical and theoretical training in sustainable building practices, renewable energy technology, environmental management, water management, green technology and innovation, green business and entrepreneurship, and climate change adaptation and mitigation. This initiative simultaneously aims to help address South Africa's significant issue of high youth unemployment by equipping young, unemployed individuals and the homeless population with essential green skills that open pathways to future employment in the growing green economic sector. By prioritising green skill development, the project positioned to align with national sustainability goals and promotes long-term economic resilience and empowerment.

The principles of biophilia are seamlessly integrated into the design to foster a harmonious relationship between people and nature. The Green TVET centre incorporates biophilic elements such as ample natural light, indoor greenery, and visual connections to nature, creating a calm and conducive learning environment. Sustainable materials and eco-friendly construction further enhance the experience, supporting well-being and focus.

The youth sports field preserves the legacy of the site as a place of athletic and communal activity while integrating natural boundaries, shaded seating areas, and rest spaces. The community garden complements the Green TVET by offering a space for local vendors and training in sustainable farming practices. The park serves as a recreational space with shaded pockets for community relaxation.

Connecting pathways throughout the site ensure smooth transitions and interactions between the different spaces, inviting exploration and fostering community cohesion. The entire site aspires to be a green oasis for the neighbourhood as a tranquil, nature-integrated environment that enriches the quality of life for users while championing sustainability and community resilience.

The proposal envisions the revitalisation of the Caledonian sports ground as a beacon of sustainable development, rooted in community education and economic growth.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table of Contents

Table of Figures

BACKGROUND

CALEDONIAN SPORTS GROUND: Heritage. Tradition. dynamism.

The Caledonian Sports Ground, located in the southern part of Arcadia and bordering Sunnyside in Tshwane, is a historic site that dates back to its establishment on August 31st, 1888 (Crawford, 1888).

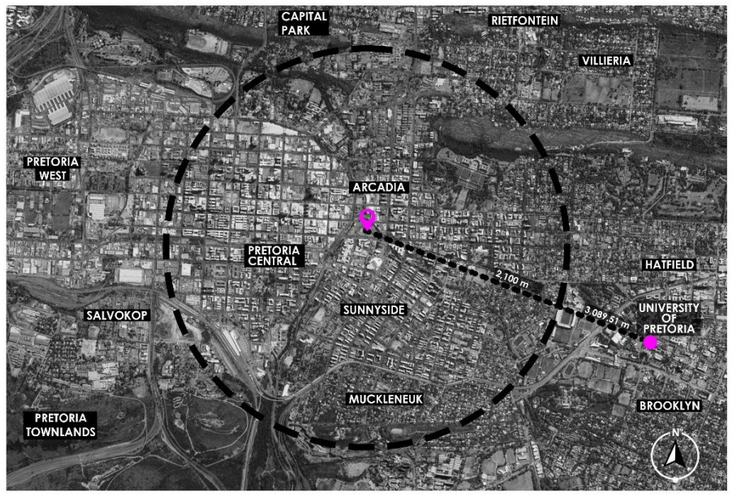


Figure 1: Site location (Author,2024).

For over a century, the Caledonian Sports Grounds served as a prominent sports and recreational hub in Tshwane's Central Business District (CBD). The site originally included a central swimming pool (now demolished) and a combined sports field and recreational park. While soccer became the primary activity over the past 60 years, the grounds historically hosted various sports such as rugby, cricket, athletics, bowls, netball, hockey, greyhound racing, and community celebrations (Vlok, 1955: 236). Initially owned by Sir John Wessels and Mr. Esselen in 1894, the property was purchased by the Pretoria Municipality in 1916 for £8,500, aimed at providing public sports and recreational facilities (Vlok, 1955: 237).

In the 1950s, the grounds were transformed into a dedicated soccer stadium, becoming the home of the Arcadia Shepherds (Vlok, 1955: 240). This club significantly contributed to the development of professional sports in South Africa. Established in 1903 by a group of 30 young individuals inspired by British soldiers playing soccer, the Arcadia Shepherds rose to prominence when sports in the country became professionalised in the 1960s, becoming the first professional soccer team (Bolsmann, 2010: 30). Their status attracted a large following, including over 2,000 non-European fans who were allowed to attend matches for free in a designated fenced-off area. This inclusive practice ended in 1965 when government restrictions barred non-European spectators from professional sports events unless specifically authorised by the Department of Community Development. This policy led to a steep decline in the club's support base (Bolsmann, 2010: 36).

By the 1970s, Arcadia Shepherds had become one of the wealthiest soccer clubs in South Africa, notably after their remarkable performance in 1973 when they won the Coca-Cola Shield, the Castle Cup, and the Embassy Cup (Bolsmann, 2010: 44). The club championed inclusivity, asserting that players should be selected based on skill, regardless of race. In February 1977, Vincent Julius broke racial barriers by becoming the first non-European to play in a "whites-only" league, a significant move toward equality in sports (Bolsmann & Alegi, 2010: 5). This development rekindled enthusiasm among non-European fans, who resorted to climbing nearby trees to watch matches. The government's response was to cut down the trees, which led to Arcadia Shepherds being banned from using the Caledonian Stadium for nine years, starting on July 1, 1977 (Bolsmann, 2010).

By 2016, in anticipation of the municipal elections, discussions arose regarding the demolition of the stadium and its transformation into a multi-purpose park. Initial construction efforts began with the demolition of several existing structures; however, the work was suddenly halted, leaving the site abandoned and in a demolished state of disrepair. Changing political and governance dynamics contributed to a decline in attention to the site, allowing it to deteriorate further over time (IOL, 2023).

As of 2024, the Caledonian Sports Grounds remains abandoned, frustrating many in the community who remember it as a lively venue now reduced to a neglected, derelict space (Daily Sun, 2024).

Figure 2: Heritage analysis (Author,2024).

TSHWANE'S 2055 REGENERATIVE VISION

The impact of apartheid, in South Africa has had an influence on how cities have evolved and become segregated over time (Bhattacharya, 2010). A consequence of which has led to the isolation Pretoria Central Business District (CBD). The vision outlined in Tshwane's 2055 vision aims to introduce innovative principles that promote the regeneration of a resilient city.

The plan sets forth a goal for the City of Tshwane to be recognised as a liveable, resilient, and inclusive space where residents enjoy a high quality of life and have access to social, economic, and political freedoms. The residents to also play a major role, in shaping the future of this African capital city (City of Tshwane, 2015).

One of the primary objectives of the Tshwane Vision 2055 is to establish the city as "The African City of Excellence." The Spatial Reform Agenda highlights the significance of the Inner City as the point from which different development nodes will emerge and grow. The city aims to allocate infrastructure funding, towards these nodes to boost growth in the Inner City (City of Tshwane, 2015).

The Tshwane Inner City Regeneration Strategy aims to achieve this vision by concentrating national government department headquarters within a Government Estate, creating a high-quality and visually appealing urban environment. This initiative aligns with Vision 2055's **Outcome 3**: "A city with quality infrastructure development that supports liveable communities."

Included in the strategy is creating **public spaces, parks and social facilities** within the government estate to enhance the quality of the environment for the inner-city users and residence.

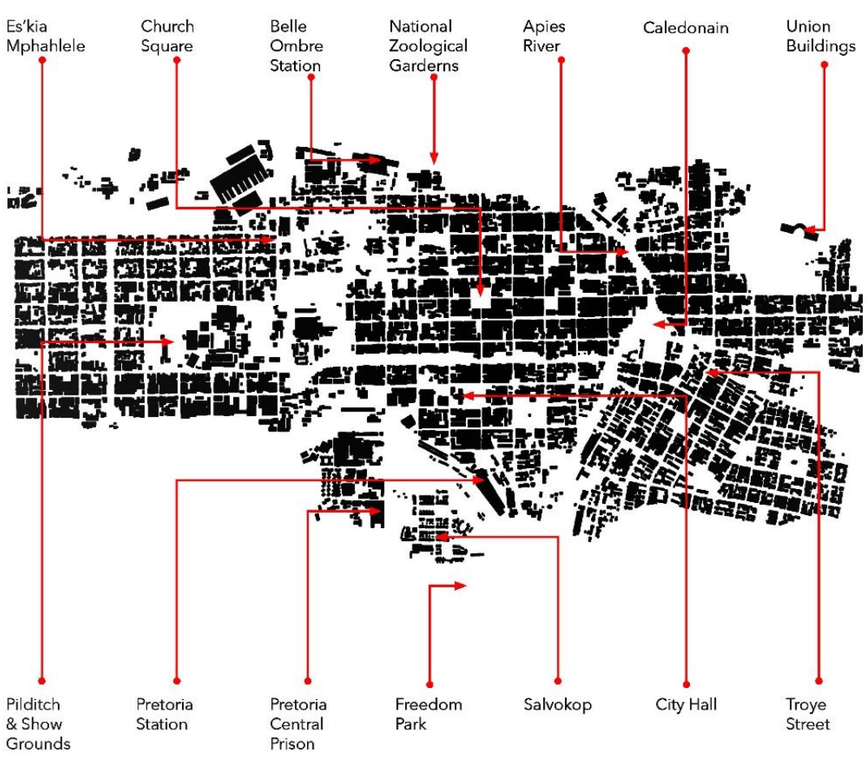


Figure 3: Map of Key Points of Interest in Tshwane's Vision 2055 (Author, 2024)

Figure 4: Government boulevard (Newla, 2017).

The Government Boulevard - Stretching along Paul Kruger Street from Pretoria Station to the National Zoological Gardens, the Government Boulevard is home to the largest concentration of governmental offices in the city. This thoroughfare exudes a formal and dignified atmosphere, prioritising pedestrian access and public transport (Newla, 2017).

Key public squares along the boulevard include Zoo Square, Synagogue Square, Church Square, City Hall Square, and Station Square. Additionally, the Northern Gateway features gateway parks that enhance the overall environment of the boulevard (Newla, 2017).

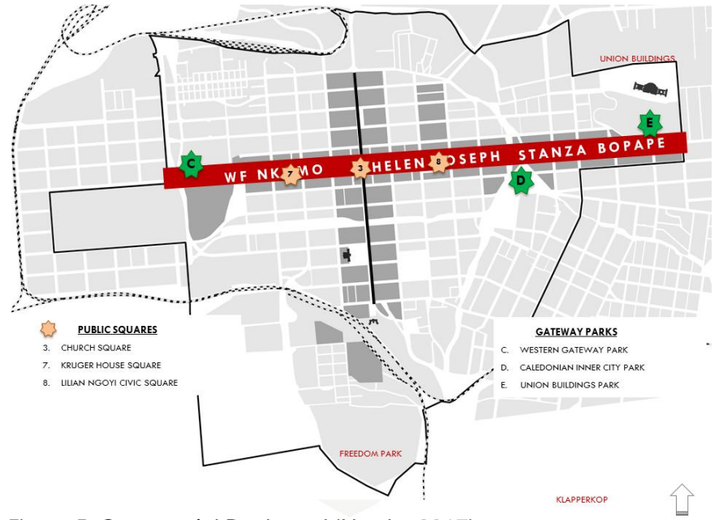


Figure 5: Ceremonial Boulevard (Newla, 2017).

The Ceremonial Boulevard - Running along WF Nkomo, Helen Joseph, and Stanza Bopape Streets from E'skia Mphahlele Drive to the Union Buildings, the Ceremonial Boulevard features a significant concentration of government functions (Newla, 2017).

Prominent squares located along this boulevard include Church Square, Kruger House Square, and Lilian Ngoyi Square. Additionally, gateway parks are situated at Heroes' Acre in the west and at the Union Buildings, with Caledonian Inner-City Park located to the east (Newla, 2017).

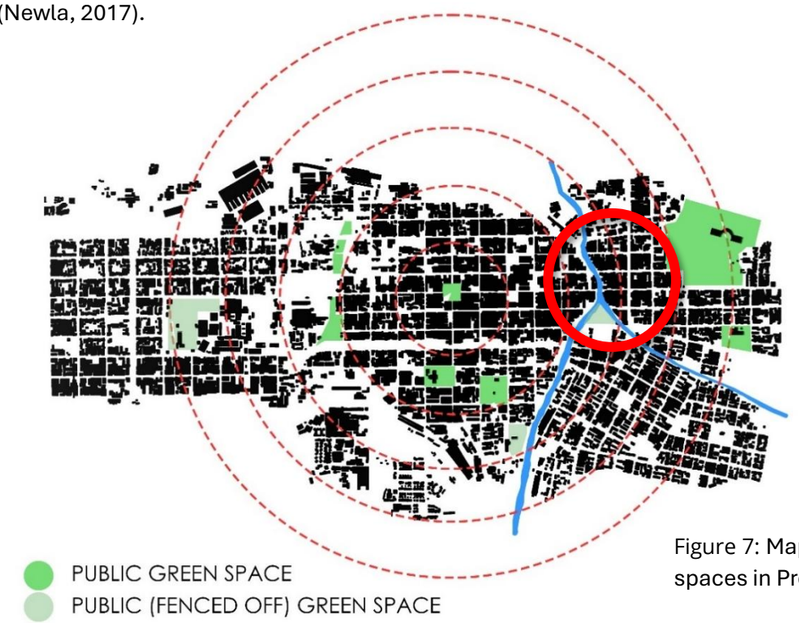
Figure 6: Map of Tshwane's 2055 vision (Newla, 2017).

Northern Gateway Precinct: Situated at the northern end of Government Boulevard (Paul Kruger Street), between Boom and Struben Streets, this precinct is planned to accommodate a cluster of government department headquarters within two prominent, tall buildings (Newla, 2017).

Civic Precinct: Located between Lilian Ngoyi, Sisulu, Bloed, and Pretorius Streets, this area will host a variety of civic facilities, including Tshwane House, the State Theatre, and the Lilian Ngoyi Women's Museum (Newla, 2017).

Caledonian Precinct: Cantered around Caledonian sports ground and bounded by Francis Baard, Helen Joseph, Steve Biko, and Du Toit Streets, this precinct is designated for an economic cluster of government departments (Newla, 2017).

Nelson Mandela Boulevard and Green Corridor: Extending along Nelson Mandela Drive and following the Apies River, this corridor spans the entire length of the Inner City, serving as a significant gateway into the city centre (Newla, 2017).



The Caledonian grounds is one of the last remaining open spaces in the city.

Figure 7: Map of green and recreational spaces in Pretoria (Author, 2024)

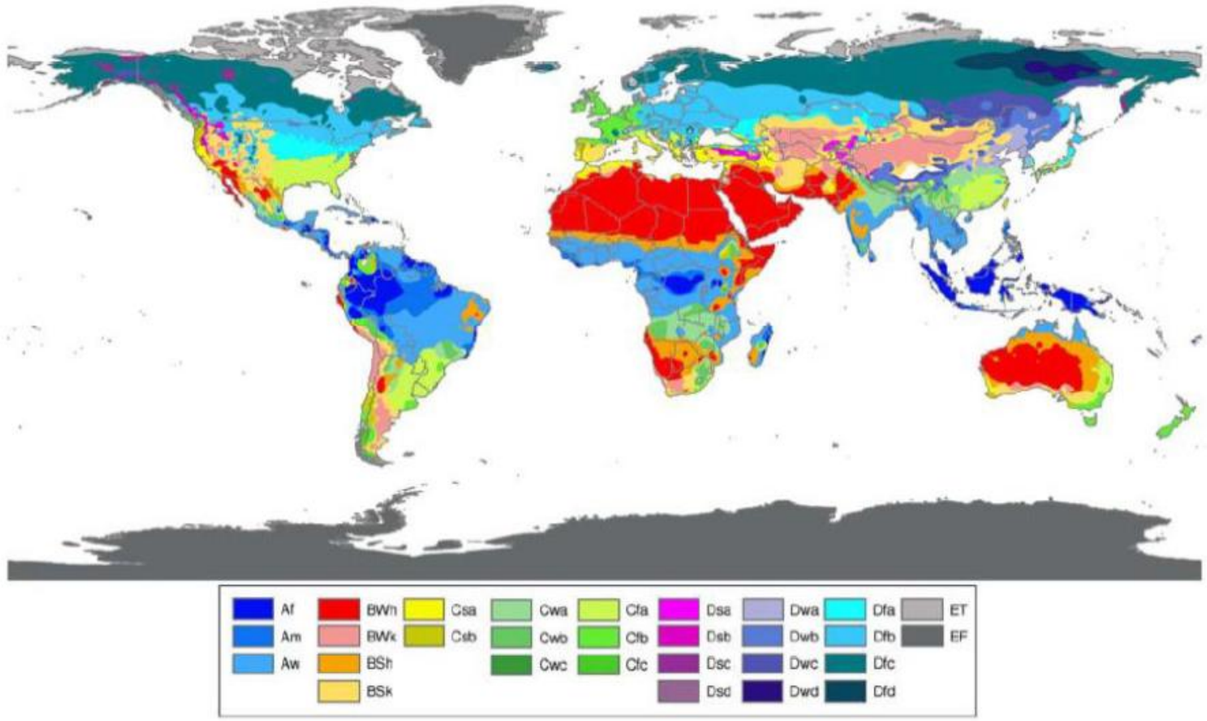


Figure 8: Köppen-Geiger climate classification of all regions (Peel et al., 2007).

The changing climatic conditions is a reality, and it is actively taking place. To live comfortably in buildings and urban areas it is imperative to adapt to climate adaptation technologies to decrease high temperatures thereby benefiting public health (Arellano & Roca, 2022).

As a result of the obstacles stemming from the changing climatic conditions, this study will investigate building technologies that can be utilised as an adaptation strategy towards the changing climatic conditions to enhance capacity for adapting to the changing climates and enhancing the ability of buildings to effectively regulate temperature particularly in Tshwane, South Africa. To get climatic conditions from various regions around the world that are similar to Tshwane's climatic conditions, the Köppen Geiger climate classification system is used. The Köppen Geiger classification system is used to group regions with similar climates together and offers insights into the types of building technologies that can be employed to enhance the thermal adaptability of buildings in Tshwane, South Africa as depicted in the figure above. It is a widely used method to categorise climates based on temperature, precipitation and vegetation characteristics.

This system groups the world's climates into five categories, namely:

Tropical - A

Arid – B

Temperate – C

Cold – D

Polar - E

Each group further subdivided into specific subcategories as displayed in the figure below (Peel et al., 2007).

1st	2nd	3rd	Description	Criteria*
A			Tropical	$T_{cold} \geq 18$
	f		- Rainforest	$P_{dry} \geq 60$
	m		- Monsoon	Not (Af) & $P_{dry} \geq 100 - MAP/25$
	w		- Savannah	Not (Af) & $P_{dry} < 100 - MAP/25$
B			Arid	$MAP < 10 \times P_{threshold}$
	W		- Desert	$MAP < 5 \times P_{threshold}$
	S		- Steppe	$MAP \geq 5 \times P_{threshold}$
		h	- Hot	$MAT \geq 18$
		k	- Cold	$MAT < 18$
C			Temperate	$T_{hot} > 10$ & $0 < T_{cold} < 18$
	s		- Dry Summer	$P_{sdry} < 40$ & $P_{sdry} < P_{wwet}/3$
	w		- Dry Winter	$P_{wdry} < P_{swet}/10$
	f		- Without dry season	Not (Cs) or (Cw)
		a	- Hot Summer	$T_{hot} \geq 22$
		b	- Warm Summer	Not (a) & $T_{mon10} \geq 4$
		c	- Cold Summer	Not (a or b) & $1 \leq T_{mon10} < 4$
D			Cold	$T_{hot} > 10$ & $T_{cold} \leq 0$
	s		- Dry Summer	$P_{sdry} < 40$ & $P_{sdry} < P_{wwet}/3$
	w		- Dry Winter	$P_{wdry} < P_{swet}/10$
	f		- Without dry season	Not (Ds) or (Dw)
		a	- Hot Summer	$T_{hot} \geq 22$
		b	- Warm Summer	Not (a) & $T_{mon10} \geq 4$
		c	- Cold Summer	Not (a, b or d)
		d	- Very Cold Winter	Not (a or b) & $T_{cold} < -38$
E			Polar	$T_{hot} < 10$
	T		- Tundra	$T_{hot} > 0$
	F		- Frost	$T_{hot} \leq 0$

Figure 9: Climate classification criteria (Peel et al., 2007).

Current and Projected Climate Classifications:

THE PRESENT CLIMATE

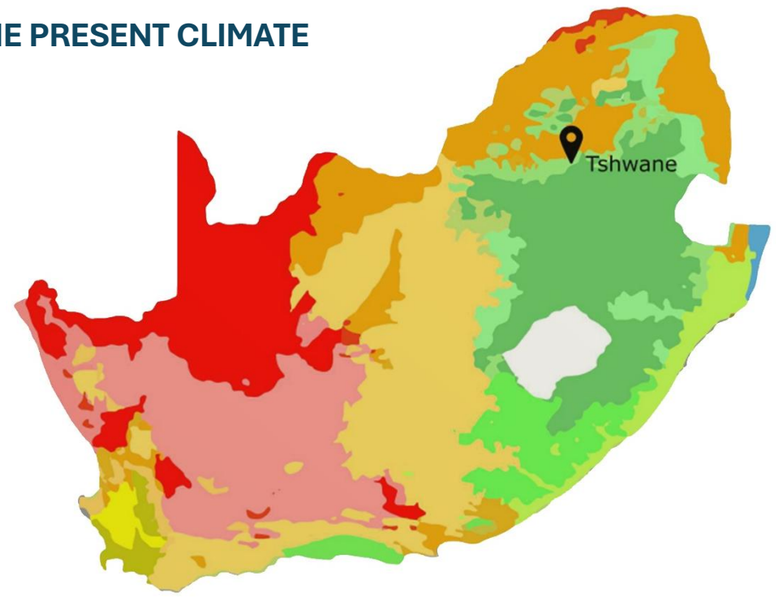


Figure 10: Cwa, Köppen Geiger Climate classification map of South Africa (Peel et al., 2007).

(i) Cwa - (Dry winter, hot summer subtropical)

The Cwa climate classification, noted by the Köppen Geiger system, represents climatic conditions found in regions like Tshwane South Africa, characterised by dry winters and hot subtropical summers. This classification signifies a climate distinguished by moist summers along with arid winters typically receiving approximately 1,500 mm in yearly rainfall of (Bueno et al., 2016). Regions categorised under Cwa encounter changes show significant variations between summer and winter conditions. The Cwa climate type is commonly linked to characteristics indicating moderate temperature ranges throughout the year (Bueno et al., 2016).

Researchers have utilised the Cwa climate classification in studies related to agriculture, environmental science and climatology. Understanding the conditions associated with the Cwa classification is crucial for evaluating agricultural productivity, water resource management strategies and ecosystem dynamics in regions marked by this particular climate type. The classification of Cwa offers insights into temperature and precipitation trends that impact the overall environmental circumstances in different regions (Bueno et al., 2016).

The Cwa climate classification is crucial, for identifying areas with climates marked by dry winters and warm summers. Through the Köppen Geiger classification system, study patterns, leading to an understanding of improved insights into environmental dynamics and reactions in regions classified as Cwa.

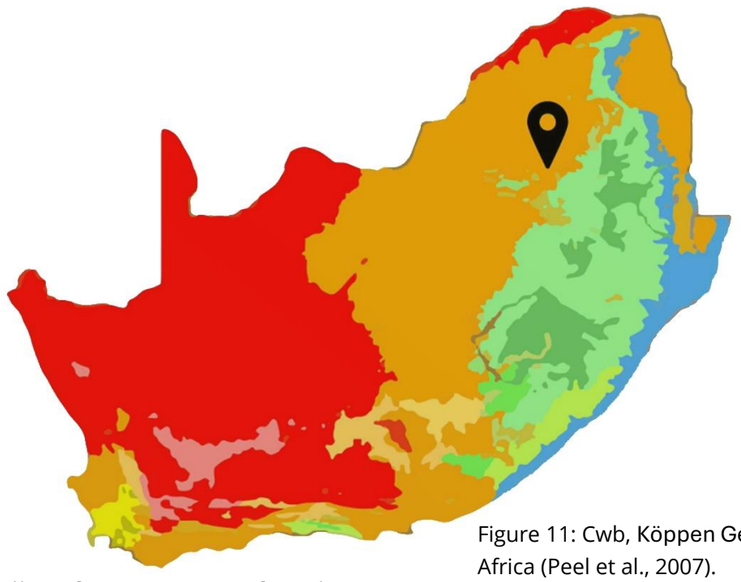


Figure 11: Cwb, Köppen Geiger Climate classification map of South Africa (Peel et al., 2007).

(ii) Cwb - (temperate dry winter, warm summer)

Climates associated with Cwb climate classification, as stipulated by the Köppen-Geiger climate classification system, signifies a temperate dry winter, warm summer. This classification points to regions known for temperatures and distinct seasons with cold and dry winters alongside relatively warm summers, which are characteristics found in the City of Johannesburg. The Cwb climate category is linked to regions that experience a contrast between winter and summer conditions with varying levels of precipitation throughout the year (Mello et al., 2012).

Researchers have utilised the Cwb climate classification in studies related to agriculture, hydrology and environmental science. Grasping the traits associated with the Cwb classification is crucial for evaluating water availability, agricultural methods and ecosystem dynamics in regions falling under this climate type. The categorisation of Cwb offers insights into temperature and precipitation trends that impact soil characteristics, plant growth and overall environmental conditions in different regions (Mello et al., 2012).

The Cwb climate classification plays an important role in identifying regions characterised by temperate climates featuring dry winters. Using the Köppen Geiger system allows researchers to categorise and study conditions, which helps enhance our knowledge in different sustainability initiatives, in different regions identified as Cwb.

THE FUTURE CLIMATE

(iii) Bsh - (hot semi-arid climate)

The BSh climate classification represents a hot semi-arid climate which is associated with warm temperatures with limited precipitation. This classification indicates regions with distinct seasonal variations, featuring dry and hot conditions, especially in summer. The BSh climate type is associated with areas that experience arid to semi-arid conditions, with moderate temperature ranges and low humidity levels (Filho et al., 2020).

Researchers have utilised the BSh climate classification in various environmental science studies. Understanding the specific climatic characteristics associated with the BSh classification is essential for assessing water availability, crop suitability, and ecological dynamics in regions classified under the Bsh climate classification (Filho et al., 2020). The classification of BSh provides valuable insights into the temperature and precipitation patterns that influence land use, vegetation distribution, and overall environmental conditions in these regions (Filho et al., 2020).

The climate categorised by BSh provides valuable insight into categorising regions with hot semi-arid climates characterised by limited rainfall and warm temperatures. By utilising the Köppen-Geiger system, researchers can effectively classify and analyse climatic conditions, contributing to a better understanding of ecosystem responses in areas classified as BSh.

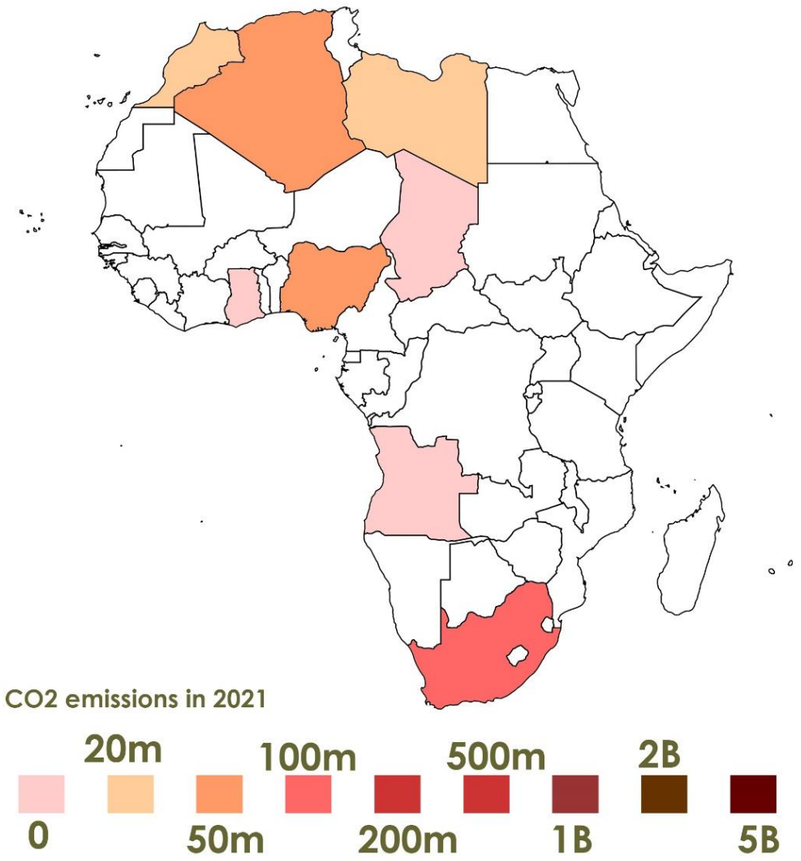


Figure 12: CO2 emissions in 2021 (AJLab, 2023).

As shown in the map above, South Africa is the largest carbon emitter on the African continent, which is a sobering reality. This highlights just how important it is for the country to rethink its approach to growth and sustainability. One of the most promising ways forward is by focusing on the green economy. By creating green jobs and equipping people with the skills needed for this transition, South Africa has a real chance to reduce its carbon footprint while still growing its economy. This is not just about meeting global climate goals, it is about ensuring a healthier, more sustainable future for all South Africans.

The challenges are significant, but so are the opportunities to reshape the country's path in a way that benefits both people and the planet.

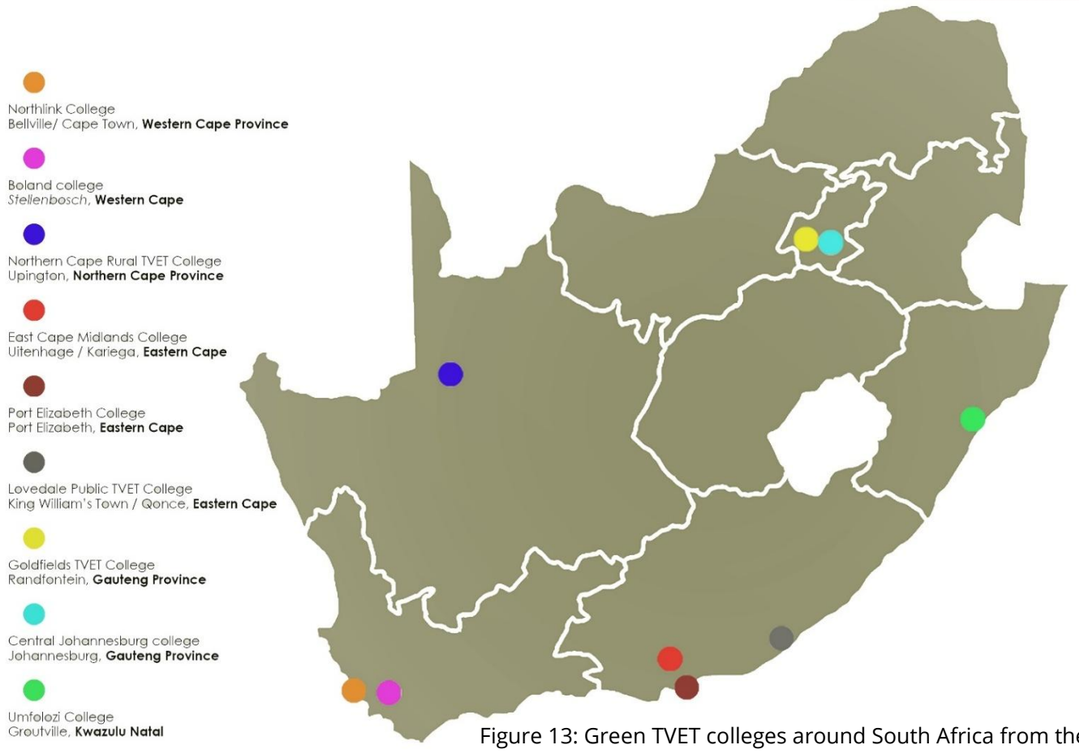


Figure 13: Green TVET colleges around South Africa from the greening of TVET colleges initiative (Author, 2024).

The Greening of TVET Colleges in South Africa

The "Greening of TVET Colleges" initiative is an inspiring effort to transform South Africa's Technical and Vocational Education and Training (TVET) colleges into environmentally sustainable institutions. This program, which began in May 2013, reflects a commitment to fostering green environments within these colleges depicted above in figure 9 while addressing the broader challenges of climate change and environmental preservation.

The initiative focuses on integrating green principles into college operations, policies, and training programs. It encourages these institutions to lead by example, reducing their carbon footprints while equipping students with the skills and knowledge necessary to contribute to the green economic sector. The colleges are also extending their impact beyond their campuses, engaging with local communities and businesses to promote sustainability through green projects and train-the-trainer programs.

This project, a collaboration between GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit/ the German development agency), South Africa's Department of Higher Education and Training, and the Department of Environment affairs, underscores the importance of building a skilled workforce for a greener future. With projections estimating that the green economy could create over 450,000 jobs by 2030, such initiatives are critical for both environmental and economic sustainability.

The nine TVET colleges currently participating in the pilot phase of the initiative are spread across the country, reflecting a national commitment to greening efforts. These colleges are not only shaping the mindset of their students but are also influencing their surrounding communities, fostering a culture of environmental care that South Africa needs for a sustainable future.

Figure 14: Unemployed Youth Sketch (Author, 2024).

This presents an opportunity to revitalise the Caledonian Sports Ground, restoring it to its former prominence while honouring its historical significance. At the same time, this revitalisation can address critical contemporary challenges in South Africa, including high **youth unemployment and homelessness** (Stats SA, 2024). Although homelessness is driven by various factors such as **substance abuse, mental health challenges, rising housing costs, lack of affordable housing, social exclusion, domestic violence, and family breakdowns etc.** This project focuses on supporting homeless individuals specifically impacted by **poverty and unemployment**. These issues provide the need to consider expanding into the green economic sector, providing unemployed youth and homeless individuals with skills that can lead to sustainable, green job opportunities (Stanef-Puică,, et al., 2022).

Establishing a Green Technical and Vocational Education and Training (TVET) centre becomes essential in this context. Embracing the green sector is a strategic initiative for South Africa, given that it currently leads in carbon emissions in Africa (Statista, 2021), as illustrated by figure 8 below.

The sites proximity, near areas where street vendors gather on Robert Sibukwe Street and Church Street, offering an opportunity to grow vegetables onsite which could boost the local economy and encourage community involvement.

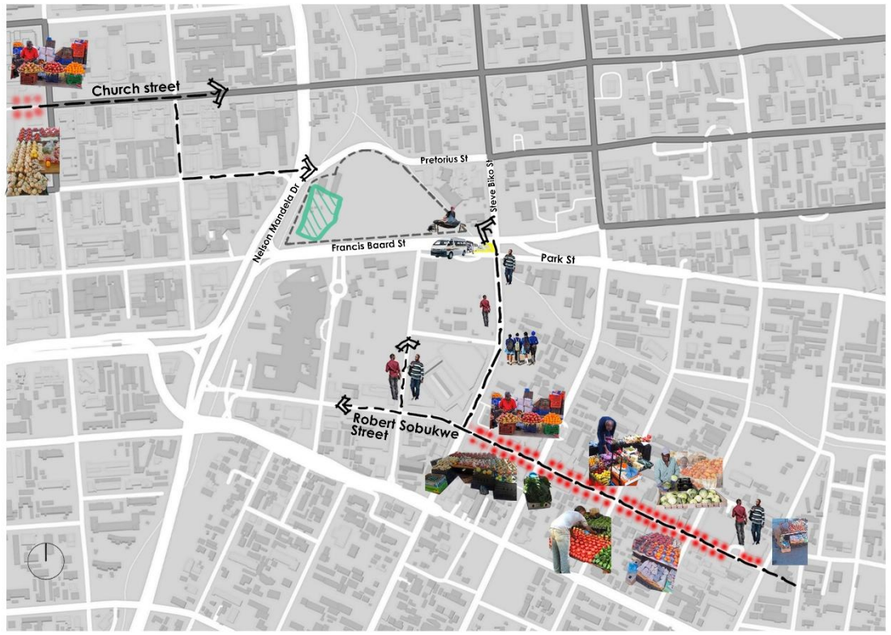


Figure 15: Vendors along Robert Sobukwe Street and Church Street (Author,

Figure 16: Community garden work (Author, 2024).

PROJECT BRIEF

The project envisions a phased implementation of an urban framework which is aligned with the Tshwane's Vision 2055, specifically supporting the city's objectives of creating public spaces, parks, and social facilities. This urban framework facilitates a comprehensive and holistic approach to economic upliftment and revitalising the surrounding context. The site was selected for its strategic position and potential to become a central hub for community engagement and development, offering a serene and inviting space for residents to connect with nature and each other.

Integrating a Green TVET within the site has the potential to empower unemployed youth by equipping them with the necessary green skills, that can help them grow in their careers and secure long term employment prospects. Additionally adding a sports field will promote activities. Encourage community engagement, and establishing a community garden will allow local vendors to grow fresh produce.

The accommodation program is aimed to establish a multifunctional space that enhances skills to South Africa's sustainable development and promote a sense of community. This approach highlights the significance of offering a haven that provides tranquil and ambient green oasis that acts as a driver, for social and economic upliftment.

URBAN FRAMEWORK

Figure 17: Urban Framework (Author, 2024).

The urban framework aims to make the Caledonian sports ground into a green oasis for the neighbourhood, so that residents can have a place of relaxation, resting, socialising and enjoying nature, promoting community engagement and overall providing green areas in the urban fabric. This particularly is in alignment with the City of Tshwane's vision 2055, which is to create public spaces, parks and social facilities as stated above.

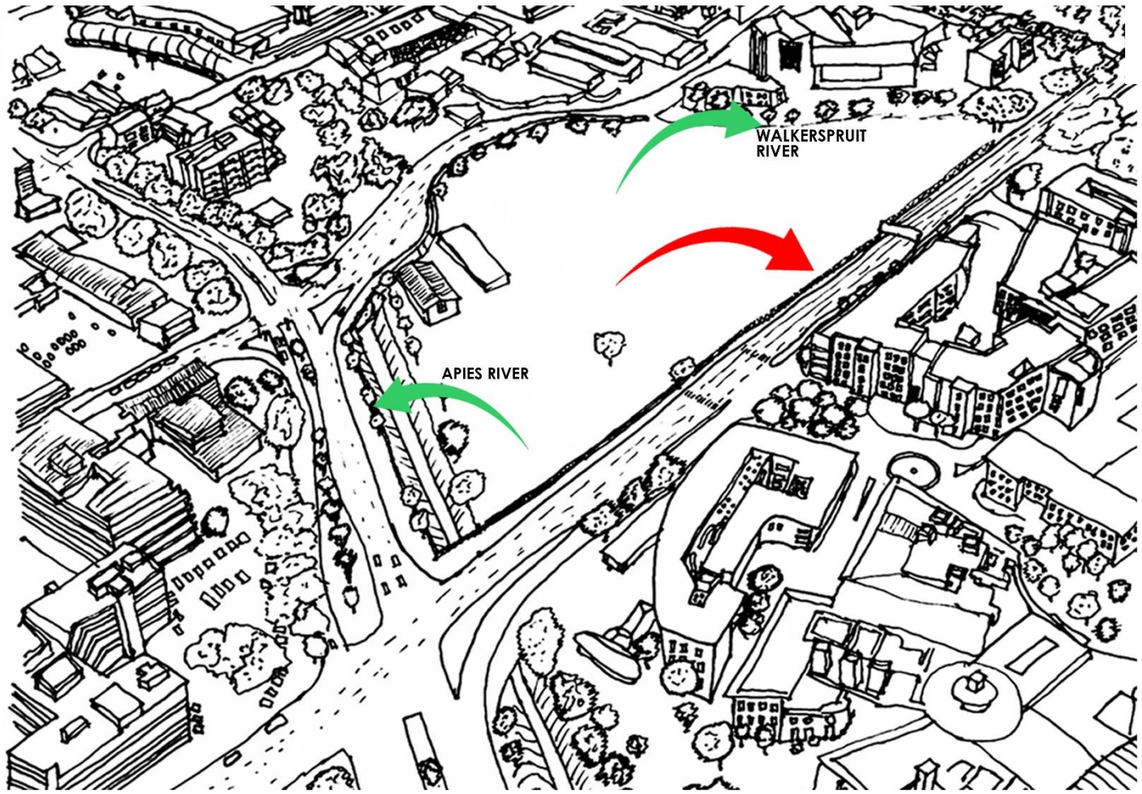


Figure 18: Neighborhood edges (Author, 2024).

The current street edges are very harsh and constricted, this makes walking along the site edge very uncomfortable.

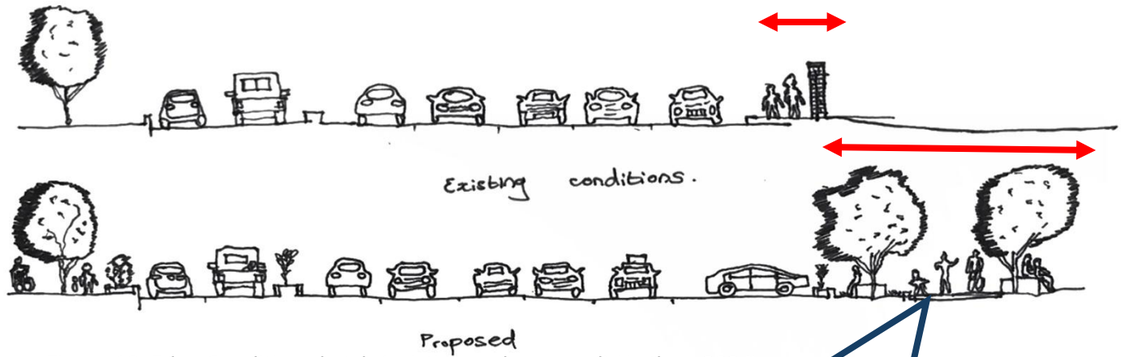


Figure 19: Edge Condition sketch (existing and proposal) (Author, 2024).

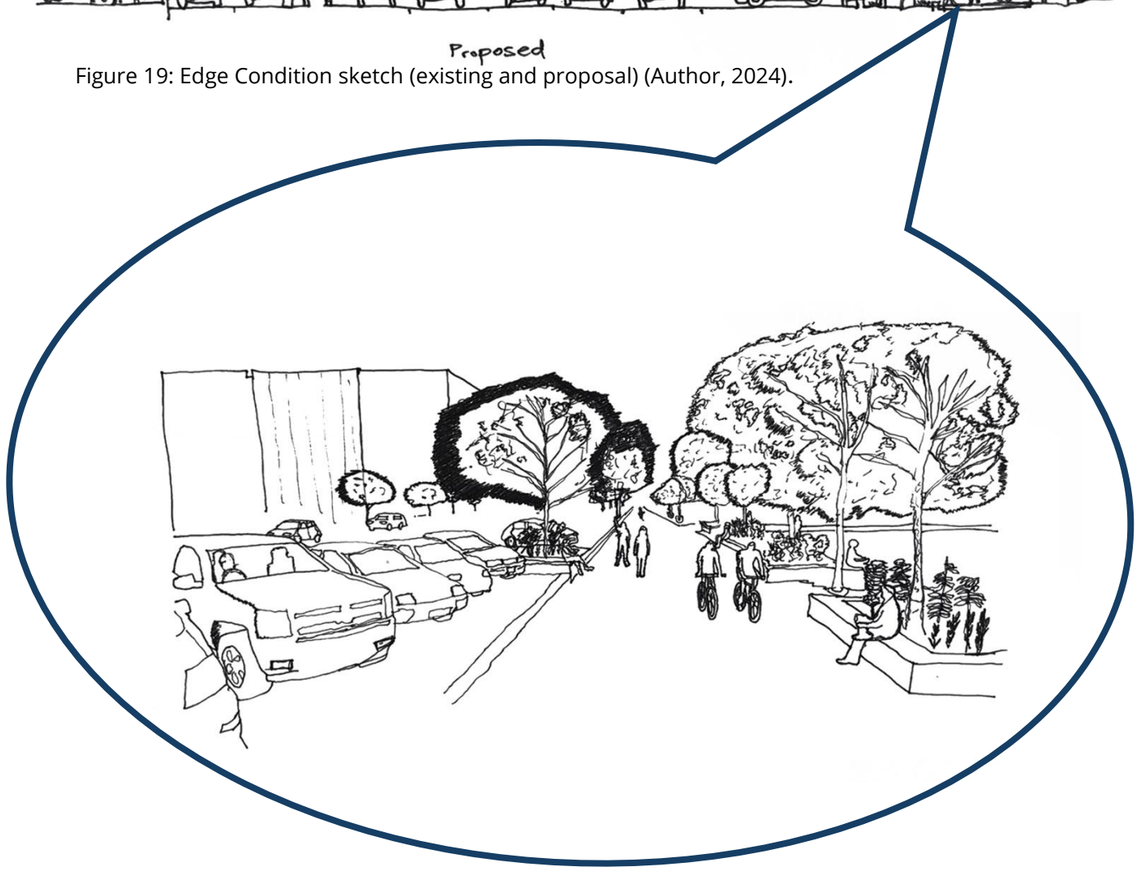


Figure 20: Edge proposal condition (Author, 2024).

The proposed street edge involves creating wider pathways, that have shading and resting spaces that are tranquil and comfortable and relaxing.

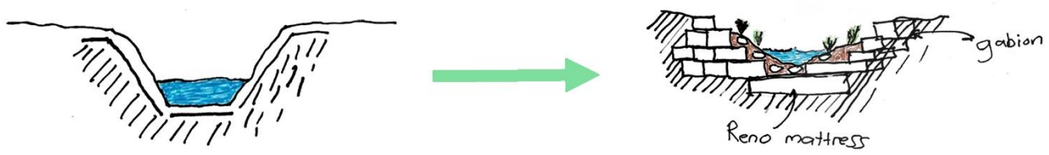


Figure 21: River transformation (Author, 2024).

Improving the street edge along the river to allow pedestrians to engage more closely with the river, creating an enhanced experience that integrates urban life with natural surroundings. Create serene seating areas along the river, enabling people to pause, relax, and appreciate the waterway. Incorporating gabions and Reno mattresses into the river channel will serve a dual purpose. Structurally, these features will help stabilise the riverbanks, preventing erosion and enhancing the durability of the channel. Environmentally, gabions and Reno mattresses can foster the growth of vegetation, which aids in water filtration and provides habitat for local wildlife (Thompson, 2016). This design not only enriches the pedestrian experience but also supports sustainable urban and ecological health.

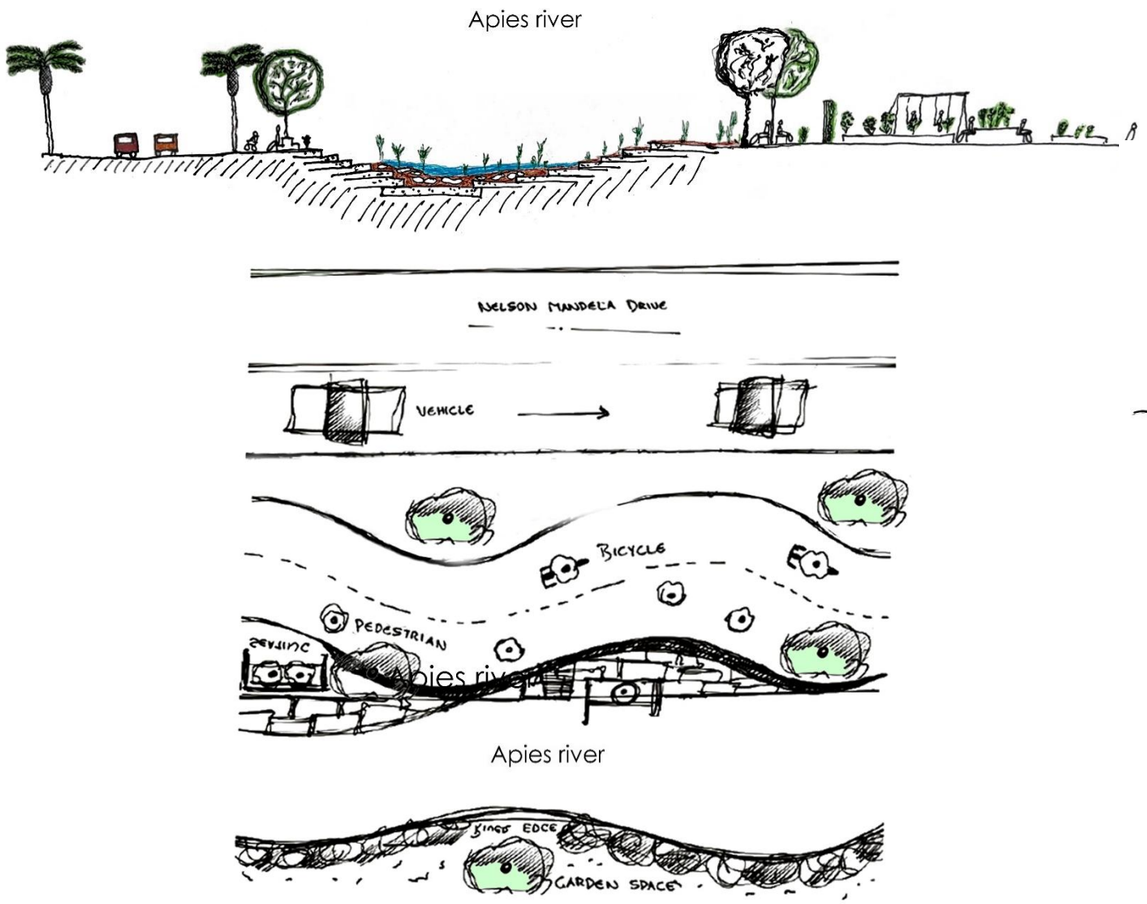
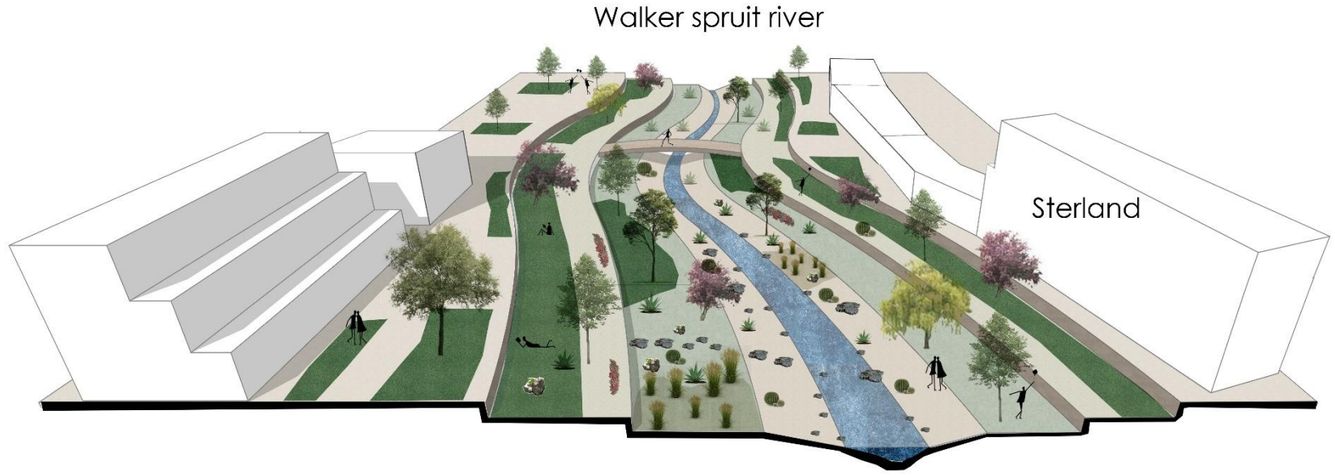


Figure 22: Apies river edge transformation and activation section and Plan view (Author, 2024).



- Creating a pedestrian promenade to enhances social, and environmental benefits, while contributing to the overall quality of life in urban and natural spaces.
- Promenades offer a dedicated space for walking, relaxing, and gathering, encouraging community interaction and outdoor activities.
- The Promenade incorporates trees, plants, and along the walker spruit river, improving urban green spaces, enhancing biodiversity, and helping to reduce the heat island effect.
- The promenade acts as connective pathways between important areas in a city, such as parks, waterfronts, cultural hubs, and residential areas, improving accessibility and mobility.

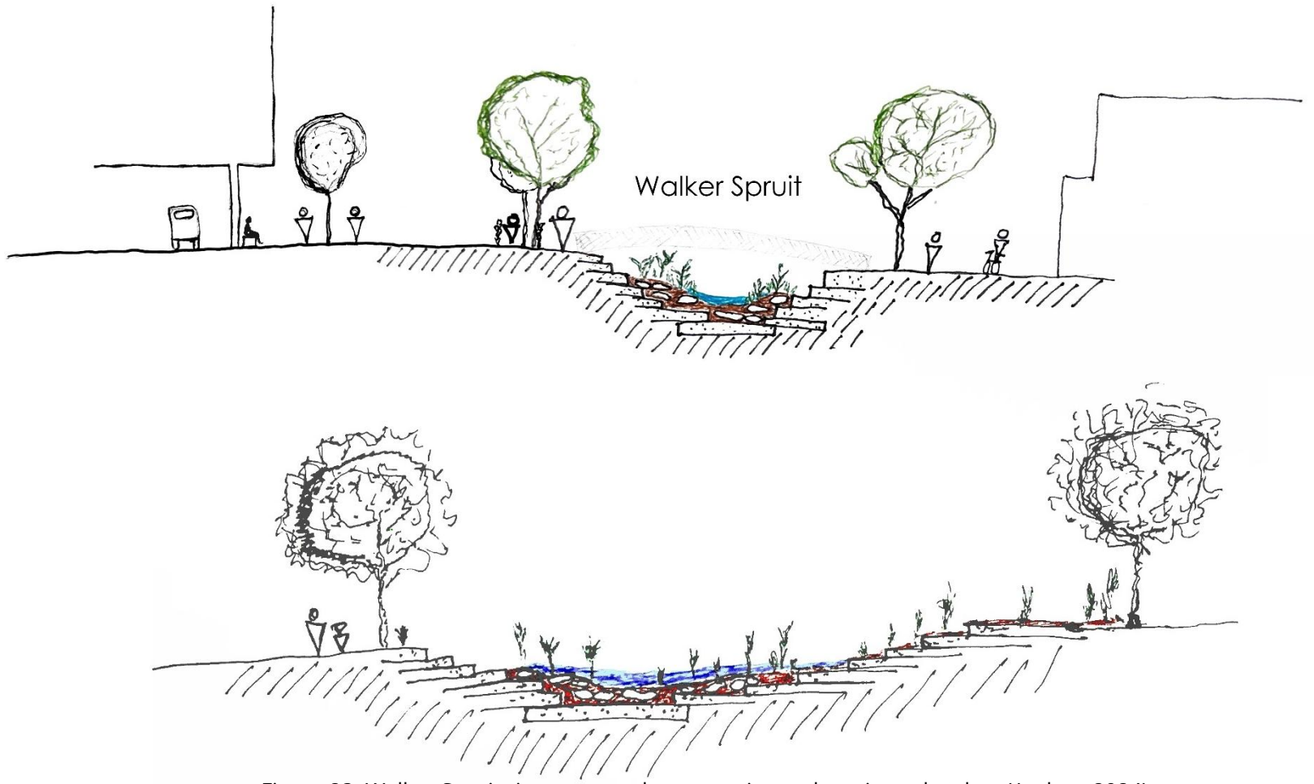


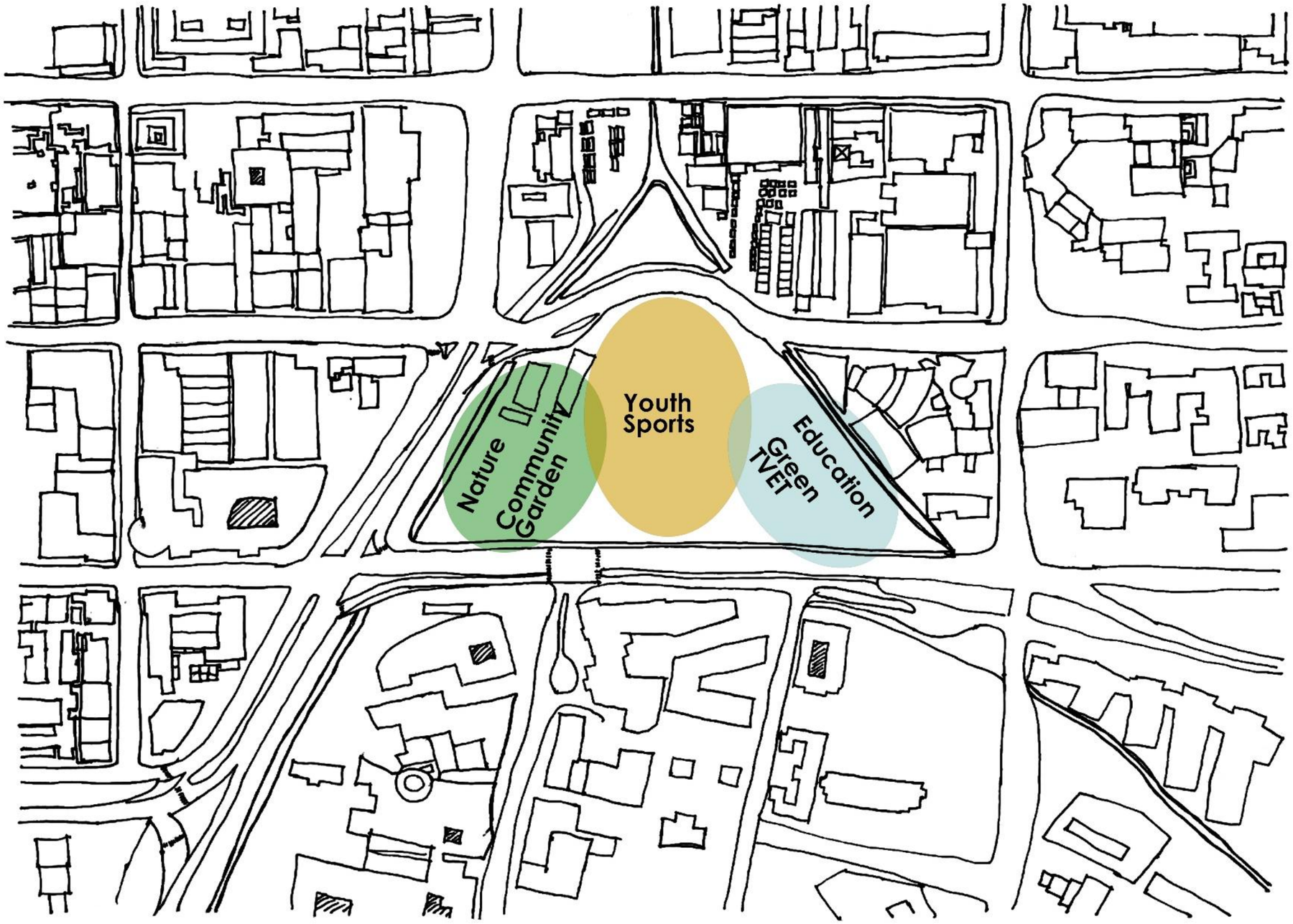
Figure 23: Walker Spruit river proposal, perspective and sections sketches (Author, 2024).

LINKING TO TSHWANE'S 2055 REGENERATIVE VISION

As part of the Tshwane 2055 Vision, Newtown Landscape Architects have proposed redeveloping the Caledonian Sports Grounds into a new Inner-City Park. This plan involves demolishing the current stadium and sports facilities to create a public park that would include playgrounds for children, a skate park, and spaces for picnics and markets. The proposal is driven by concerns over the deteriorating condition of the sports grounds, which are poorly managed and considered unsafe (City of Tshwane, 2015). However, local communities have opposed the redevelopment, as it would result in the loss of their only accessible sports facility within the city (Mudzuli, 2015).

Figure 24: Site plan and perspective of the commons (NEWLA, 2024).

PROGRAMME



1. Youth Sports:
• Youth Sports Program
2. Community Garden
3. Green TVET (Education):
• Green Building and Construction
• Renewable Energy Technology
• Environmental Management
• Water Management
• Green Technology and Innovation
• Green Business and Entrepreneurship
• Climate Change Adaptation and Mitigation
4. Park
Serve as recreational space for the community

These programs foster education, sustainability, and community engagement, creating a holistic environment for both learning and development.

Figure 25: Site programmes (Author, 2024).

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

USERS + STAKEHOLDERS

STAKEHOLDERS

CITY OF TSHWANE
IGNITING EXCELLENCE

City of Tshwane

higher education & training
Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

Department of higher Education

USERS


Vendors

Unemployed Youth


Commuters

Sports Enthusiast

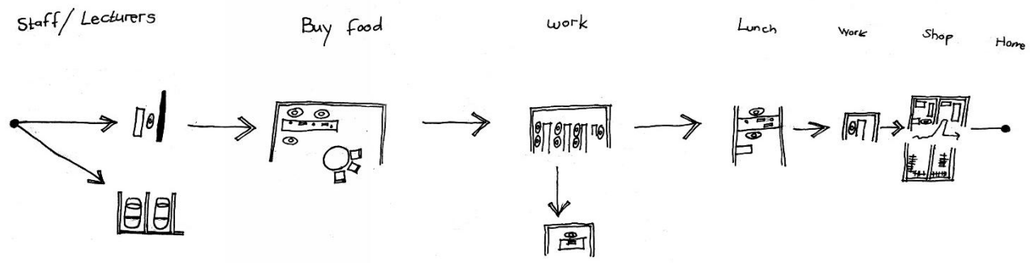

Leisure seekers


Homeless

Figure 26: Stakeholders (Author, 2024).

The diagrams of various archetypes provide an analysis on how they interact on and with the site, showcasing their unique movements patterns and their functions. This is important in understanding how the different users can make use of the space and what their spatial needs.

ARCHITYPES



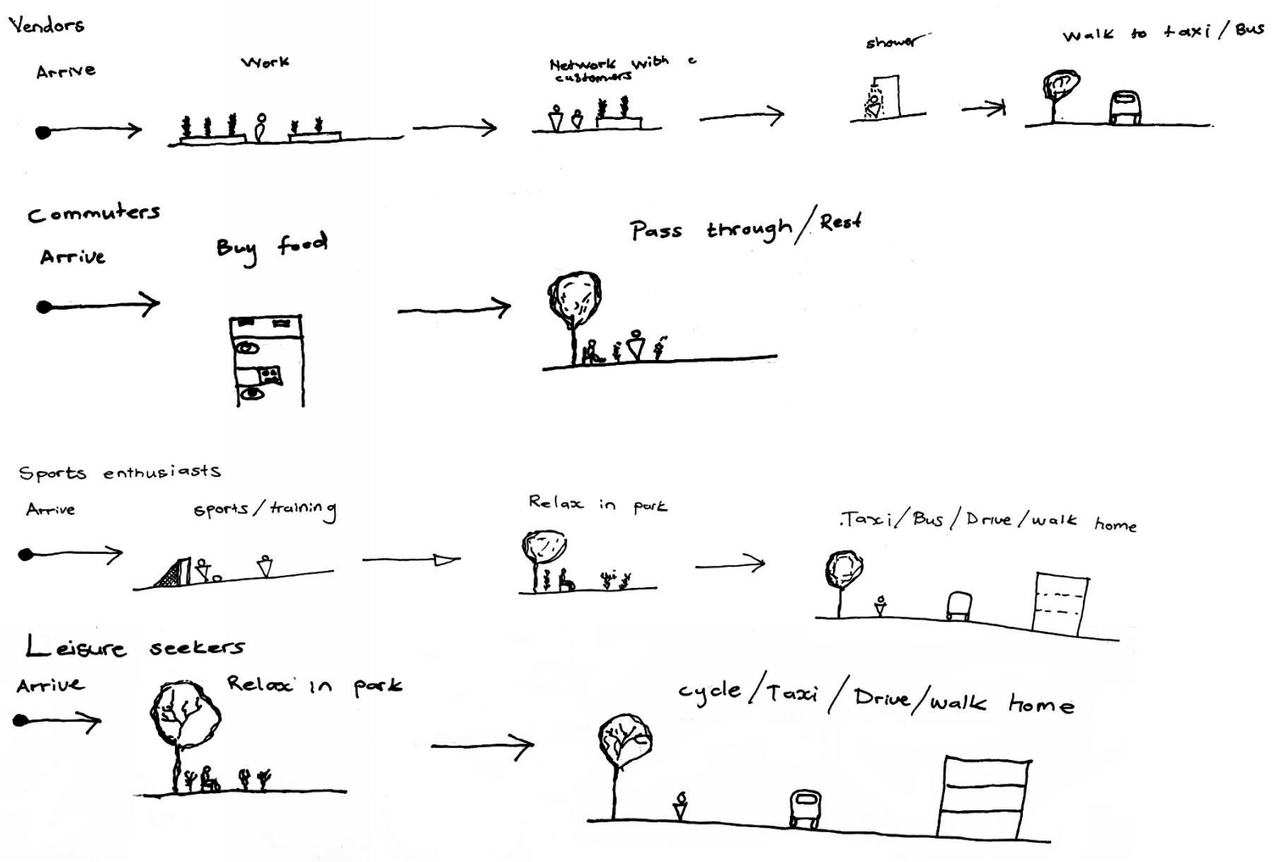


Figure 27: Architypes sketches (Author, 2024)

Archetypal movements aid in creating a cohesive design strategy that aligns with the overarching project goals, ensuring that the space is both user friendly and purpose driven.

CONTEXT

Figure 28: Land use and buildings 1 (Author, 2024)

The site is surrounded by high-rise buildings, primarily ranging from three to six stories, although a few are taller in the immediate context.

Figure 29: Land use and buildings 2 (Author, 2024)

Figure 30: Existing buildings (Author, 2024).

CONCEPTUAL APPROACH

The architectural approach pursues the ideals, goals and aspirations of the theoretical underpinning of BIOPHILIA

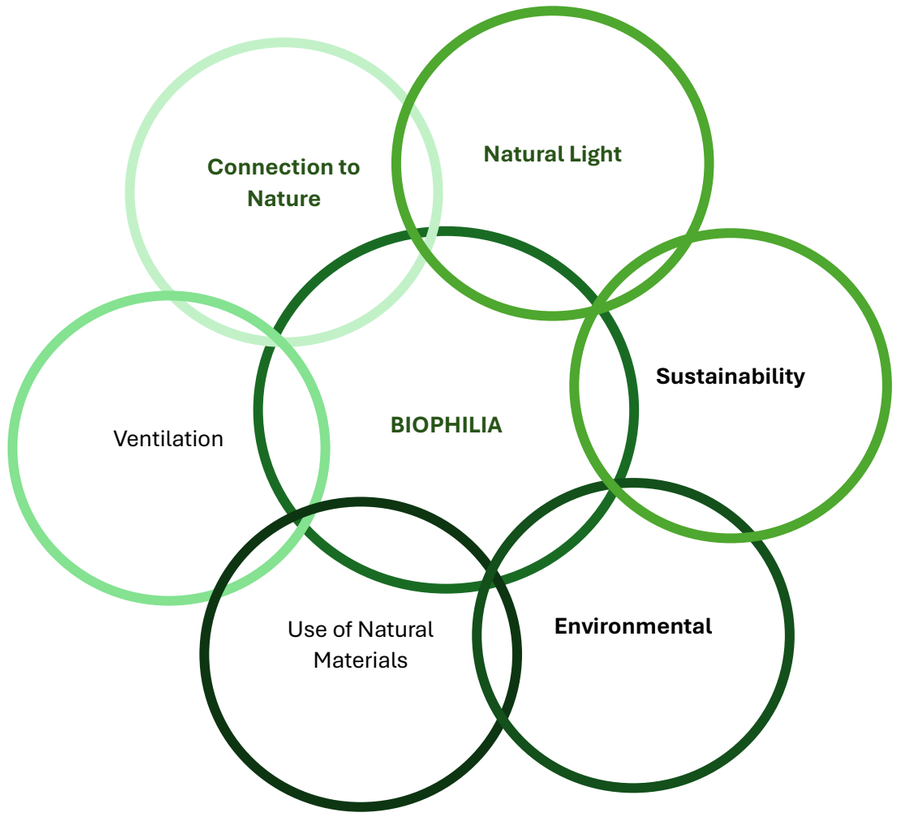


Figure 31: Conceptual ideas (Author, 2024).

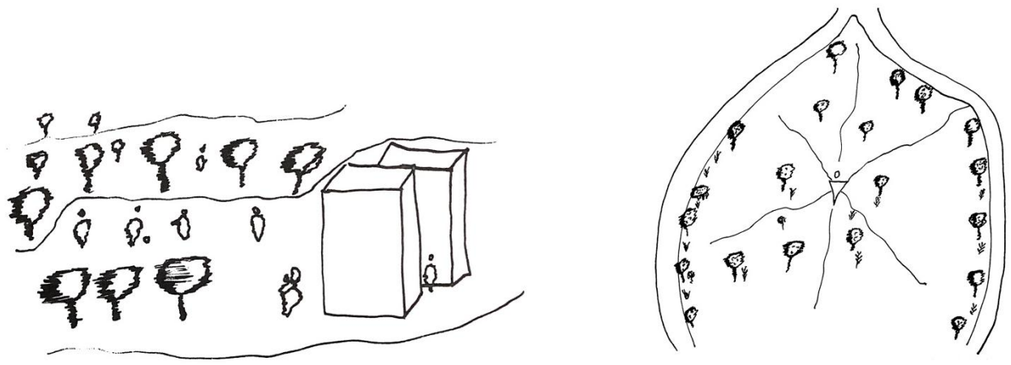


Figure 32: Conceptual sketches (Author, 2024)

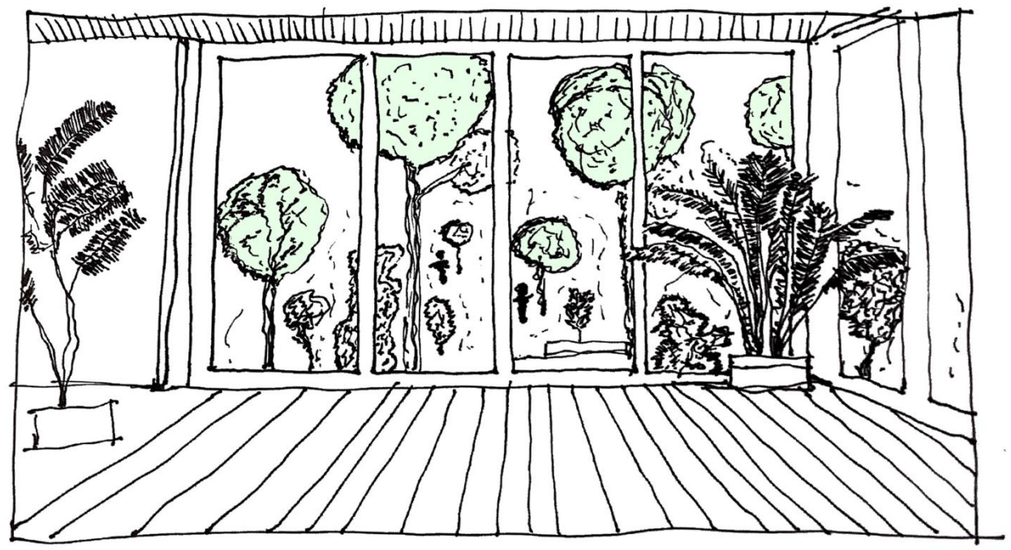


Figure 33: Visualisation of conceptual approach as it starts to manifest as physical space (Author, 2024)

DESIGN APPROACHES

The integration of Natural Elements is a key aspect of biophilic design, which emphasise the incorporation of plants, greenery, and water features into architectural spaces. This is achieved through indoor plants, green walls, and gardens, fostering a sense of tranquillity and well-being (DeKay, 2012).

Natural Light Optimisation focuses on maximising daylight within interiors spaces through incorporation of large windows, and skylights. This approach not only illuminates spaces but also improves mood and productivity by reducing reliance on artificial lighting. Access to views of nature further enhances the connection to the outdoors, enriching occupant experience (Goharian et al., 2023).

Use of Natural Materials emphasises sustainable, locally sourced materials such as wood or timber, and stone. These materials create warmth and authenticity, enhancing sensory experiences. By prioritising the use of natural materials, designers can create welcoming spaces that promote well-being while minimising environmental impact (Yahia et al., 2024).

Biophilic design principles are important to help guide the design.

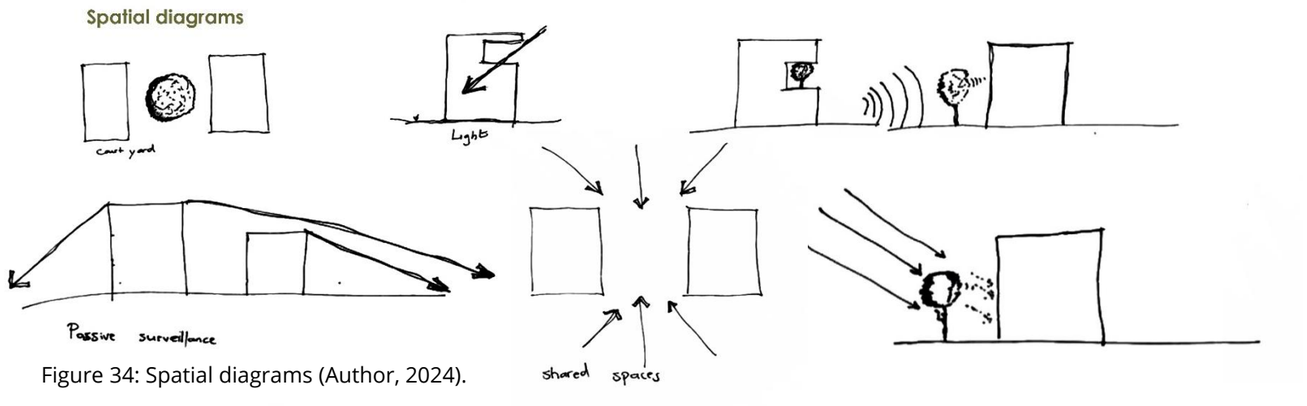
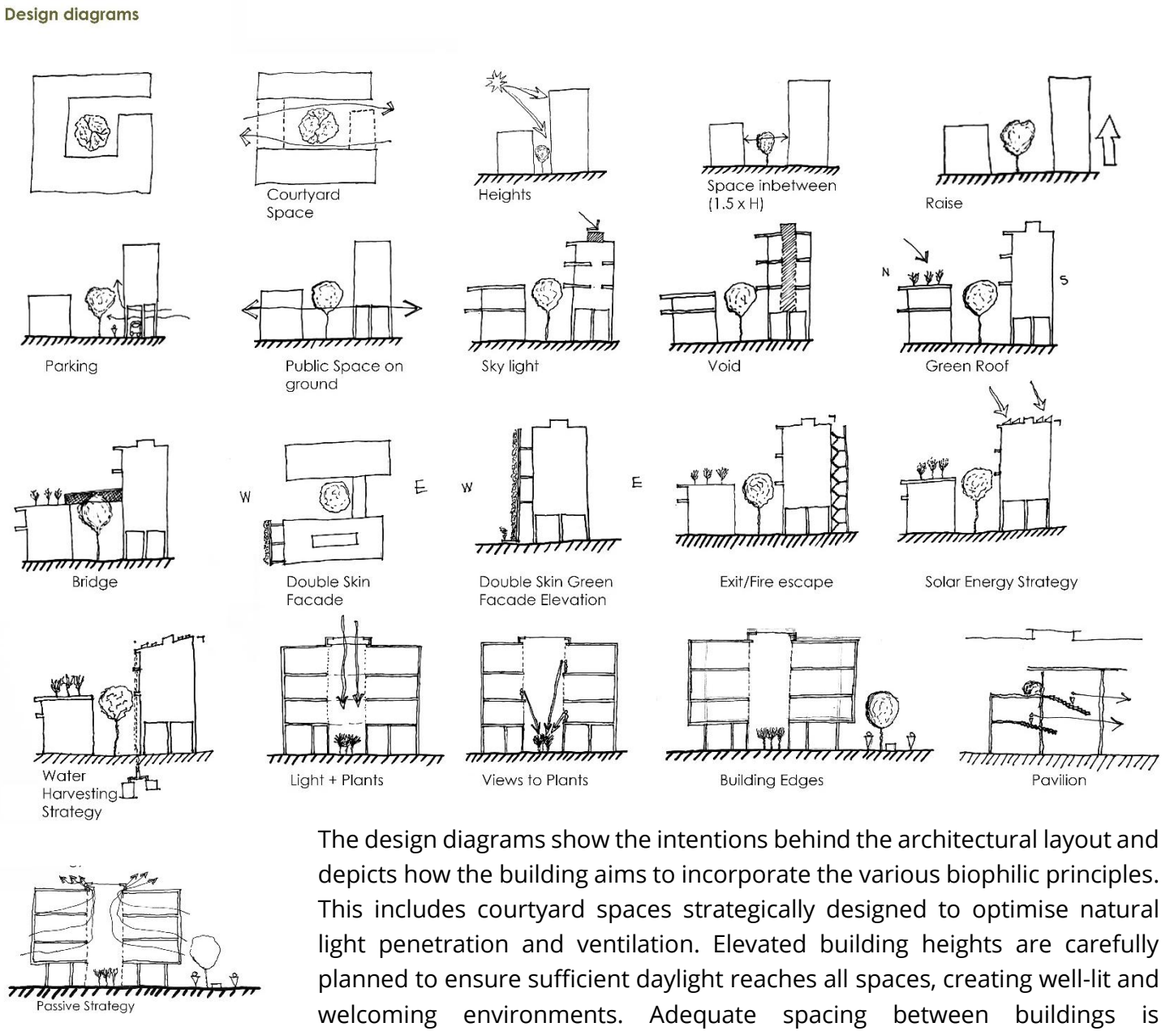


Figure 34: Spatial diagrams (Author, 2024).



The design diagrams show the intentions behind the architectural layout and depicts how the building aims to incorporate the various biophilic principles. This includes courtyard spaces strategically designed to optimise natural light penetration and ventilation. Elevated building heights are carefully planned to ensure sufficient daylight reaches all spaces, creating well-lit and welcoming environments. Adequate spacing between buildings is maintained to enhance airflow and light distribution.

Figure 35: Design diagrams (Author, 2024).

Parking facilities are incorporated beneath certain sections of the building, thoughtfully designed to accommodate individuals with disabilities and ensure accessibility. The ground floor serves as an active public space. Skylights are integrated in the design to maximise daylighting, enhancing the interior and reducing the need for artificial lighting.

Green spaces are incorporated both indoors and outdoors, contributing to the biophilic essence of the design. Green double-skin facades are employed to improve thermal comfort by regulating indoor temperature. The building design embraces solar energy harnessing and rainwater harvesting systems, aligning with sustainable principles.

Views to plants and gardens are established, enhancing the occupants' connection to nature. Additionally, passive design strategies are incorporated, focusing on natural ventilation, and thermal mass to reduce energy consumption and create a comfortable and environmentally responsible space.

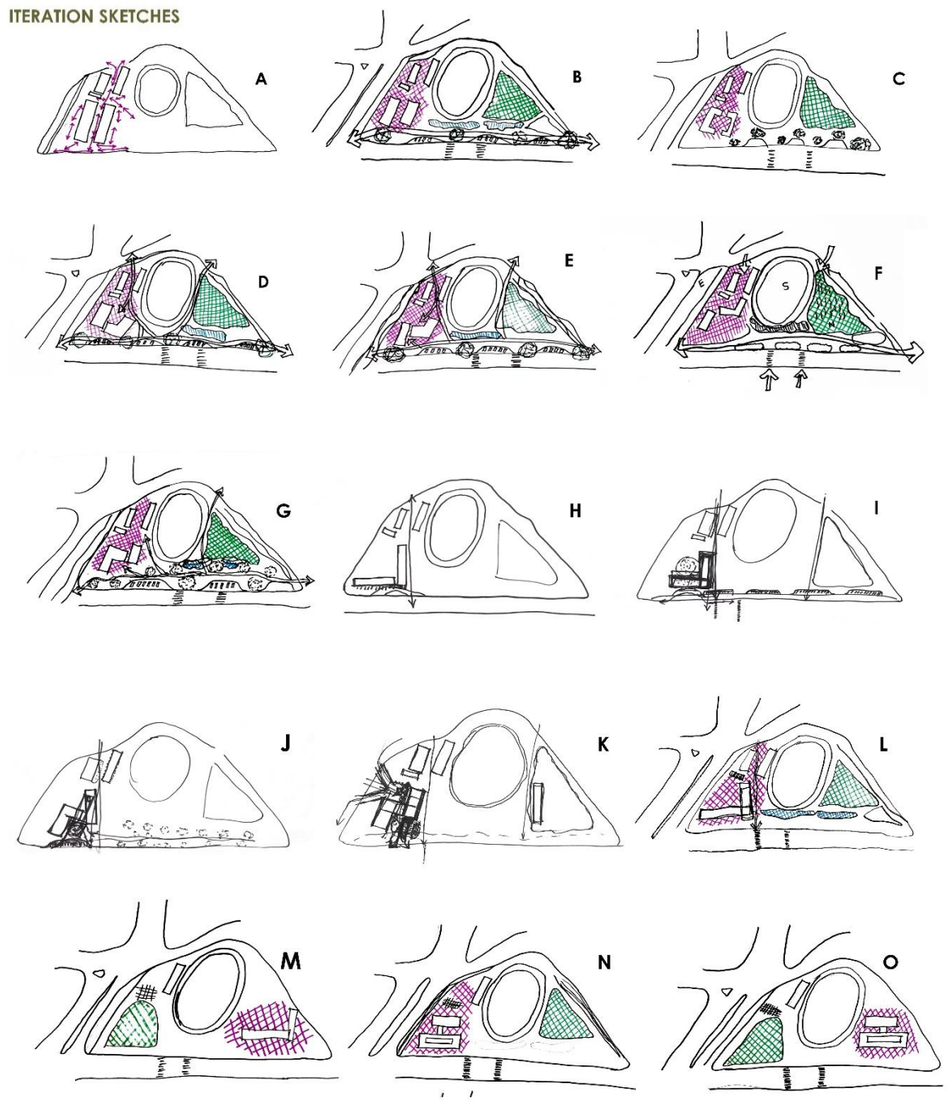


Figure 36: Iteration sketches (Author, 2024).

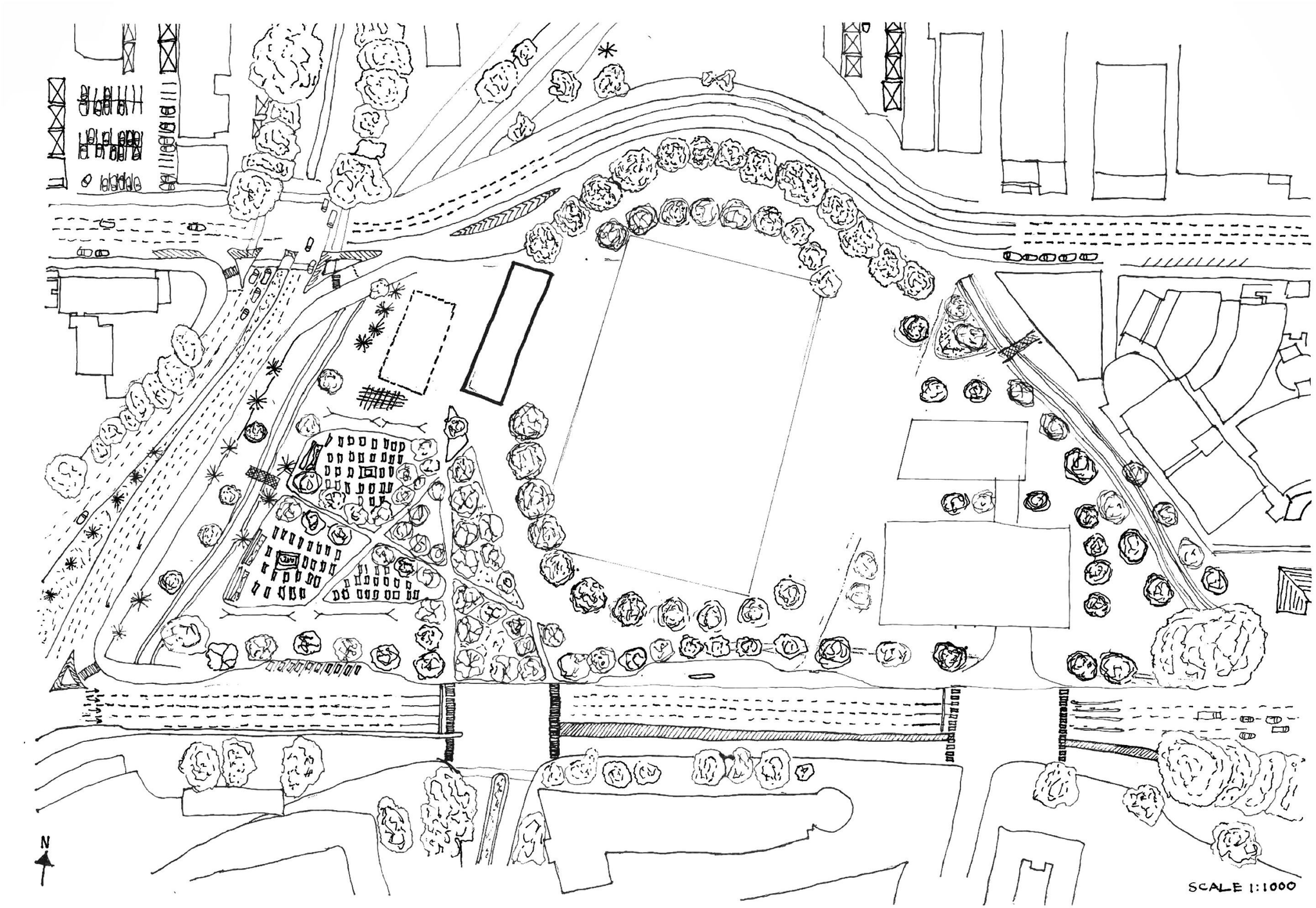


Figure 37 A: Site plan (Author, 2024).

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

SITE PLAN

Figure 37 B: Site plan (Author, 2024).

TECHNOLOGICAL INTERGRATION

The use of mass-engineered timber (MET) was chosen for its numerous advantages, particularly its sustainability and performance benefits (Balasbaneh & sher, 2021). MET, specifically cross-laminated timber (CLT) for slabs and glued laminated timber (GLT) for columns and beams, is highlighted as the building's largest carbon-free component. This sustainable material significantly reduces the building's overall carbon footprint, as timber acts as a natural carbon sink, sequestering carbon throughout its life cycle (Himes & Busby, 2020).

MET is prefabricated off-site and then assembled on-site, which streamlines the construction process, saving both time and labour while ensuring high precision and quality control.

According to Nordby et al. (2019), Incorporating reused red clay brick from dilapidated buildings emphasises a commitment to sustainable practices and resource efficiency. This approach not only preserves the historical essence of the site but also reduces waste and the demand for new materials.

The use of cavity walls as part of the building's envelope design is strategic due to their thermal and moisture control benefits. Cavity walls, particularly with a brick veneer on the exterior, provide excellent insulation, enhancing the building's energy efficiency by reducing heat transfer and maintaining comfortable indoor temperatures (Lawrence et al., 2013). The air gap within the cavity wall acts as a barrier to moisture, preventing water infiltration and protecting the structural integrity of the building. Brick veneer, as the outer layer, offers durability, aesthetic appeal, and low maintenance, contributing to a visually appealing and robust exterior finish (Na & Shen, 2021).

Mass Engineered Timber

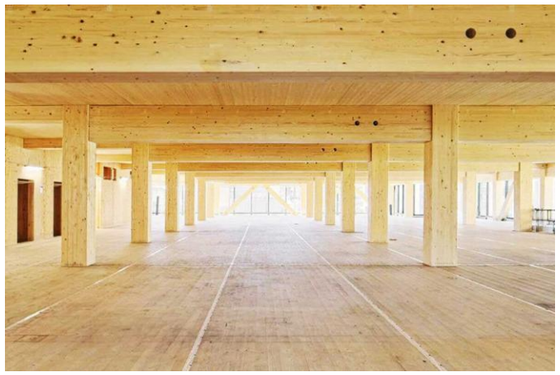


Figure 38: Timber CLT slabs and GLT beams and columns (Permax_Dev, 2024)

Figure 39: Timber usage (Lambert Sustainability LLC, 2024)

Red Clay brick

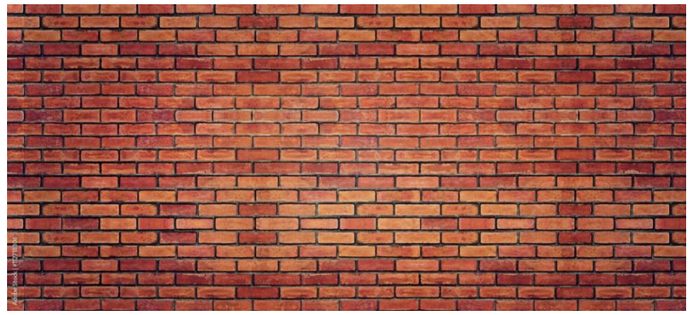


Figure 40: Red clay brick (RinoCdZ, 2014).

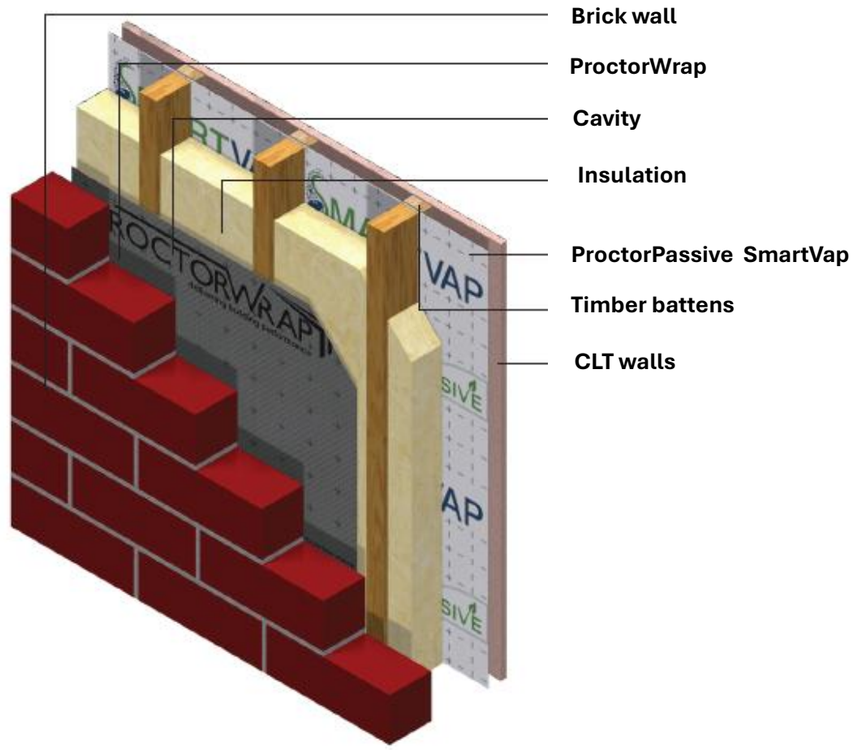


Figure 41: Cavity wall (DCTech, 2023).

The building is designed with the intention of futureproofing its spaces to be flexible and adaptable, allowing for seamless transitions to new functions after its initial lifecycle. This approach ensures that the structure can be repurposed efficiently, supporting sustainable development and extending the building's utility over time. By incorporating adaptable design elements, the building remains relevant and functional, accommodating changing needs and purposes with minimal modifications (Gosling et al., 2008)

DESIGN RESEARCH AND TECHNOLOGY INTEGRATION INTERPRETATION

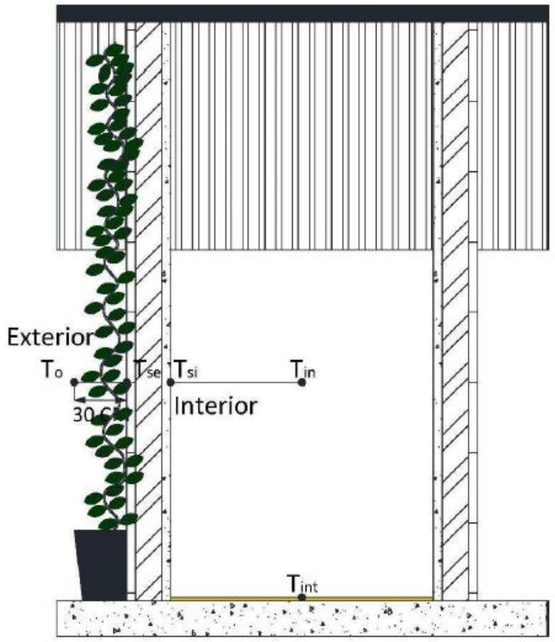
The integration of climate-responsive facade systems within the revitalisation of the Caledonian Sports Ground plays a vital role in achieving the project's goals, especially through the application of the green facade (Kabisch et al., 2016). This approach is essential for balancing the thermal performance, environmental responsiveness, and educational functionality of the Green TVET centre, aligning seamlessly with both the Design research and technological components.

Research conducted in Design Investigation Treatise (DIT) investigated climate change adaptation technologies with thermal behaviour modification potential to improve the thermal performance of multi-storey buildings in Tshwane, South Africa. This research informed the properties and selection of the building technologies in the design development process.

The facade's outer vegetated layer, combined with an air cavity between layers, acts as a buffer against solar radiation, helping to regulate indoor temperatures. The design's adaptability not only maximises energy efficiency but also fulfills biophilic principles by visually and physically integrating nature into the building, enhancing occupant comfort and well-being (Ahriz et al., 2022).

In relation to the Design Investigation Treatise (DIT), the double green skin facade exemplifies the use of climate adaptation technologies in real-world architectural applications. By adopting this advanced facade system, the project creates an interactive learning opportunity where students can observe and study sustainable construction methods directly on-site. The facade serves as a practical demonstration of adaptive design, allowing students to gain hands-on experience with concepts such as thermal amelioration and sustainable material use, which are core aspects of climate-responsive design.

This integration of facade technology not only supports the operational goals of the Green TVET centre but also embodies the educational mission of the project, positioning the building as both a sustainable structure and a learning tool for students in the field of climate-adaptive architecture.



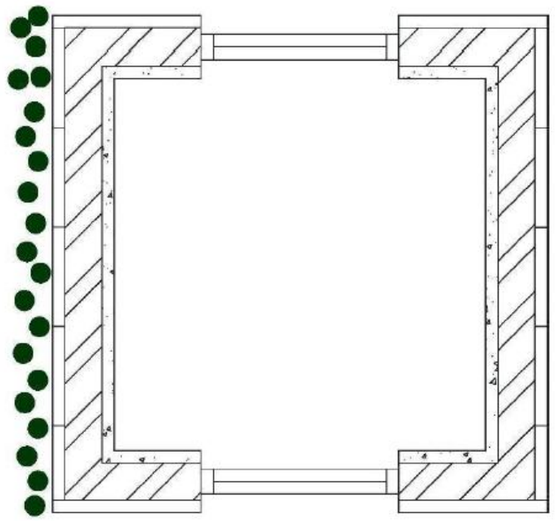


Figure 42: Green façade system section and plan view (Widiastuti et al., 2020).

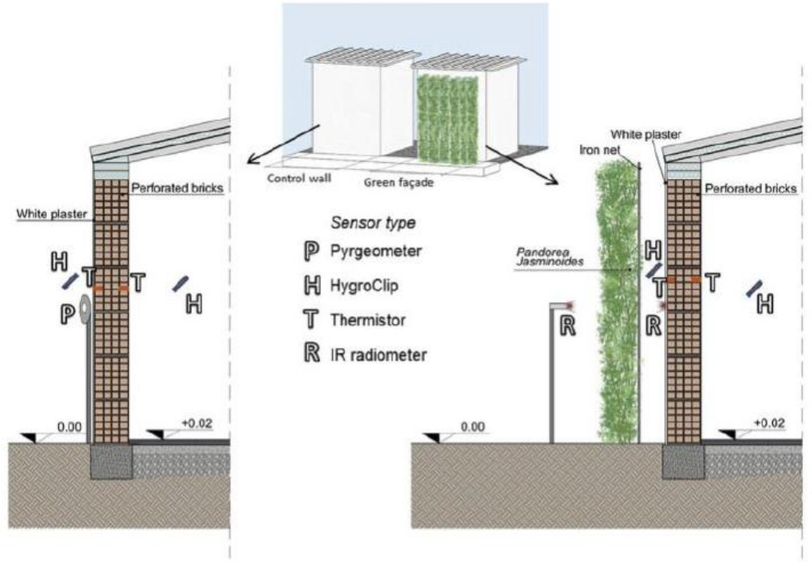


Figure 43: Green Façades testing and experiment (Convertino et al., 2019).

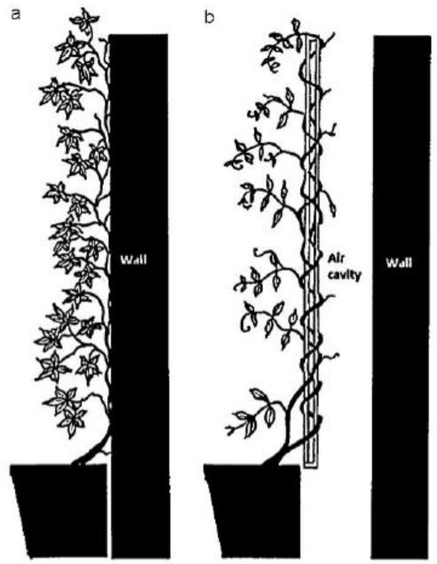


Figure 44: Types of green façade systems direct and DSF (Hunter et al., 2013).

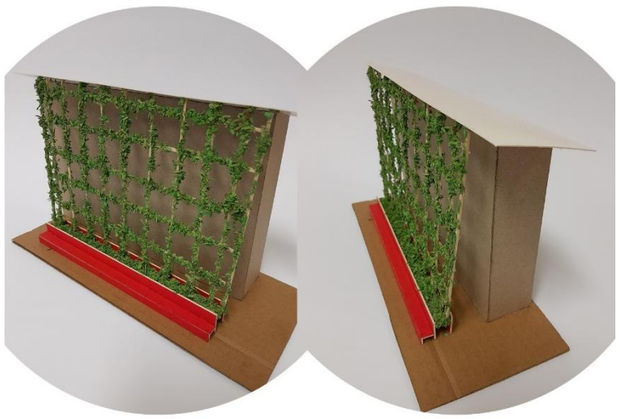


Figure 45: Green facade illustrations (Author, 2024).

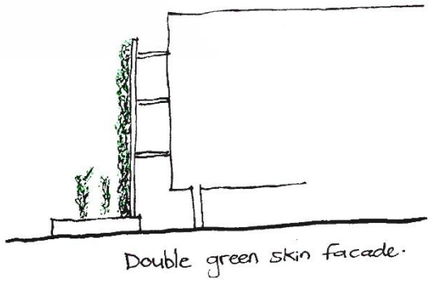


Figure 46: Green facade maquette and sketch (Author, 2024).

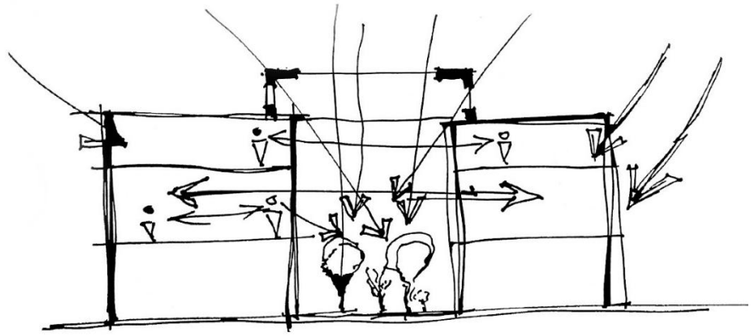


Figure 48: Sketch depicting plants, airflow and lighting in green TVET

CRITICAL REFLECTION

THE DESIGN PROCESS

The design has evolved through multiple iterations into a solution that accommodates a range of programmes and contextual needs. Numerous spatial arrangements were tested along the way, ultimately achieving a balanced outcome that combines complexity with contextual sensitivity. The design process has operated as a continuous feedback loop, addressing scales from the broader urban environment to the smallest details. This journey has shown that the design process is not linear; instead, it is multi-layered, sometimes complex, and constantly changing. Within this complexity, it is essential to consistently reflect on the original design intent to keep it clearly in focus.

THE FINAL DESIGN OUTCOME

Overall, the design aims to create a sustainable, community-cantered hub through the Green TVET, integrating green skills training with climate-responsive architecture and sustainable materials to address climate change. By employing renewable energy sources, environmentally friendly materials, and biophilic elements, the Green TVET fosters both environmental resilience and community empowerment, providing a model for sustainable development while equipping individuals with the skills needed for a green economic sector.

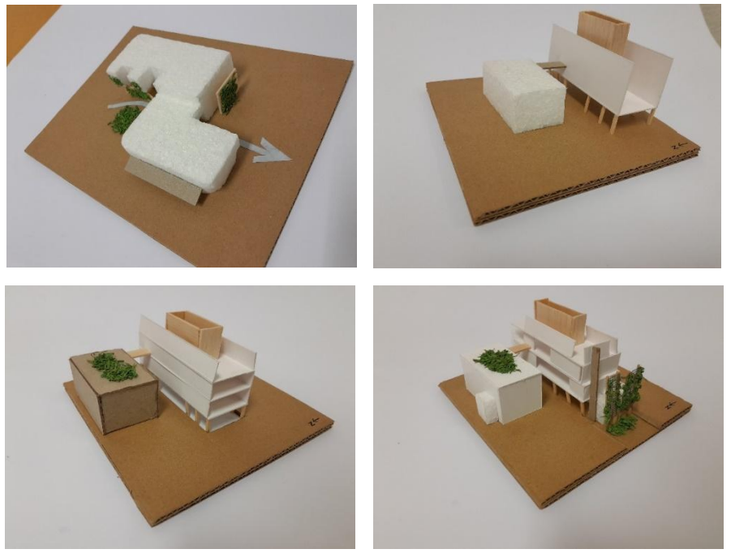


Figure 47: Maquettes showing iterations (Author, 2024).

Figure 49: Maquettes showing iteration with plants growing from ground and onto the grandstand (Author, 2024).

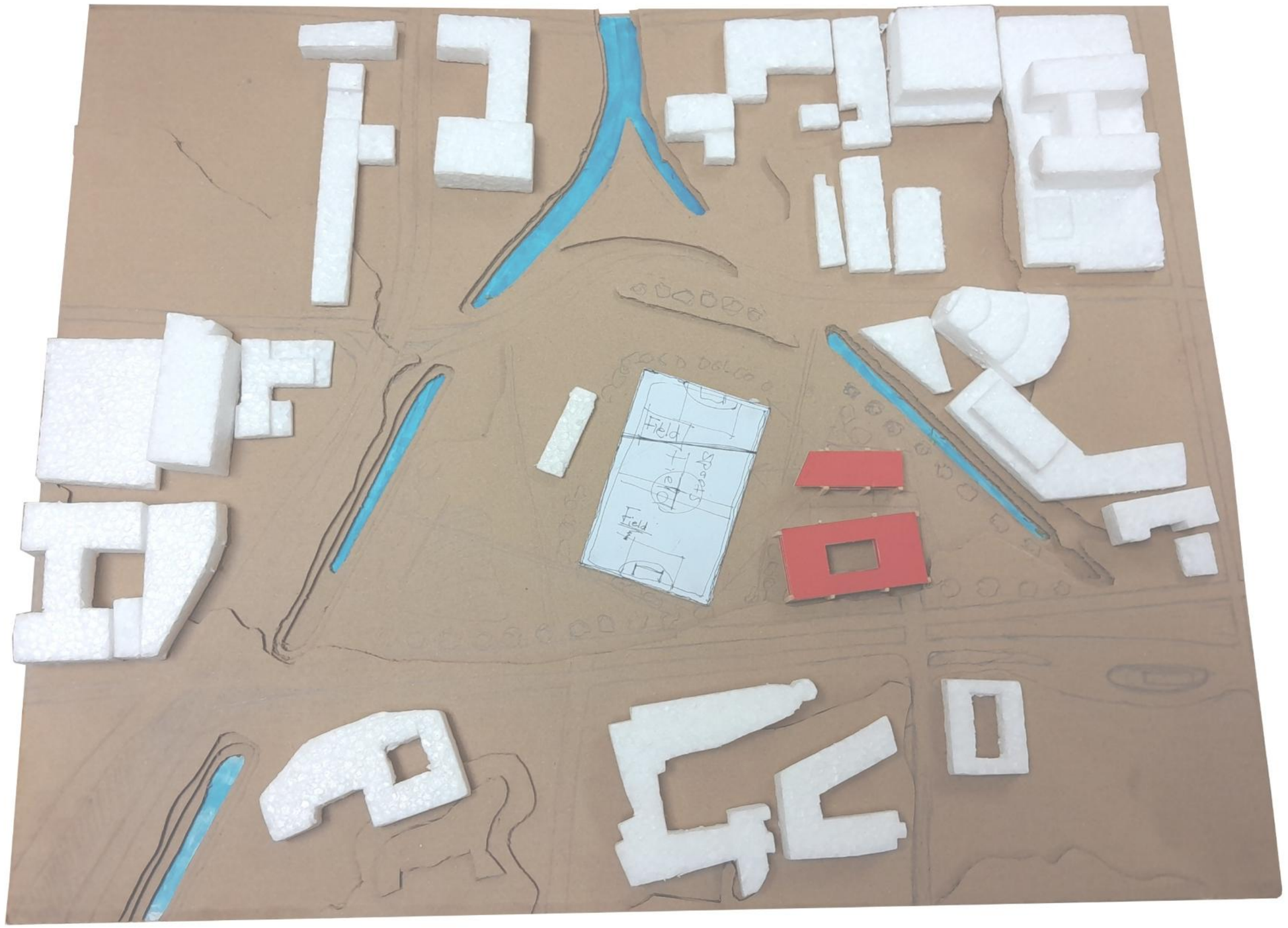
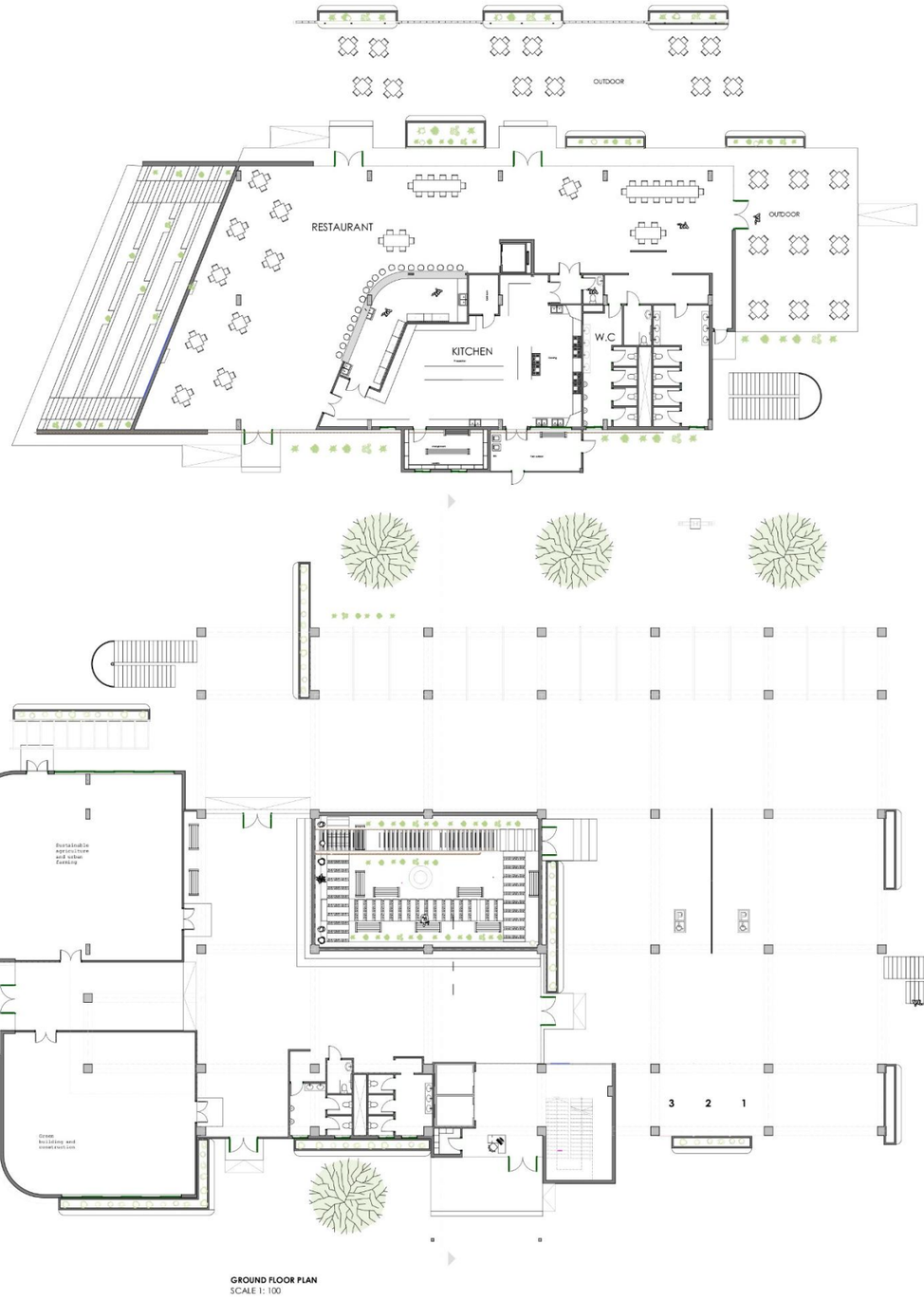


Figure 50: Site Plan Maquettes iteration showing (Author, 2024).

Figure 51: Maquettes showing iteration with plants growing from ground and onto the grandstand (Author, 2024).



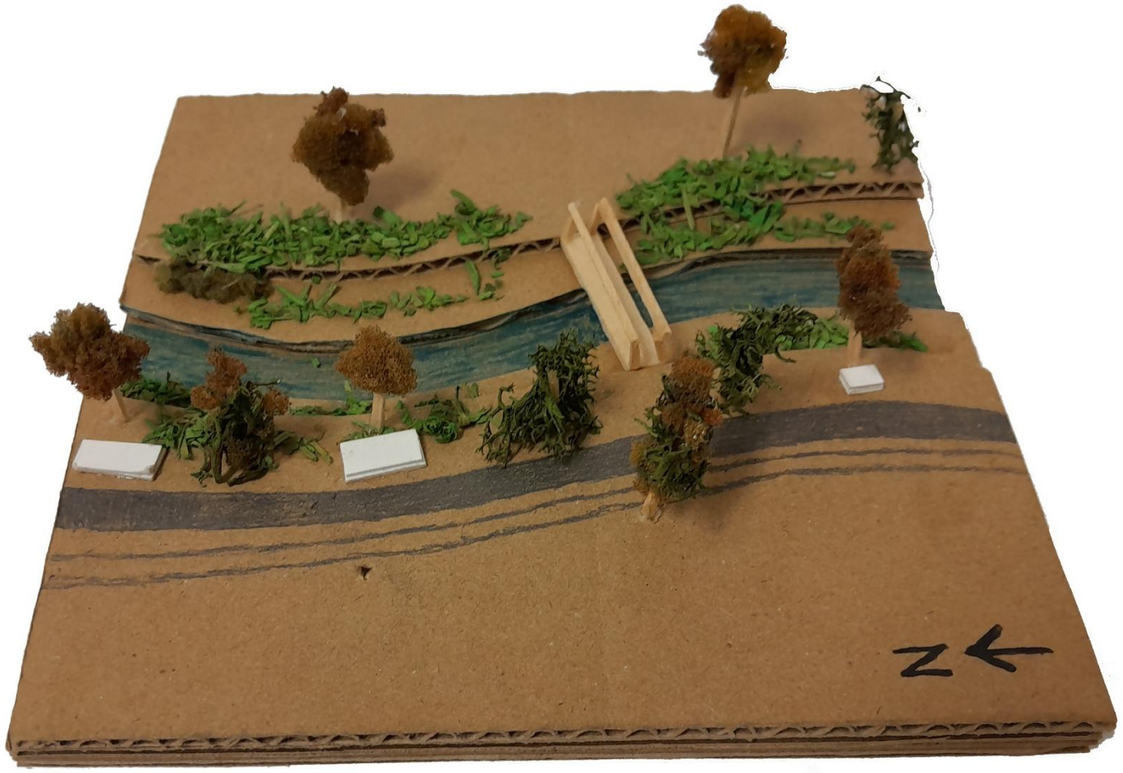
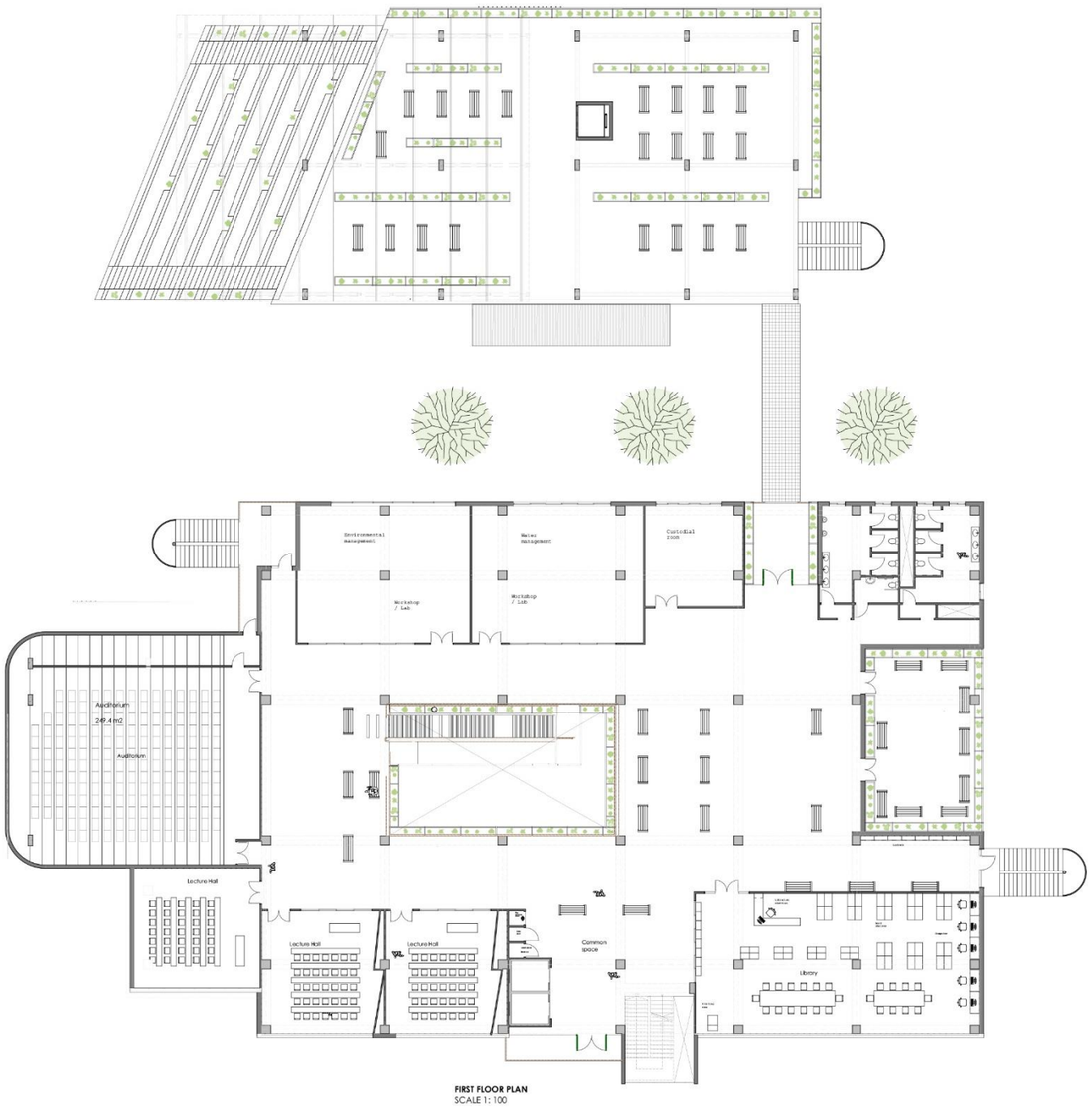
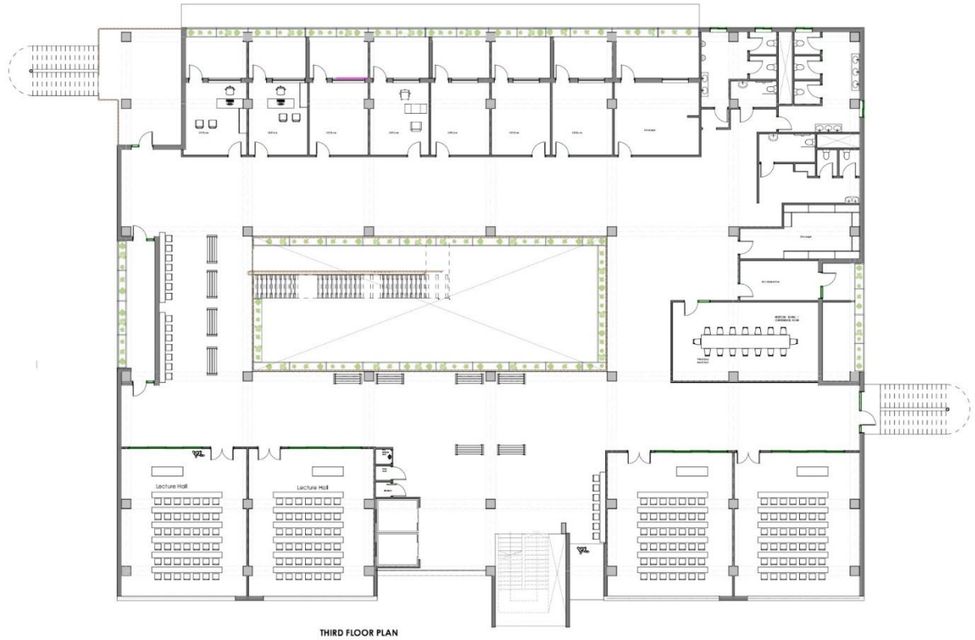


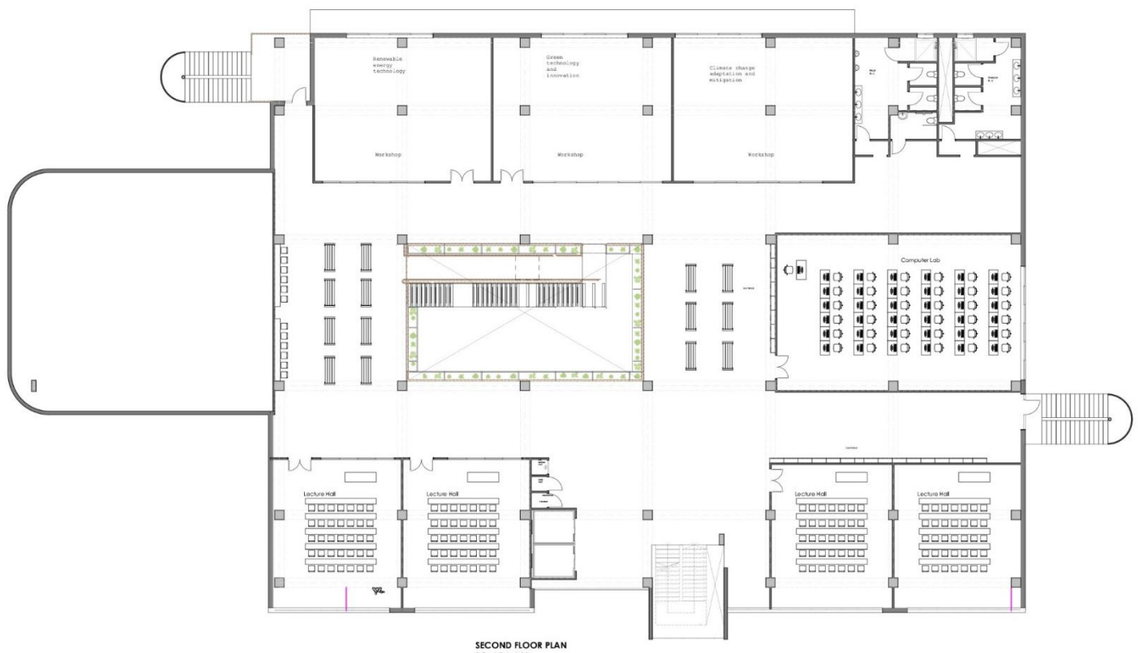
Figure 52: Maquette showing iteration of the Walker Spruit river proposal (Author, 2024).



FIRST FLOOR PLAN
SCALE 1: 100



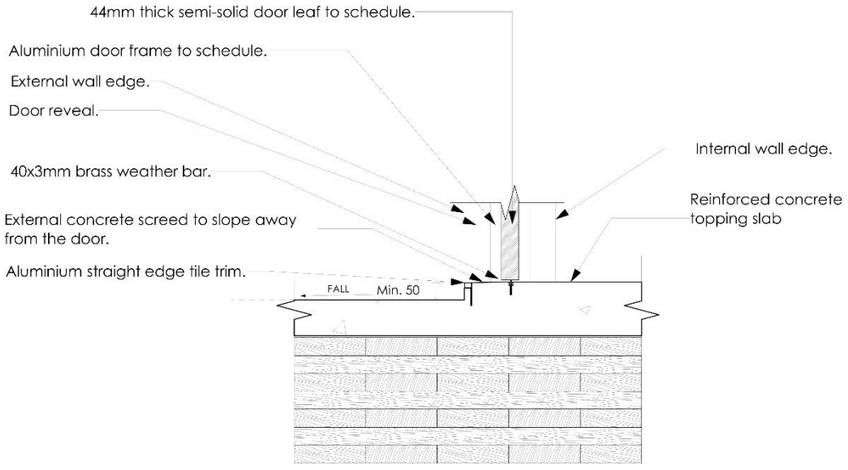
THIRD FLOOR PLAN
SCALE 1: 100



SECOND FLOOR PLAN
SCALE 1: 100

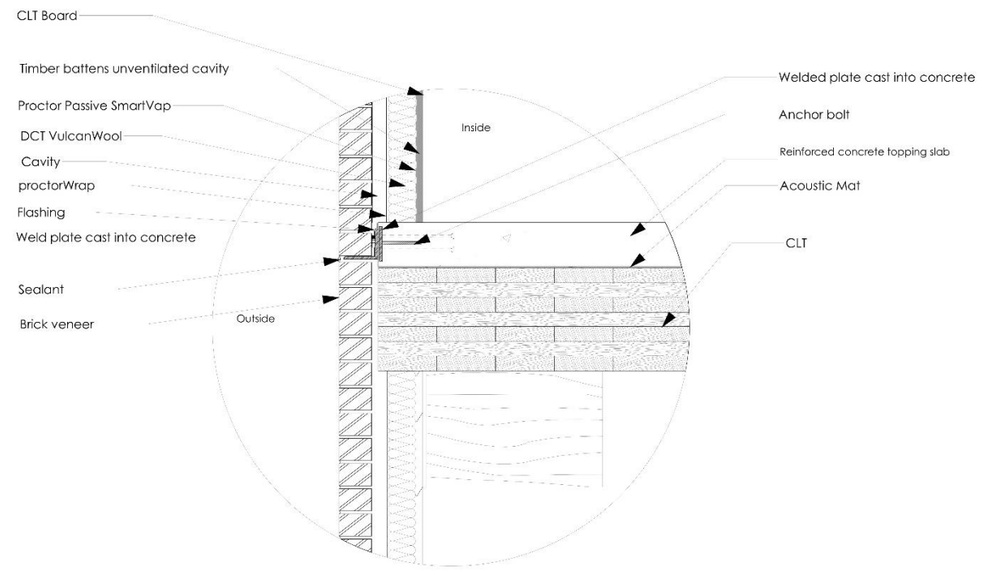
SECTION

DETAIL 2



EXTERIOR DOOR THRESHOLD DETAIL
scale 1:5

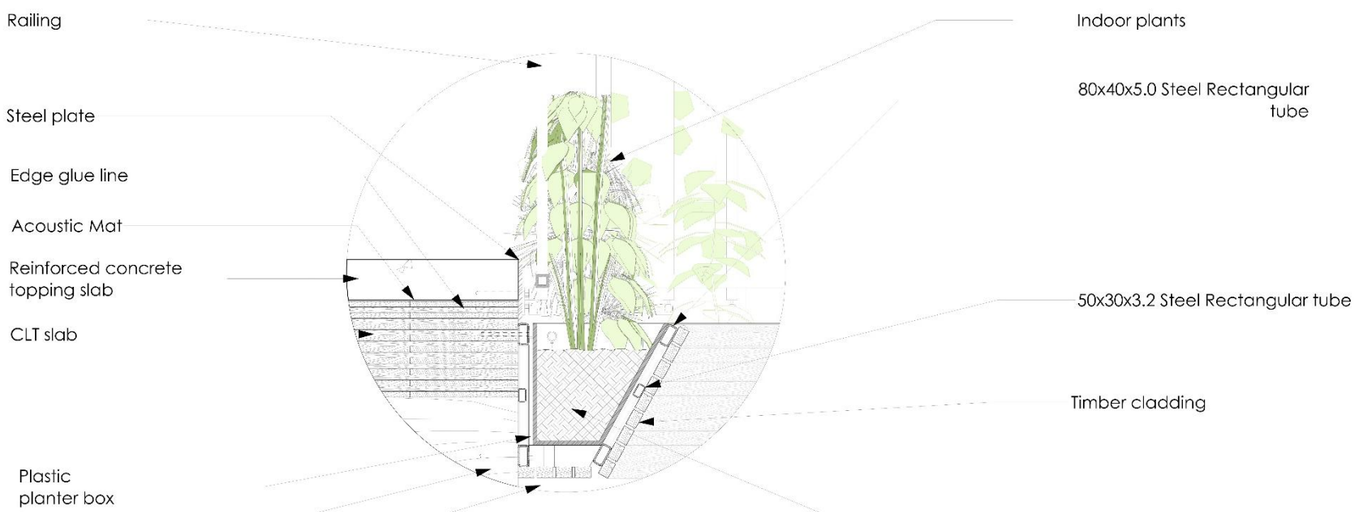
DETAIL 4



Building Envelope wall detail

Scale 1: 5

DETAIL 3



PLANTER BOX DETAIL
SCALE 1:5

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CONCLUSION

The project signifies the beginning of a new journey for the Caledonian Sports Ground's from being an abandoned landmark into its renewal and rebirth. Through the use of sustainable design practices, climate-responsive architecture, and green skills development, while simultaneously targeting local needs and promoting community engagement.

Like a phoenix rising from the ashes, the Caledonian Sports Ground will be a vibrant place for sustainable growth and community engagement. This ensures maintaining its heritage while creating a space for education, and nature. By empowering individuals with skills for the green economic sector, the Green TVET stands as a symbol of hope and sustainability for future generations, paving the way forward for a thriving community and a greener tomorrow for South Africa and the world at large.

Like a Phoenix Rising from the Ashes, the Caledonian Grounds embodies Renewal and Rebirth, Shaping a Resilient Future

REFERENCES

Ahriz, A., Mesloub, A., Djeffal, L., Alsolami, B., Ghosh, A. & Abdelhafez, M.H.H. 2022. The use of double-skin façades to improve the energy consumption of high-rise office buildings in a Mediterranean climate (csa). *Sustainability*, 14(10):6004. [Online] Available from: https://doi.org/10.3390/su14106004 [Accessed: 2024-04-07].

Al Jazeera [AJLabs]. 2023. How much does Africa contribute to global carbon emissions? [Online] Available from: https://www.aljazeera.com/news/2023/9/4/how-much-does-africa-contribute-to-global-carbon-emissions [Accessed: 2024-11-03].

Arellano, B. & Roca, J. 2022. Effects of urban greenery on health. a study from remote sensing. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLIII-B3-2022:17-24.

Arellano, B. & Roca, J. 2022. Effects of urban greenery on health. a study from remote sensing. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLIII-B3-2022:17-24.

Balasbaneh, A.T. and Sher, W., 2021. Comparative sustainability evaluation of two engineered wood-based construction materials: Life cycle analysis of CLT versus GLT. *Building and Environment*, *204*, p.108112.

Bhattacharya, R. and Lowenberg, A.D., 2010. Impact of apartheid on economic growth: Implications and empirical evidence from South Africa. *Comparative Economic Studies*, *52*, pp.38-61.

Bolsmann, C,.H, & Alegi, P,. 2010. 'From apartheid to unity: white capital and black power in the racial integration of South African football, 1976-1992' African Historical Review, vol. 42, no. 1, pp. 1-18. City of Tshwane. 2015 Tshwane Vision 2055. Pretoria: City of Tshwane.

Bolsmann, CH & Alegi, P 2010, 'From apartheid to unity: white capital and black power in the racial integration of South African football, 1976 - 1992' African Historical Review, vol. 42, no. 1, pp. 1-18.

Bueno, E.O., Mello, C.R. & Alves, G.J. 2016. Evaporation from camargos hydropower plant reservoir: water footprint characterization. 21(3):570-575.

Convertino, F., Vox, G, & Schettini, E. 2019. Convective heat transfer in green facade system. *Biosystems engineering*, 188:67-81.

Daily Sun, 2024. EFF: Bring back our stadium. [Online] Available from: https://www.snl24.com/dailysun/news/residents-and-eff-call-for-tshwanes-caledonian-stadium-to-be-re-build-20240222 [Accessed: 2024-07-02].

DCTech. 2023. *DCT-W10-2 TIMBER FRAMED BRICK VENEER WALL WITH INTERNAL AIR BARRIER (SMARTVAP) - DCTech*. Dctech. [Online] Available from: https://dctech.com.au/products/dct-w10-2/ [Accessed: 2024-11-02].

DeKay, M., 2012. *Integral sustainable design: Transformative perspectives*. Routledge.

Filho, C.M., Medeiros, R.M., Cavalcanti, N.L.L., Piscoya, V.C., Holanda, R.M., França, M.V., Araújo, W.R., Cunha, A.L.X., Moreira, G.R., Brito, C.C.R., Costa, M.L.L., Araújo Filho, R. N., Correa, M.M., Rocha, J.S., Freitas, J.R., Guerra, S.M.S. & Piscoya, T.O.F. 2020. Distribution of heat stroke in the Ipojuca/PE river basin, Brazil, *Research, Society and Development*, 9(10):e5599108708.

Goharian, A., Daneshjoo, K., Shaeri, J., Mahdavinejad, M. and Yeganeh, M., 2023. A designerly approach to daylight efficiency of central light-well; combining manual with NSGA-II algorithm optimization. Energy, 276, p.127402.

Gosling, J., Naim, M., Sassi, P., Iosif, L. and Lark, R., 2008, September. Flexible buildings for an adaptable and sustainable future. In *Proceedings of 24th Annual ARCOM Conference* (pp. 1-3).

Himes, A., & Busby, G. 2020. *Wood buildings as a climate solution.* Developments in the Built Environment, 4, 100030. doi.org/10.1016/j.dibe.2020.100030

Hunter, A., Williams, N., Rayner, J., Aye, L., Hes, D. & Livesley, S. 2013. Quantifying the thermal performance of green facades: A critical review. *Ecological Engineering*, *63*:102-113.

IOL, 2023. Tshwane's multimillion rand project to refurbish Caledonian Stadium in limbo. [Online] Available from: https://www.iol.co.za/pretoria-news/news/tshwanes-multimillion-rand-project-to-refurbish-caledonian-stadium-in-limbo-bd308d15-83d3-4214-b949-2477bfe1a44e [Accessed: 2024-07-02].

Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., Hase, D., Knapp, S., Korn, H., Stadler, J., Zaunberger, K. & Bonn, A. 2016. Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. *Ecology and Society*, 21(2):3

Lambert Sustainability LLC. 2024. Lambert Sustainability LLC. [Online] Available from: https://www.lambertsustainability.com/ [Accessed: 2024-11-02].

Mello, R., Norton, L.D., Curi, N. & Yanagi, S.N.M. 2012. Sea surface temperature (SST) and rainfall erosivity in the Upper Grande River Basin, Southeast Brazil. *Ciência E Agrotecnologia*, 36(1):53-59. [Online] Available from: https://doi.org/10.1590/s1413-70542012000100007 [Accessed: 2024-05-06].

Na, R. and Shen, Z., 2021, August. Assessing cooling energy reduction potentials by retrofitting traditional cavity walls into passively ventilated cavity walls. In *Building Simulation* (Vol. 14, No. 4, pp. 1295-1309). Beijing: Tsinghua University Press.

Newtown Landscape Architects 2017. 2017 ILASA MERIT AWARDS, *CALEDONIAN INNER-CITY PARK,*

Nordby, A.S., Berge, B., Hakonsen, F. and Hestnes, A.G., 2009. Criteria for salvageability: the reuse of bricks. *Building Research & Information*, *37*(1), pp.55-67.

Peel, M.C. Finlayson, B.L. & McMahon, T.A. 2007. Updated world map of the Köppen-Geiger climate classification. *Hydrology and. Earth System Sciences*, [Online] Available from: https://doi.org/10.5194/hess-11-1633-2007 [Accessed: 2024-03-15].

Stanef-Puică, M.R., Badea, L., Șerban-Oprescu, G.L., Șerban-Oprescu, A.T., Frâncu, L.G. and Crețu, A., 2022. Green jobs—A literature review. *International Journal of Environmental Research and Public Health*, *19*(13), p.7998.

Statista 2021. Production-based carbon dioxide (CO2) emissions in Africa in 2021, by country. [Online] Available from: https://www.statista.com/statistics/1268395/production-based-co2-emissions-in-africa-by-country/ [Accessed: 2024-11-02].

Stats SA 2024. Unemployment in South Africa: A Youth Perspective. [Online] Available from: https://www.statssa.gov.za/?p=17266 [Accessed: 2024-08-02].

Thompson, D.M., Puklin, L.S. and Marshall, A.E., 2016. The long-term impact of channel stabilization using gabion structures on Zealand River, New Hampshire. *Ecological Engineering*, *95*, pp.779-792.

Vlok, J.C. 1955. History of the city of Pretoria. Pretoria (1855 - 1955), 231-243.

Widiastuti, R., Zaini, J. & Caesarendra, W. 2020. Field measurement on the model of green facade systems and its effect to building indoor thermal comfort. *Measurement*, *166*, 108212. [Online] Available from: https://doi.org/10.1016/j.measurement.2020.108212 [Accessed: 2024-05-01].

Yahia, A.K.M., Rahman, D.M.M., Shahjalal, M. and Morshed, A.S.M., 2024. Sustainable Materials Selection in Building Design And Construction. *International Journal of Science and Engineering*, *1*(04), pp.106-119.