Collective Emergence

An architecture for cultivating entrepreneurial growth in the isolated community of Khalambazo.

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Research Field
Unit for Urban Citizenship

Programme
Glass up-cycling plant & traders market

Site
Khalambazo, Mamelodi

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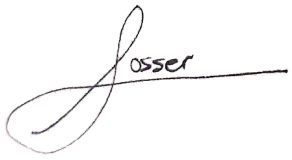
Declaration

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

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

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



Dale Rosser

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Mom and Dad, words cannot describe how thankful I am for you two. Thank you for teaching me everything I know and always believing in me, even when I didn't believe in myself. Your endless love, guidance and patience helped me in ways you cannot understand.

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Project Summary

Although national and local spatial development frameworks and approaches are satisfactory in their aspirations, very few practices translate down at street levels. This is often more severe within the less affluent urban settings, like Mamelodi. For example, Khalambazo neighborhood in Mamelodi, is severely stunted in its ability to meaningfully contribute to the local cultural-economic futures because it is structurally and spatially limited.

The historic context and fragmented urban relationships do not allow for cultural-economic emergence to spontaneously take place. As an antidote, communal/collective entrepreneurship is often seen as a catalyst which generates livelihood, liveliness and longevity within communities. However, without anchoring the identity of the place, livelihood and liveliness cannot be sustained.

As a means of combating this condition of urban sterility, this dissertation proposes the design of a new communal market & recycling facility within Khalambazo. Through the celebration of the existing and essential characteristics of the market typology coupled with principles of placemaking, this new communal facility offers perspective as to what is possible while working within the lines of the NDA and will act as a precedent for further interventions in similar contexts.

Table of content

Definition of terms

Informal Entrepreneurship
Informal entrepreneurship is the activity of setting up a business or businesses, taking on financial risks in the hope of profit where monetary transactions are not declared to the state for tax, benefit and labour law purposes when they should be declared. (Williams 2014:3).

Formal Entrepreneurship
The activity of setting up a business or businesses, taking on financial risks in the hope of profit.
(Adapted from Oxford dictionary, 2021).

Placemaking
Placemaking is the process of creating quality places where people want to live, work, play, shop, learn, and visit. (Wyckoff et al. 2015: 6, Lynch 1960, Da Costa & Van Rensburg 2008).

Public spaces
This means any open or enclosed space, square, garden or park, street, road or thoroughfare which is for the use by the general public and which is owned by or vests in the ownership of the municipal council or organ of the state. (Adapted from Ekurhuleni Metropolitan Municipality Regional Spatial Development Framework: Region C, May 2015).

Densification
Densification is fundamental towards the restructuring of the South African Apartheid City as well as to the concept of a compact city, which optimally utilises all existing resources within the area. (Adapted from Ekurhuleni Metropolitan Municipality Regional Spatial Development Framework: Region C, May 2015).

Urban sprawl
The spread of low-density development (e.g. single dwelling units) away from the urban core areas. This occurs mostly in the form of incremental development on the periphery of existing urban areas. (Adapted from Ekurhuleni Metropolitan Municipality Regional Spatial Development Framework: Region C, May 2015).

Spatial Development Framework (SDF)
SDF is a core component of a municipality's economic, sectoral, spatial, social, institutional, environmental vision. In other words, it is a tool to achieve the desired spatial form of a municipality. (South Africa 2015).

Node
Spatial concentrations of economic, social and related activities occur in a distinct focal area where both public and private investment tends to concentrate. (CoT Vision 2055 2013:14).

Urban edge
A mechanism to manage the outward sprawl of urban areas and to protect potentially vulnerable natural and ecological areas through the introduction of a spatial limit to urban development. Urban development will not be allowed outside the Urban Edge.
(Adapted from Ekurhuleni Metropolitan Municipality Regional Spatial Development Framework: Region C, May 2015).

Circular economy
Circular Economy (CE) is a concept that would turn goods at the end of their service life into resources for others, closing loops in industrial ecosystems, minimising waste and following sustainable methods (Valavanidis 2018)

Chapter One: Position and Situation

Chapter one, titled, *Position and Situation*, serves to initiate the design project and to develop a real-world, discipline-specific stance.

Figure 1.0: Mamelodi location from greater South Africa to City of Tshwane and Mamelodi (Author 2021)

Background

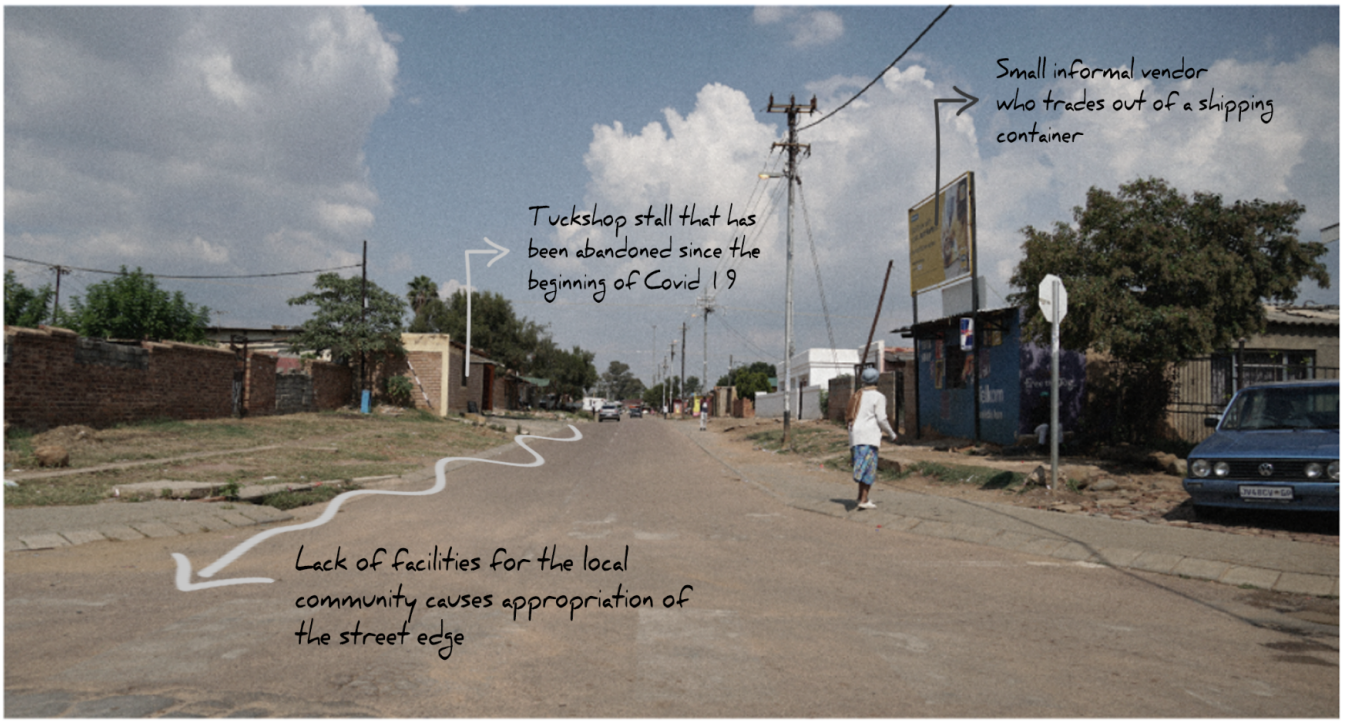


Figure 1.1: Streetscape of typical road located within Khalambazo (Author 2021)

Abstract
Although South African national and local spatial development frameworks and approaches are satisfactory in their aspirations for better urban environments and stronger communities, very few of these higher-order thinking and practices translate down to street level implementation (Peres et al. 2017:691). This transference of strategic action is often more severe within the less affluent urban settings. For example, the Khalambazo neighbourhood in Mamelodi is a lower socio-economic urban area, severely stunted in its ability to meaningfully contribute to thriving local futures. The Khalambazo neighbourhood cannot meet the higher-order national and local planning aspirations, nor can it thrive on its own because it is structurally and spatially limited (Levy 2020: 308). This historic context and fragmented urban relationships do not allow for cultural-economic emergence to spontaneously occur, a common topic in local place-making and planning goals (RSDF 2018:74). As a result, the places that need localised cultural-economic emergence the most are not able to contribute to this on their own and are stuck in a form of developmental paralysis.

As an antidote to this cultural-economic and spatial paralysis, communal entrepreneurship is often the catalyst that generates livelihood, liveliness and longevity within communities. However, without anchoring the identity of the place, livelihood and liveliness cannot be sustained. To combat this condition of urban paralysis, this dissertation proposes a design approach that focuses on leveraging the existing entrepreneurial systems and behaviour in Khalambazo while providing a new spatial identity of place and belonging. Through the celebration of the existing, coupled with principles of placemaking, Kevin Lynch's *Elements of the city* and Van Rensburg's *Space as Ritual*, a new communal market and recycling facility within Khalambazo is proposed. This new communal facility offers perspective as to what is possible while working within the lines of the National Development Agency (NDA). This dissertation contributes to the discourse of public space-making and provides insight to springboard further investigation into similar previously disadvantaged landscapes.

Position

Urban Condition

Mamelodi township is located on the north-eastern periphery of Pretoria, City of Tshwane. The central urban

spatial axis of Mamelodi runs from east two west, and its northern boundary is dictated by the slopes of the Magaliesberg mountain range, and the southern edge is defined by railway lines (Van der Waal 2000). Mamelodi East and Mamelodi West are separated by the Pienaar's River and its floodplains, which results in an abundance of green and brown open space. Even though this is constructible, habitable and productive land, this space is severely underutilised and not used to its full potential.

The first residents to inhabit Mamelodi settled on the Vlakfontein farm in 1945 in search of work in close proximity to the city of Pretoria. The Group Areas Act of 1950 saw the mushrooming of size in Mamelodi with the forced removal of people of colour into this area (Van der Waal 2000). With the abolishment of the apartheid regime in 1994, South Africans experienced a drastic change in government, which resulted in a new era of economic opportunity and large rural-urban migrations, specifically migrations towards informal urban settlements (Deotti & Estruch 2016:16). The legacy of apartheid embedded segregation into the urban fabric, spatial structure, and spatial distribution of the urban population of post-apartheid South Africa (Hamann & Horn 2014:39). The current urban fabric of Mamelodi is an outcome of these policies and practices, which is characterised by urban sprawl and single-use residential zoning. This condition leaves very little space left over for informal and formal economic nodes, public space, and cultural facilities to emerge (Steyne 2005). The urban fabric not only results in the sprawl of these conditions but also social, spatial, and economic fragmentation. As a result of the urban fabric, and confirmed through site observations, as seen in Figure 1.2 below, residents have appropriated the street and edge conditions into the primary public gathering space, which facilitates the informal trade.

Figure 1.2: Informal trade located along appropriated street edges in Khalambazo (Author 2021)

Unemployment

According to Statistics South Africa (2021), South Africa currently has an unemployment rate of 32,5%, a dramatic increase from the recorded 21,9% unemployment rate experienced in 2008. This indicates that there is a severe need for strategic implementation of interventions that improve the poor unemployment numbers. The

unemployment figures are expected to be further exacerbated due to the Covid-19 epidemic (Strauss et al. 2020:1). South Africa's unemployment (currently one of the highest in the world) directly feeds the socio-economic challenges of poverty and persistent inequality (Strauss et al. 2020:1). Mamelodi is no stranger to these unemployment rates, and according to Moller (2008:16), the local unemployment rate experienced within Mamelodi is 63.6%. The concern about employment was also reiterated throughout the Khalambazo neighbourhood, as evident from site observations and interviews conducted with informal entrepreneurs.

	Area (km²)	Number of SMME's
Western Cape	129 462	200 488
Eastern Cape	168 966	261 435
Gauteng	**18 178**	**676 831**
Kwa Zulu-Natal	94 361	394 599
Mpumalanga	76 495	155 732
Northern Cape	372 899	18 823
Free State	129 825	132 167
North West	104 822	155 689
Limpopo	125 755	264 363

Table 1.1: Distribution of SMME's throughout South Africa (Adapted from Bureau for Economic Research 2016)

Small, Medium and Micro Enterprise Entrepreneurs (SMMEs)

Small, medium and micro enterprises (SMMEs) play an essential role within South Africa's economy. SMMEs drive job creation, innovation, and help to stimulate economic growth, a significant contribution to the South African GDP. (Bureau for Economic Research 2016:5). During the state of the province address, premier David Makhura resonated with this statement by stating: "*The significant participation and meaningful inclusion of the people of the township into the mainstream economy of Gauteng through their own township enterprises that are supported by the government and big business will be one of the key game-changers, townships must be self-sufficient and vibrant economic centres*" (Premier David Makhura, State of the Province Address June 2014).

South Africa's SMMEs are mostly found within the informal micro-enterprise category, where the majority are self-employed persons from the poorer population layers (Bureau for Economic Research 2016:5). However, this does not negate the fact that entrepreneurship has acted as a catalyst for development within the world's established economies, and SMME business dominates the new entrepreneurial society (Maphalla 2009:13). Table 1.1 demonstrates that while Gauteng has the smallest available urban land, it also exhibits the highest number of SMME's. Therefore the existing landscape in Khalambazo also exhibits beneficial characteristics towards the creation and incubation of these SMME's and, with further engagement, can progress into the development of healthy localised places and economies.

Overall, entrepreneurship can make a significant impact on economic contribution in terms of wealth creation, job creation, and in terms of employment (Bell et al. 2004:1). In the SA context, the informal spaza shop (micro convenient store) sector brought in over R7 billion in 2014 alone (South Africa 2014: 13). Another informal economic practice found throughout the South African landscape is the informal waste pickers. These waste pickers are common throughout Mamelodi, particularly Khalambazo, as they contribute significantly to the South African economy, with an estimated R748 million saved annually in landfill space (Samson 2021). In order for enterprises to stimulate an economy, a sprightly SMME sector needs to be developed (Rwigema & Karungu 2004:315). As seen from Table 1.1, the distribution of SMMEs throughout South Africa is relatively

even throughout most provinces, barring Gauteng, which contributes almost 30% to the total number of SMMEs. Furthering on from Table 1.1, Table 1.2 illustrates the distribution of these SMMEs between the formal and informal sector, with 66,5% being located within the informal sector. This reflects the current economic landscape experienced within Khalambazo, as seen through site observations and community interviews with informal spaza shop owners and waste pickers.

SMME's					
	Formal Sector	**Informal Sector**	Agriculture	Private Households	Total
An Employer	462 815	**304 303**	41 971	740	809 829
Own account worker	204 318	**1 193 577**	14 803	29 014	1 441 992
Total	667 433	**1 497 860**	56 744	29 754	2 251 821

Table 1.2: Composition of SMMEs within South Africa (Adapted from Bureau for Economic Research 2016)

The current unemployment problem experienced within Mamelodi, particularly Khalambazo, can potentially benefit from further economic stimulation both within the informal sector and developing a formalised entrepreneurial sector.

Collective Emergence

In general, Collective Emergence can be described as a combination of both collective entrepreneurship and emergence. Collective entrepreneurship is defined by Connell (1999) as combining business risk and capital investment through the social values of collective action. It exists when collective action aims for the social and economic betterment of a locality employing transformation of values, social norms, and networks to produce goods (Connell 1999:19). Emergence theory is defined as the existence or formation of collective behaviours, in this case, the unplanned individual social interaction (Concepts: Emergence 2011).

Through the understanding of these two terms, a greater understanding of Collective emergence can be achieved. The term collective emergence refers to the collective action of socio-economic betterment of a locality through collective behaviours. This collective emergence is vital within Khalambazo to ensure socio-economic prosperity, as seen through the precedent study of Warwick Junction and its inherent success.

Figure 1.3: Informal glass processing on-site forming part of the green economy (Author 2021)

Green Economy

The green economy is an economy in which public and private investments drive income and employment growth, reducing pollution and carbon emission, preventing loss of biodiversity and ecosystem services, and increasing resource efficiency (Tulebayeva et al. 2020:1). This economy is vital as green growth can create a new source for development and provide solutions to environmental and economic problems (Lavrinenko et al. 2019:1115). An informal form of the green economy can be seen in Khalambazo through the glass processing existing on-site, as seen in Figure 1.3**.** This is important as it contributes to the architectural intervention's programmatic informants and reflects the Gauteng Township Revitalisation Strategy on *Developing a systematic approach to support productive enterprises* (South Africa 2014).

Perceived barriers to entrepreneurship

To achieve a collective emergence, there are several barriers to overcome before entrepreneurial growth can be experienced within Khalambazo.
This includes:

a) The current unemployment rate experienced within isolated communities such as Khalambazo (Strauss et al. 2020:1).
b) The fragmented urban landscape contributes towards a pendulum migration in order to find jobs (Van der Waal 2000).
c) The perceived lack of implementation of SDF's within landscapes which require intervention.
d) The observed lack of formalised gathering and socio-economic space within the fragmented landscape inhibits collective emergence.

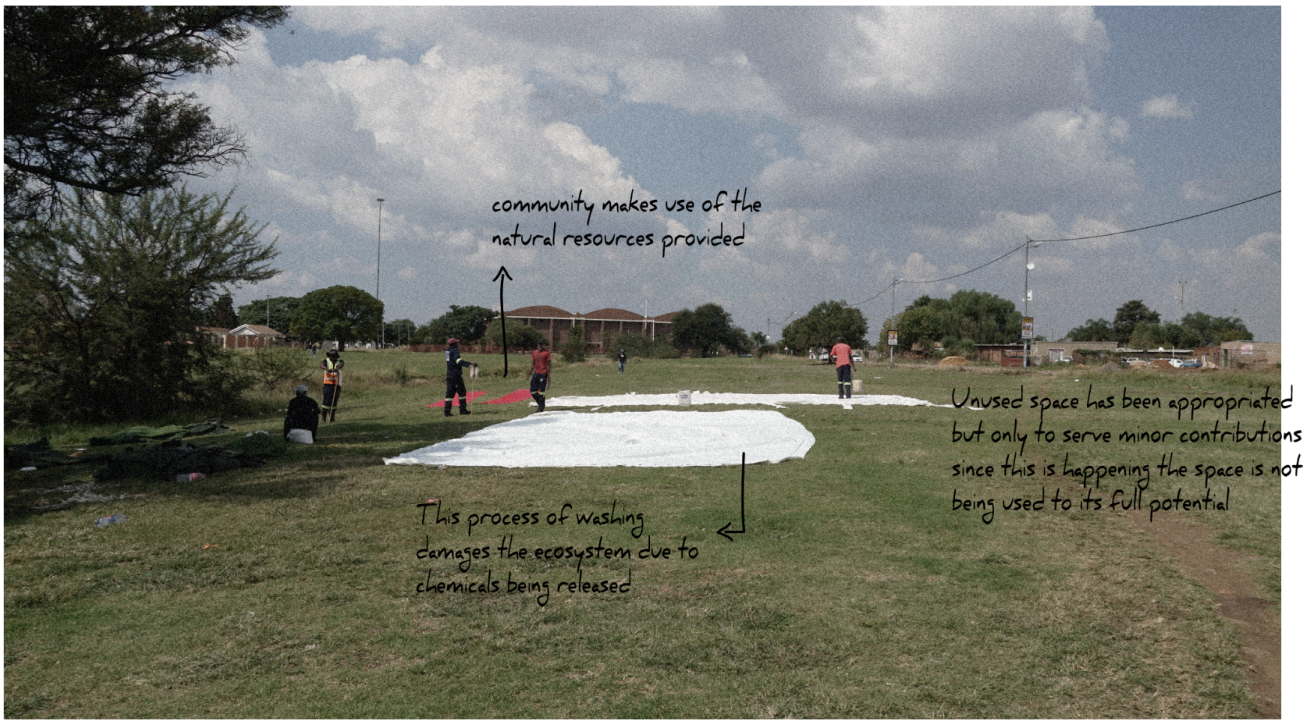


Figure 1.4: Green belts around Khalambazo which contribute towards the disconnect from surrounding communities (Zorn 2021)

Aside from the aforementioned barriers, there are additional barriers that pose challenges to local SMMEs within Mamelodi. In interviews discussed with Maphalla (2009), the prevailing barriers experienced are:

- The lack of business premises.
    - The current lack of business premises can be attributed to the higher cost of renting out a storefront as initial capital costs are high (Maphalla 2009:118).

- Lack of access to funding.
    - The majority of SMME's are self-funded and struggle to access the funding allocated towards SME development (Mutezo 2005:2).
- Crime.
    - There is a risk of the poverty-stricken self-employed being robbed or having their premises looted (Cichello et al. 2011:11).

- The adverse effects remain from the spatial legacy of apartheid.
    - These scars take form in both physical manifestations of land zoning as well as psychological as it affects the way people view themselves and those around them (Maphalla 2009:4). This can be seen in Figure 1.4.

The research conducted by the Gauteng Township Revitalisation Strategy (South Africa 2014) aligns closely with the interview findings of Maphalla. These findings articulate further barriers to ease-of-doing-business, including a poor understanding of entrepreneurial abilities found within townships and poor quality information or hard evidence to demonstrate the direct value-added by township enterprises (South Africa 2014).

However, despite all the barriers mentioned above, many Mamelodi residents believed that the existing entrepreneurship could be expanded to facilitate market growth (Maphalla 2009:4). With Mamelodi being characterised by its high levels of poverty and unemployment, it is considered an environment where contributions of entrepreneurship interventions can be beneficial (Maphalla 2009:4). Preliminary findings from informal interviews reveal that Khalambazo reflects and reiterates the sentiment expressed regarding perceived barriers. Dialogues held with community members also expressed their interest in a more formalised communal space to further the green economic activity on-site and accommodate the existing entrepreneurial activity found within Khalambazo. Figure 1.5, below, shows the dialogue being held with a member of the community.

Figure 1.5: A member of the Khalambazo community during a discussion about informal trade (Zorn 2021)

Benefits of entrepreneurship in township communities

Through the research conducted by Maphalla (2009), the benefits of entrepreneurship and the establishment of SMMEs can positively influence the immediate society and economy. These benefits uncovered in Maphall's study include, but are not limited to:

- Job creation and unemployment reduction (Maphalla 2009:110).
- Indirect job creation and economic stimulation via proximity with the SMMEs and entrepreneurial hubs (Maphalla 2009:118).
- Wealth creation and income-generating abilities (Maphalla 2009:118).
- The ability to enable the self-empowerment of people and societies through entrepreneurial activities. (Maphalla 2009:118)

For example, if there is a project to build a bridge in the township, the company awarded the project uses an emerging local construction company to conduct part of the project. This work will enable the emerging company to gain in-depth experience from working with the larger construction company, and money flows into the township through job creation. (Matli & Jordaan 2016:132)

Issues

These preceding texts encapsulate the persistent South African condition whereby the historical context and fragmented urban relationships do not allow for cultural-economic emergence to occur spontaneously. The lack of transition from aspiration to implementation within governmental frameworks further exacerbates the apartheid driven formation of our cities and landscapes. This can be seen through the Tshwane Vision 2030, which aims to ensure growth, job creation and poverty alleviation by the year 2030. However, as the objective date approaches, unemployment and poverty rates increase. This leads to the further marginalisation and persistent economic deterioration of these already isolated communities.

- **General issue**: Scars of the past are etched onto our urban landscape.

Apartheid spatial planning legacy has etched scars of the past into the urban fabric of our cities, towns and townships, one of these areas being Mamelodi. Post-1994 saw the abolishment of the National Party and a drastic change to the government of South Africa; along with that, new economic opportunities emerged, which initiated a large migration of people from rural areas to informal urban settlements (Deotti & Estruch 2016:16). Despite a population influx, Mamelodi inherited the apartheid spatial legacy with an inherent disconnect from the city and underdeveloped buffer zones. This has resulted in the need for informal entrepreneurship, as shown in Table 1.1 and Table 1.2.

- **Urban issue**: Lack of implementation of SDF's.

Mamelodi was initially planned to be a predominantly residential and industrial area (Van der Waal, 2000). The influx of people caused stagnated monofunctional development of low to medium-density housing. This single-faceted landscape has resulted in a lack of informal and formal economic convergence spaces, public space, communal facilities, and desirable living conditions (Moloisane 2018:42). However, through initial mapping, the micro-urban fabric which has prevailed displays resilience in the form of appropriated street edges and a vibrant local economy, as seen in Figure 1.6. There is a need to implement recent spatial development frameworks on a street level to enable socio-economic growth within Mamelodi, specifically Khalambazo.

- **Architectural issue**: Attenuation of public architecture.

To combat the macro mono-functional urban fabric, the micro solution must facilitate the multiplicity of informal economic activity found, this can be done by creating space that is inclusive to the needs of the community. Architecture cannot alter the cultural and economic scars of the past, but it can be used as a tool for spatial reconciliation and upliftment to encourage transformation and act as a platform for this transition. Thus the architectural issue which will be addressed is how to combat the attenuation of public architecture within Mamelodi while providing the members of Khalambazo with a platform that celebrates the local economy.

Figure 1.6: Series of images representing the urban and architectural issues of the Attenuation of public architecture and the inherent lack of implementation of SDFs. (Author 2021)

Research question and Sub questions

This thesis focuses on the development of contextually appropriate entrepreneurial space: to investigate the potential of the larger vibrant informal economy to uplift a dormant community. Moreover, how architecture can become a device for collaboration and engagement between entrepreneurs and the community within the isolated community of Khalambazo.

Due to the vastness of Mamelodi, the study area will be limited to Mamelodi East, in particular, Khalambazo and the green belt on the northern periphery. The isolation of Khalamabzo from its greater surroundings, as seen in Figure 1. 7, has resulted in the development of its formal, informal and green economy. With a greater understanding of the South African historic and future urban conditions, unemployment, the businesses which it affects and the perceived barriers which exist, the research question is as follows:

How can architecture facilitate the existing entrepreneurial knowledge system in order to overcome the crippling mono-functional urban fabric of Mamelodi?.

Sub questions:

a) How can architecture create space which results in the rejuvenation of the existing mono-functional urban fabric of Mamelodi?
b) How can the informal entrepreneurial systems inform social space making within Khalambazo?
c) How can architecture create space which responds to the spatial imperatives of the NDA, Gauteng Township Economy Revitalization Strategy, and the local municipal frameworks?

Figure 1.7: Artificial and natural borders which surround the district of Khalambazo (Author 2021)

Research methodology

This dissertation was done through a multi-faceted methodology approach that was used to answer the research question. This approach ensures the final solution is informed by a variety of theoretical and practical methods, which will enable multiple informants towards a design solution. All of the research contained within this dissertation was done in accordance with the Universities code of ethics for research.

- Urban Mapping: Inventory of physical and environmental characteristics

In order to generate a comprehensive understanding of the historical and current layering of Mamelodi and, in particular, Khalambazo, a series of urban mapping exercises were done. This informed precedent and SDF analysis as well as uncovered historical land-use patterns, current occupations and an overall synthesised urban gestalt.

- Urban Spatial Analysis: Shape, Identity, Rhythm and Form of Khalambazo

Evaluation and analysis of the existing architectural identity will be done in order to determine the existing limitations experienced as well as provide a base from where architectural suggestions can stem.

- Urban Systems and Value-Chain Analysis

The green economies which are found on site will be mapped and analysed in order to determine gaps in the existing value chain and if architecture can facilitate the growth of these existing systems.

- Archival and Desktop Research

Relevant historical literature and archival material were used to develop an understanding of the history of Mamelodi. Site visits were conducted in conjunction with desktop studies to generate a greater understanding of the existing topographical and environmental conditions and constraints, as seen in Figure 1.9.

- Precedent Studies

In order to understand how architecture can respond to similar conditions, a contextual precedent study will be conducted. Precedent studies will also be done into programmatic and sustainability systems in line with the NDA.

Site and Programme selection

Site Selection

The site area chosen for investigation sits on the cusp of Mamelodi East and Mamelodi West. The area is isolated by both natural and man-made barriers on all sides. With Tsamaya Avenue (the main arterial) on its southern edge, the Pienaarsrivier (and accompanying buffer zones) on its northern and western, and unused open green space and "educational" zones on the eastern edge, the site is largely isolated from its surroundings. Khalambazo is physically and economically removed from its greater surroundings, which places the residents in a state of vulnerability and socio-economic dependency (Levy 2020: 22).

The programmatic intention is to foster entrepreneurial collective emergence within Khalambazo while achieving the goals of the NDP. The aim is to investigate how the architectural process and design can assist the existing landscape and communities in order to become a multi-functional destination within the monofunctional urban fabric.

The programme mediates between the formal and informal entrepreneurial enterprises to create and facilitate livelihood and liveliness within Khalambazo. The programme informs the architectural response to re-envision the boundaries between existing neighbourhoods and broaden the entrepreneurial landscape and abilities to promote an inclusive economic environment within Khalambazo. The immediate context is investigated as an informant as to how architecture can establish formalised economic space and the community to which it serves. Figure 1.8 breaks down the target state cluster of enterprises found within Khalambazo and allows for a greater understanding of the characteristics of the already existing informal economy.

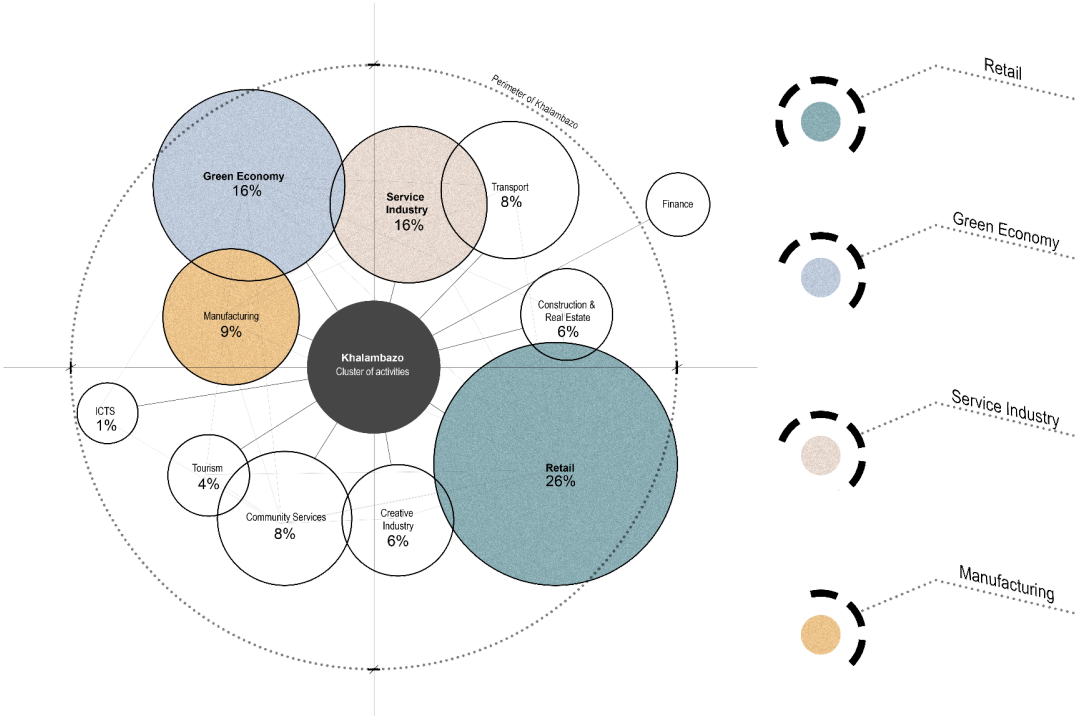


Figure 1.8: Cluster of economic activities which take place within Khalambazo (Author 2021)

The enterprises reflected in Figure 1.8 were informed by transect walks through Khalambazo and the urban edge. This mapping of entrepreneurial clusters aids in developing the programmatic requirements of the architectural intervention as the intervention should respond to the plethora of economic informants uncovered. With a greater understanding of the activities which are currently taking place on-site, the proposed programme is as follows:

- **Primary programme**: Recycling & sorting facility

Primary programme one responds directly to the site and its users, predominantly green economy activities such as recycling, coupled with the *public market space,* act as the core for this dissertation.

- **Secondary programme**: Public market space

The secondary programme is focused on the retail scope of activities. This includes the SMME's within Khalambazo, both formal and informal. This space needs to be multifunctional to facilitate the multiplicity of activities that take place on-site.

- **Tertiary programme**: Activated street edge

The tertiary programme allows for the edge to be appropriated according to the needs of the community.

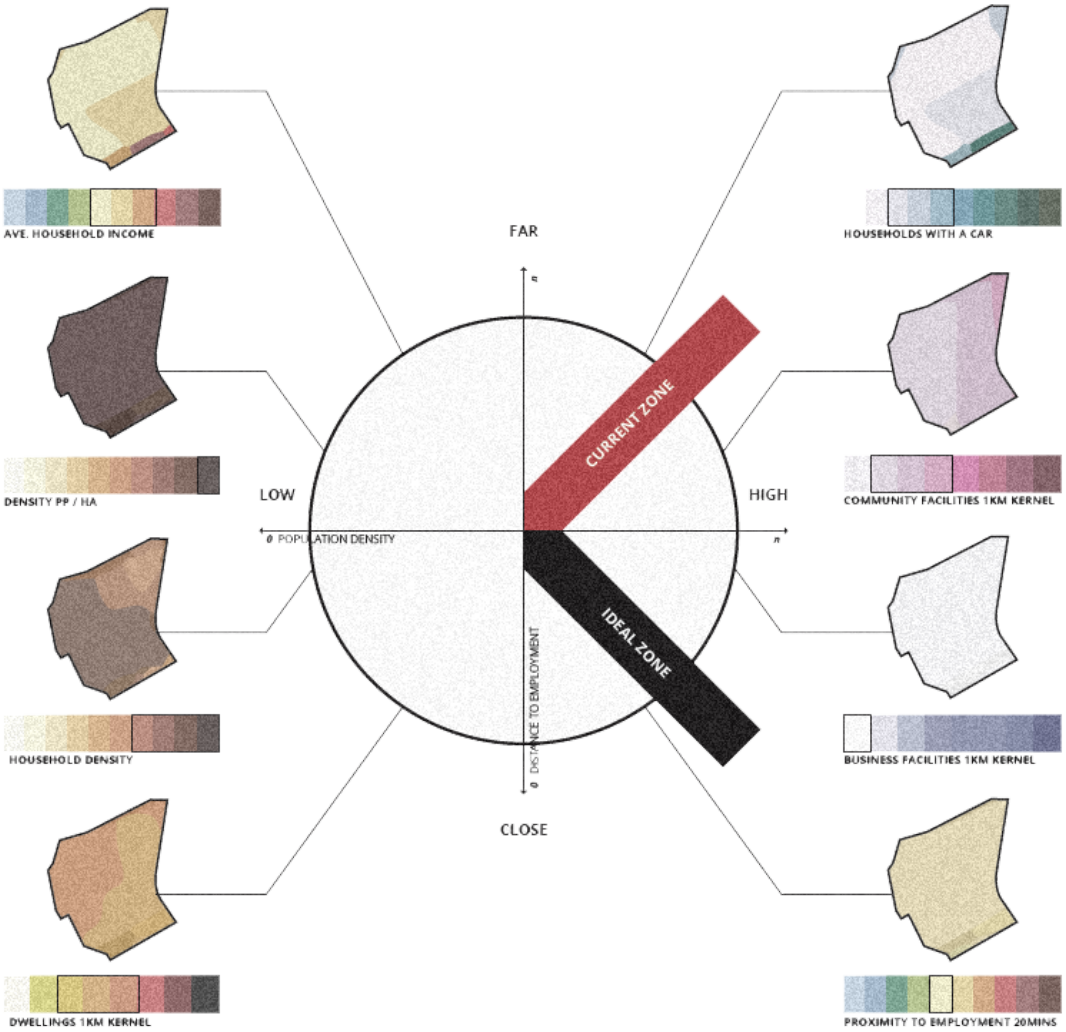


Figure 1.9: Macro analysis desktop studies reveal the site is dormant and has limited access and opportunities (Levy 2020)

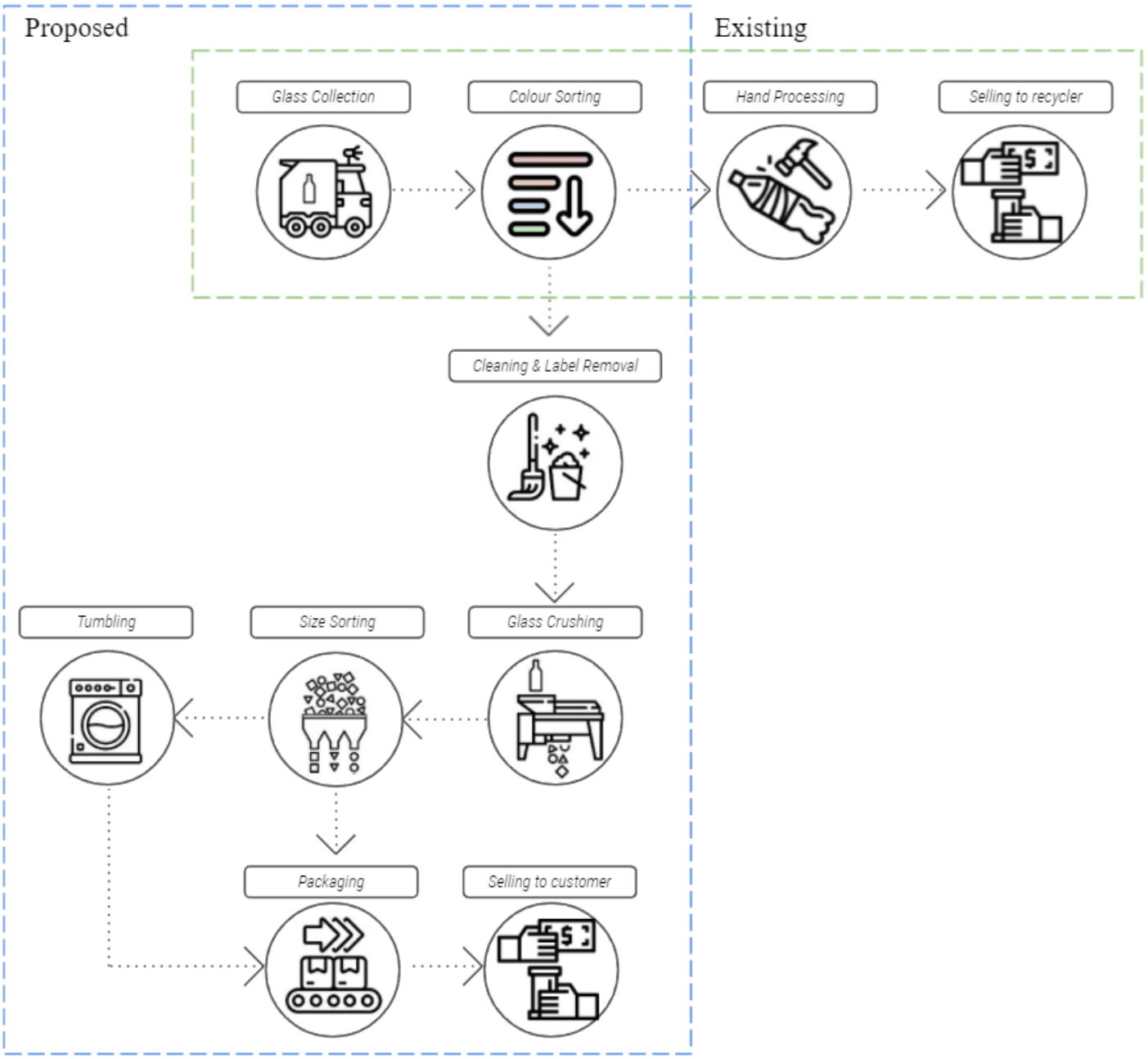


Figure 1.10: The existing glass value chain and the proposed additional steps to add value to the glass lifecycle (Author 2021)

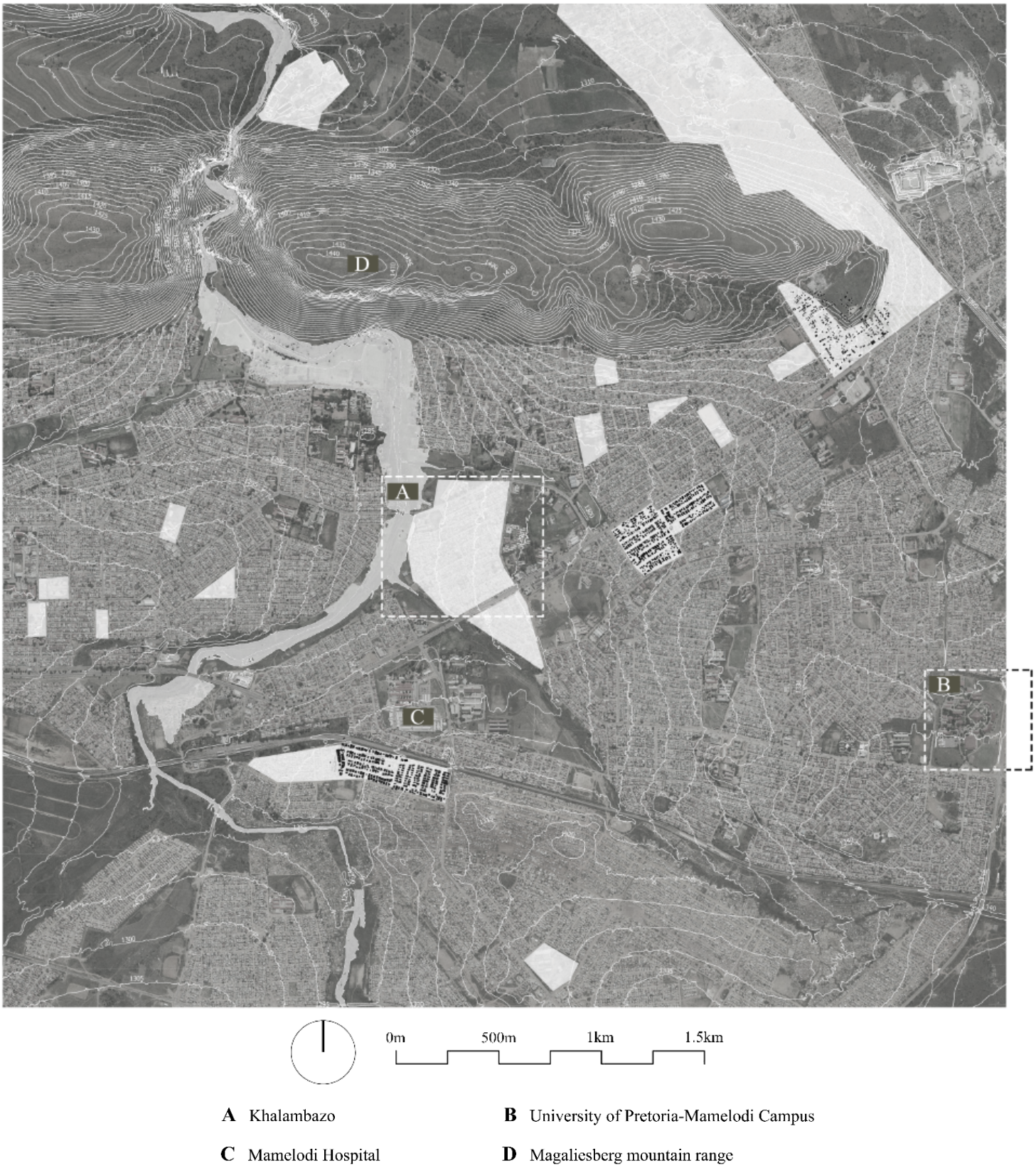


Figure 1.10: General location of Khalambazo and identifiable landmarks in Mamelodi (Author 2021)

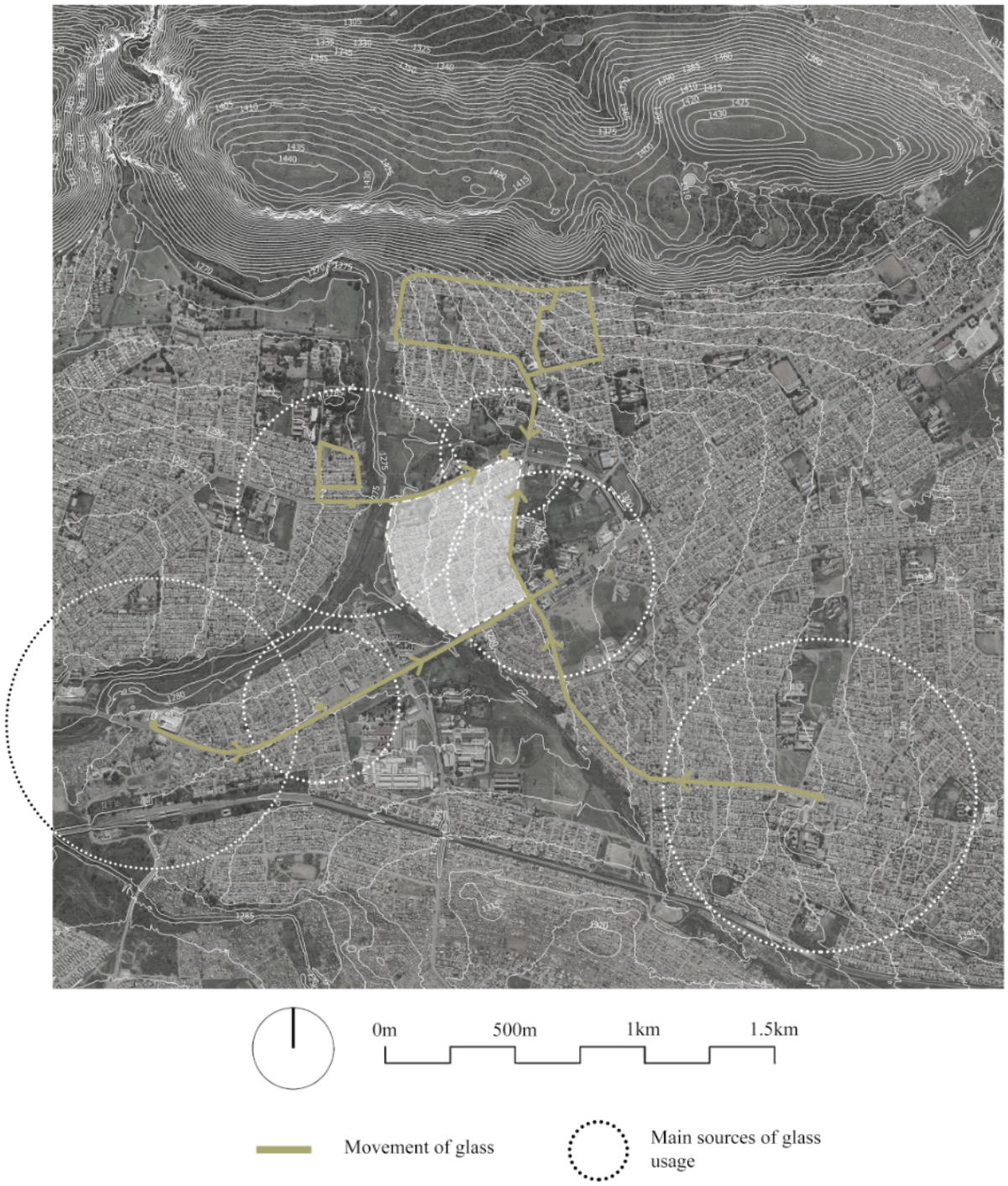


Figure 1.11: Movement of glass into Khalambazo (Author 2021)

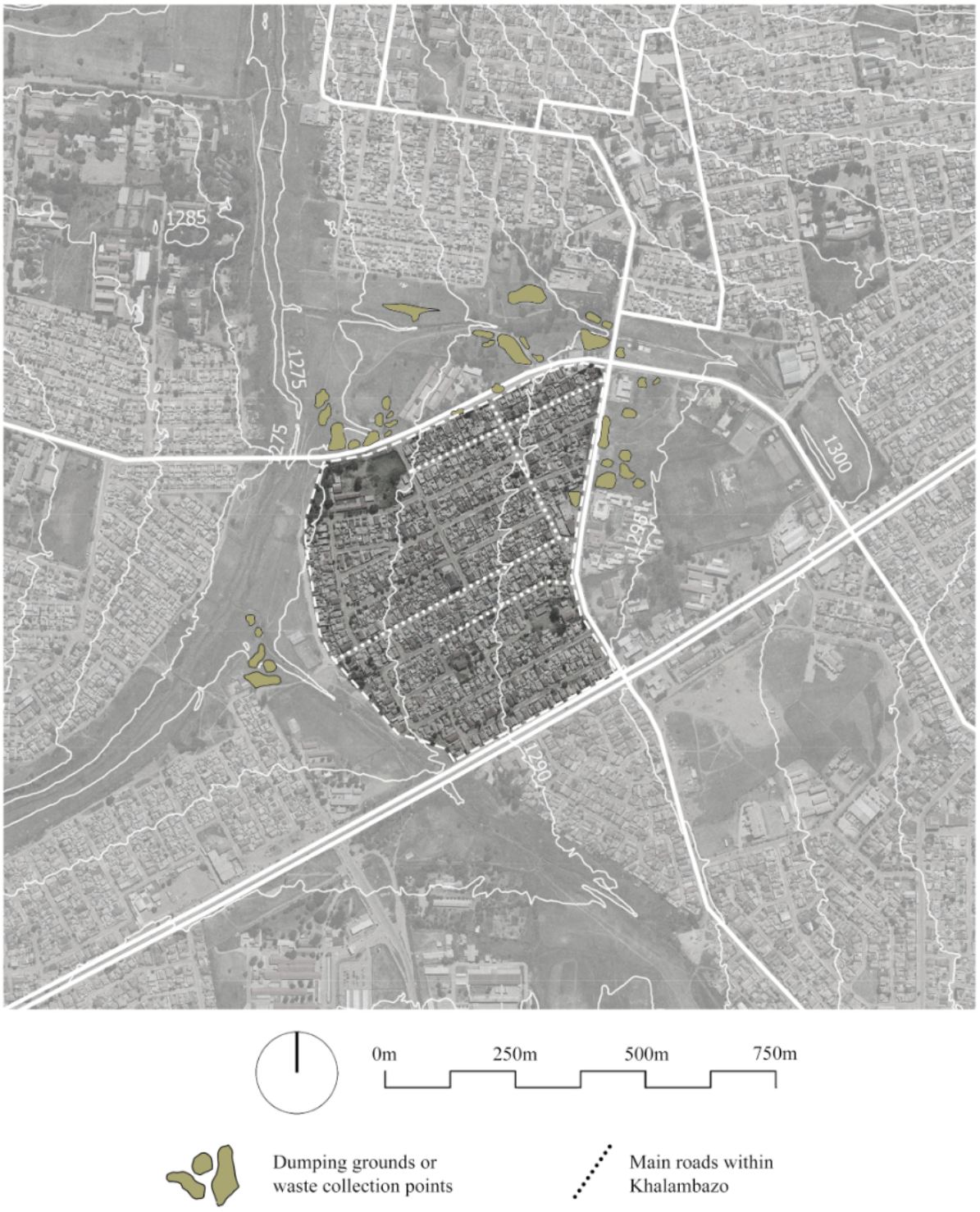


Figure 1.12: Map of overly polluted areas (Author 2021)

Figure 1.13: Map of entrepreneurial landscape along with associated gathering places (Author 2021)

Chapter Two: Design Research

The intention of essay two is to continue the argument and thought process of essay one, position and situation, with the introduction of research into design. Investigation and discussion of design informants will take place through the lens of selected theories which results in architectural implications.

Figure 2.0: Programmatic collage representing the glass processing plant, the market space, and the appropriated street edge (Author 2021)

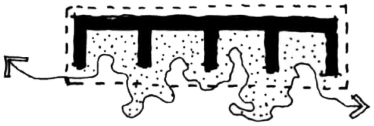
Precedent studies

It is the role of designers within the South African landscape to generate an understanding of the positive attributes of existing architectural interventions and to develop these positive qualities further. The selected precedents not only demonstrate uplift of their immediate context, but they also make the architecture part of the "every day" as they continue to prosper beyond the initial open day exposure. Many projects found within sites similar to Khalambazo express concern with addressing heritage and cultural issues. However, in light of the current climate, South Africa currently has an unemployment rate of 32,5% (Statistics South Africa 2021), which means that one cannot ignore the chance to address economic and social hindrances experienced within the landscape.
This precedent study analysis is to generate a greater understanding of the dynamics of informal trade, which is used to further formulate and inform appropriate design strategies which directly relates to the existing informal trade found on site. The critical evaluation of the selected precedent studies generates an understanding of the market typology, which is scattered through the South African landscape. This, however, only responds directly to a component of the programmatic requirements. The Upcycle-Centrum Almere will also be consulted, which deals with recycling and upcycling principles which responds to the remaining programmatic function of the proposed intervention.

In the decades following the independence of many African countries, numerous cities constructed central markets to combat the attenuation of necessary social infrastructure (Gantner 2009:1). Gartner (2009) further elaborates on these central markets by stating, "these buildings condense the strata of society into a single space: vendors of the rural peasantry, urban migrants, the growing middle class; patrons of peri-urban farmers, squatters, and the wealthy urban elite all take part in urban condition at and surrounding the market buildings". This has resulted in the production of some of the most vibrant, complex, and most locally identifiable spaces experienced in urban Africa (Gartner 2009:1). It is through an understanding of these precedents which informs the architectural intervention to achieve a vibrant, complex, and locally identifiable space.

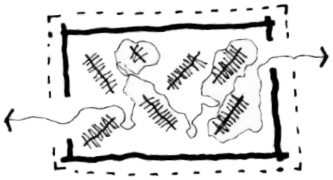
Warwick Junction: *Durban, Kwa Zulu-Natal, Circa 1910*

Figure 2.1: Image of Warwick Junction illustrating the spatial appropriation of existing structures (Gilbert 2009)



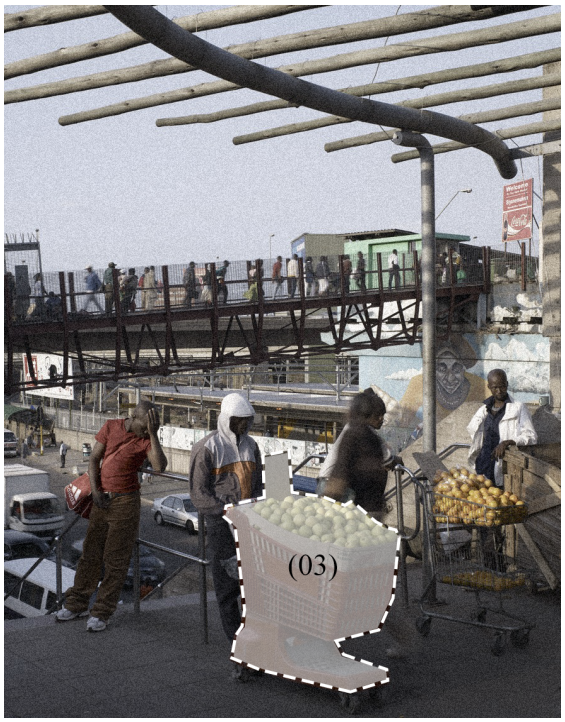
(01) Spatial appropriation of existing structures allows for unique spatial configurations and characteristics.

Figure 2.2 : (Left) Spatial appropriation of existing structure allows for unique configurations (Author 2021)



(02) Stores open up onto public walkways allowing for permeability and passive surveillance.

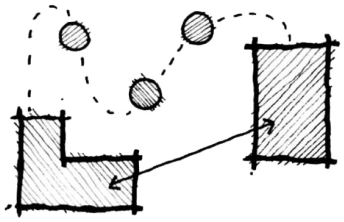
Figure 2.3: (Left) Stores open up onto public walkways allowing for permeability (Author 2021)



Warwick Junction lies in the centre of Durban City and is a trading and transport hub. The area around Warwick Junction has been used as a market for as long as 100 years, initially by Indian merchants. When racial segregation laws began to loosen in 1980, trade flourished, but infrastructure remained insufficient for the volume of users within this space.

Warwick Junction has established itself as an icon for collaborative and "people-centred" governance within South Africa. The result is not only one of the largest informal traders markets within South Africa, which contributes significantly to the economic prosperity of the area, but also the creation of a bustling atmosphere with reduced crime rates (Warwick Junction 2016).

The Warwick Junction Urban Renewal Project is responsible for tackling design challenges and urban management (Dobson et al. 2009:4) and was initiated after 1994. This project understood that informal trading is vitally essential to the local economy and employment (Dobson et al. 2009:4). Warwick Junction is an example of collective emergence as it significantly contributes to the social and economic futures of its users.



(03) The tertiary activities are scattered between main market spaces creating interstitial moments of interaction.

Figure 2.4: (Left Above) Image of Warwick Junction and its informal traders (Gilbert 2009)

Figure 2.5: (Left Below) The tertiary activities are scattered between main market spaces creating interstitial moments of interaction (Author 2021)

Baragwanath Transport Interchange and Trader Market: *Johannesburg, Gauteng, 2006, Ludwig Hansen Architects + Urban Designers*

The Baragwanath transport interchange acts as one of the busiest transport nodes within South Africa, which accommodates over 500 street traders and their associated amenities (Baragwanath Taxi Rank 2008). The Baragwanath Transport Interchange and Traders Market is a scheme that reflects the principles set out by the NDP with the consolidation and expansion of transport infrastructure (NDP 2030 2013:56). Not only does it respond directly to the objectives set out by the NDP, but it also exhibits elements of a quality place such as the ease of walkability and mixed-use functions (Wyckoff et al. 2015:15).

This approach allows for multiple configurations for spatial appropriation and programmes, for example, traders can occupy the trader's hall or the covered walkways along the street edge. The materiality choice allows for the permanence and resilience of this structure as a landmark in its environment allowing it to not only become a transient space but also a destination. This precedent not only responds to the needs of the traders and commuters but also adds to the general environmental aesthetic with the aid of the volumetric structures which have become landmarks within the environment.

Figure 2.6: Public architecture scale and order (Mathenge 2015)

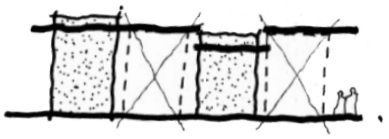


Figure 2.7: (02) Architectural rhythm experienced in plan and elevation (Author 2021).

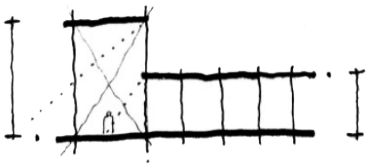


Figure 2.8: (01) Scale indicative of landmarks, not transient space (Author 2021).

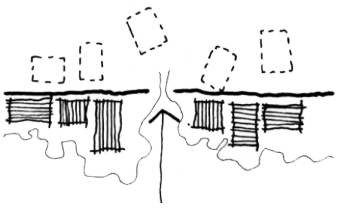


Figure 2.9: (03) Permeability of space to allow appropriation of the street interface (Author 2021).

Figure 2.7 and Figure 2.9 illustrate how the design not only responds directly to the needs of the traders but how the architecture contributes to its environment. Architectural rhythm can be experienced in plan and elevation throughout the intervention with the scale being indicative of landmarks, not a transient space. The permeability

of space from street edge to market space has allowed for the formation of a linear development representing the street from which it originates.

Kariakoo Market: *Dar es Salaam, Tanzania, 1974, B.J Amuli*

The Kariakoo Market found in Dar es Salaam exemplifies the placemaking principles with multiple destinations within one place, the ease of walkability, functional sidewalk amenities and multiple choices in recreation (Wyckoff et al. 2015:15). These placemaking principles have caused Kariakoo to become the definitive commercial centre with positive effects on socio-economic life within the city centre (Gartner 2009:49). Over the years, the physical restraints of the building have become inadequate for the ever-expanding city Dar Es Salaam. Figure 2.10 illustrates how the informal market space has outgrown the market's perimeter walls and extended outwards.

The success of the Kariakoo market can be attributed to the high concentration of small scale traders, which rely on a constant flow of transport to and from hubs surrounding the market (Gartner 2009:49). “Collective emergence” is reflected within the Kariakoo market as the “influx of individual participants” is “essential to the identity of a central market”(Gartner 2009:49).

The market is not only apt for its function as a market but also its environment as its roof structure provides much-needed shelter during the days. It also acts as funnels which harvest rainwater and store them in tanks underneath the structure (Kariakoo Market n.d.).

Figure 2.10: Traders appropriate street edge as the informal market has outgrown the existing space

Upcycle-Centrum Almere *Almere Stad, Netherlands, 2018, LKSVDD architecten*

The Upcycle-Centrum Almere is the exemption from marketplace related precedents with a focus on all facets of circular economic practices and is a direct response to the green economies found on site. The Upcycle-Centrum is a modern pavilion that focuses on a circular economic system (Razoky 2020). Not only is its programmatic function to recycle and upcycle, but the building itself also reflects these circular principles with rainwater harvesting facilities (Figure 2.11) as well as being made of majority recycled materials (LKSVDD Architects 2019). This intervention reflects sustainability systems that are applicable to any site or context. As reflected in Figure 2.11, the Upcycle-centrum allows starting entrepreneurs to use waste in order to make and sell products from display rooms (Upcycle Centrum Almere 2019).

Figure 2.11: The Upcycle-Centrum Almere with rainwater collection roof and a public interface for upcycled products (LKSVDD 2018)

Lessons learnt from precedent studies

The precedent studies aided in the overall understanding of what is required from the intervention in Khalambazo. Warwick Junction exemplified collective emergence as it significantly contributed to the social and economic futures of its users and utilized informal trade to stimulate the local economy and employment (Dobson et al. 2009:4). The Baragwanath Transport Interchange's materiality choice allows for the permanence and resilience of this structure as a landmark in its environment allowing it to not only become a transient space but also a destination marked by its volumetric structures and appropriated street edges. The Kariakoo market exemplifies collective emergence as the influx of individual participants is essential to the identity of the market (Gartner 2009:49). Kariakoo also reflects placemaking principles as it allows for multiple destinations within one place, the ease of walkability, functional sidewalk amenities and multiple choices in recreation. The Upcycle-Centrum Almere directly responds to the green economies found on-site, allowing for circular economic practices to take place with a focus on the green economy.

Design Investigation

Following on from the precedent studies a design investigation stage follows, which uncovers hidden elements of the site through different theoretical lenses. In order to be able to generate a site vision, the elements of the site need to be analysed and identified. The physical markers established within Lynch's theory aid in building an identity as they speak directly to the physical manifestation of space. Lynch (1960:41) classified the perceived physical forms into five convenient types of elements which include:

- Paths
- Edges
- Districts
- Nodes
- Landmarks

These elements are generally perceived at a city-wide scale, however, these elements applied to a micro-scale over Khalambazo allow for a greater understanding of the physical perception of space, as seen below in Figure 2.12. Very few of these elements act in isolation from one another with, "districts being structured with nodes, defined by edges, penetrated by paths, and sprinkled with landmarks"(Lynch 1960:48).

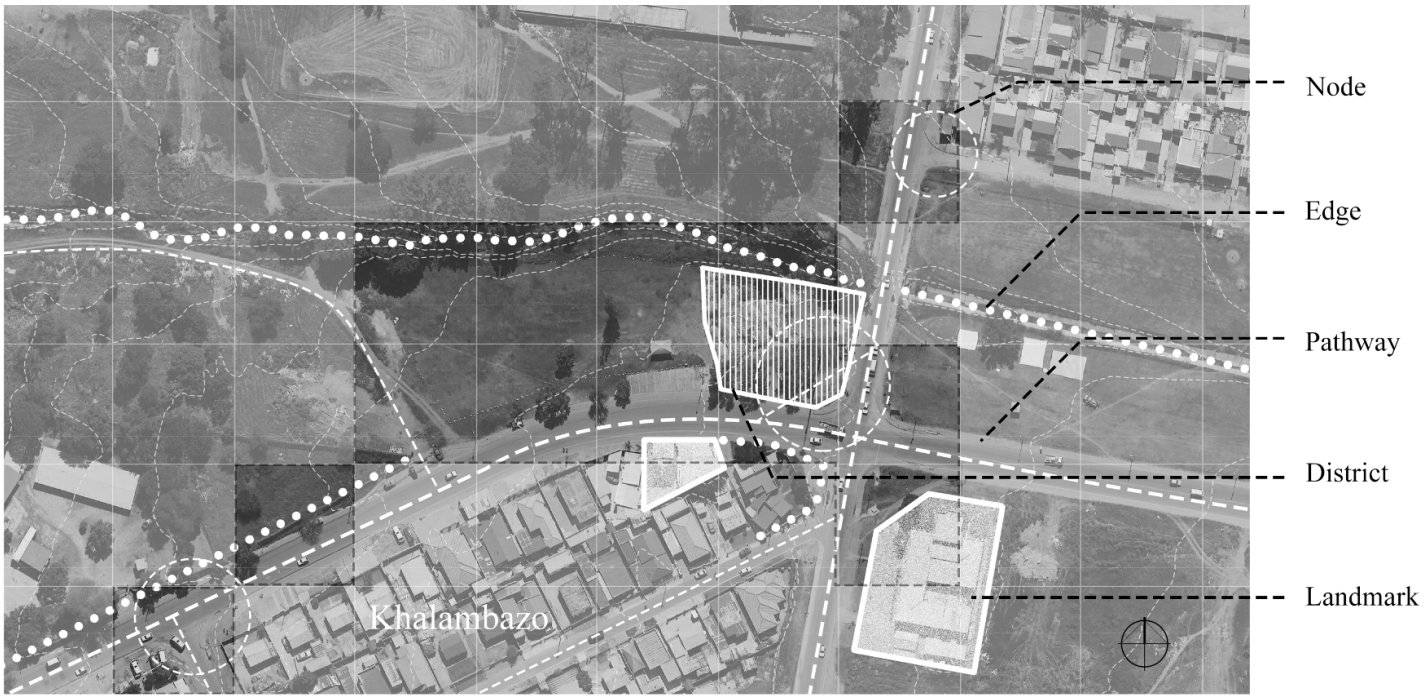


Figure 2.12: Lynch's elements of the city highlighting the identity of Khalambazo (Author 2021)

This interweaving and overlapping of physical elements expose areas of the site which are wealthier in socio-economic potential as there is perceived to be more activity. This concentration of activity gives the particular area prominence in the eyes of the observer, even if it may be subconscious. A critique of Kevin Lynch's *Elements of the City* (1960), may be that these principles are outdated, however, it allows an initial investigation into the physical potential of the site, which is identity, with room to investigate further design informants to lead to a collective emergence eventually.

A more contemporary approach to site analysis is to critique the existing programmes against placemaking principles. Placemaking inspires individuals to collectively reinvent and reimagine public spaces which are at the heart of communities, thus supposed to strengthen connections between people and the places which they share (Ellery & Ellery 2019:238). Public space lies at the crossroads of placemaking as it is inherently multidimensional in nature, with successful public space being used by many people for many different purposes and different times of the day and year.

The result of placemaking is the creation of quality places. These quality spaces are where people would want to work, play, shop, learn and visit (Wyckoff 2015). Users understand when they are in a quality space since these spaces have a strong sense of place. For example, a parking lot is phenomenologically just as crucial as any other place. While a parking lot is more negative, we can contrast the place to a more positive feeling that one feels when at any other important space such as a school or church, places which generally evoke a positive emotion, as seen through Figure 2.13.

Coupling Lynch's *Elements of the City* (1960) together with the quality spaces realised by placemaking principles allows for the establishment of the identity of place. This combination of thoughts manifests within Khalambazo through the identification of space that holds socio-economic potential (Figure 2.12) and the standard of being able to strengthen connections between people and the places which they share (Ellery & Ellery 2019:238).

Figure 2.13: A comparison between a typical parking lot and House of Uzma, which evokes a more positive emotion (Author 2021)

Many of these areas of activity identified within Khalambazo exhibit fringe characteristics of quality spaces. The understanding of each place individually aids in the generation of overall guiding characteristics which frame the quality space aspirations of the intervention.

- The locality of street vendors and tuck shops located throughout Khalambazo exhibit great walkability attributes which contribute to the overall walkability of Khalambazo.
- House of Uzma has a perceived sense of safety as it is pulled in from the street edge (Figure 2.13).
- Glass recycling became a social activity through the openness of the operation which has resulted in passive surveillance through the site.
- Fourways Fashion Lounge acts as a social activator by enabling secondary activities to take place around the site (Figure 2.14)

Figure 2.14: Fourways Fashion Lounge as an enabler of secondary activities.

From a greater understanding of these fringe quality spaces, the most essential characteristics of a quality space from the local examples can be extruded and used to inform design decisions further. These important form characteristics include:

- Scale to denote importance within the landscape.
- Walkability on the street interface.
- Appropriate building mass and density to further prevent urban sprawl.

Once form characteristics have been adequately implemented, other quality space characteristics materialise such as (Wyckoff et al. 2015 & What is Placemaking 2007):

- Safety.
- Space becomes more accessible.
- Spontaneous interaction is encouraged.
- Civil engagement is promoted and facilitated.

After site analysis investigation began the narrative inquiry approach, which arose from an initial site visit. What was discovered was that a particular group of traders had changed position from 2020 to 2021 and abandoned their permanent and mobile stores and relocated to the street edge on Tsomo Street (which is where the intervention is proposed). In an interesting observation, Levy's research uncovered the architecture of economic opportunity within Khalambazo and the different stages of spatial appropriation, what was observed was not the usual incremental upgrading of the household as seen in Figure 2.15 to Figure 2.17 but rather the abandonment of it altogether to seek a better economic landscape. Through conversation with community members and informal traders, it was uncovered that these traders are suggesting a communal facility to conduct trade from with the belief that it will be better for local businesses.

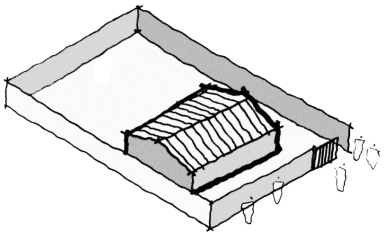


Figure 2.15: The existing household before any entrepreneurial addition or change has been made (Adapted from Levy 2020)

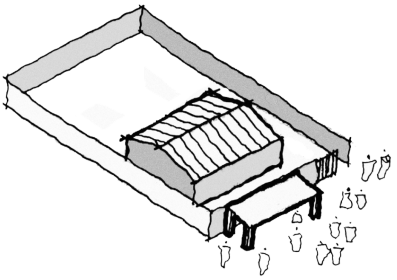


Figure 2.16: The first incremental upgrade to the home, which is a portable platform used for trade (Adapted from Levy 2020)

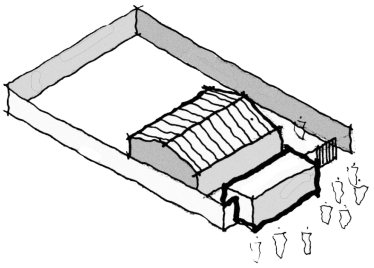


Figure 2.17: Upgrade from mobile stall to permanent trade location as a result of additional infrastructure (Adapted from Levy 2020)

This narrative inquiry revealed the need for the stimulation and creation of a socially vibrant market and recycling facility which uplifts the existing community (Khalambazo) through addressing spatial inequality and issues. Therefore the objective is to develop an architectural intervention that responds to the existing grain of urban informality as well as the green economy activities which take place on-site allowing for a collective response to the socio-economic needs of the community, which are currently lacking. Figure 2.18 reflects how the existing landscape, as well as the entrepreneurial context, acts as the main driver and informant for an architectural response, this will provide a scale sensitive, appropriate intervention.

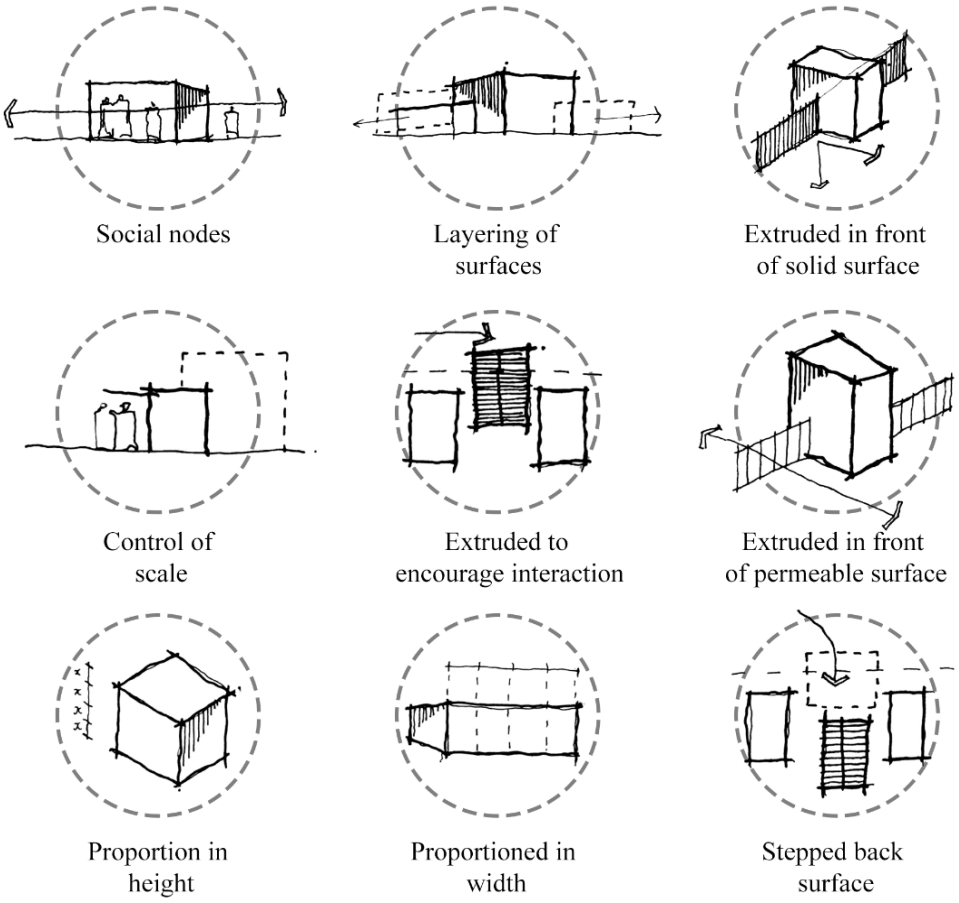
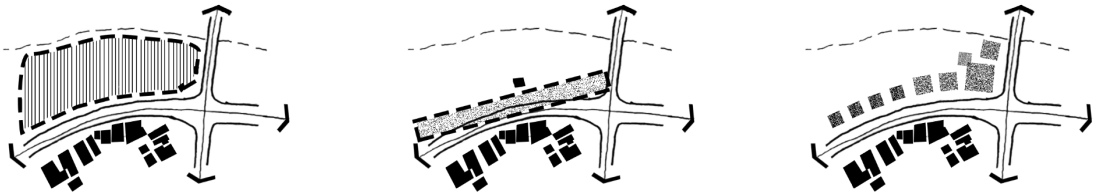


Figure 2.18: Architecture of economic opportunity found within Khalambazo (Adapted from Veldsman 2020)

Site Vision

The site vision is informed by the guiding principles of the National Development Plan and the accompanying Municipal Spatial Development Frameworks, which cumulatively work towards creating an environment conducive to economic stimulation. The potential in the site lies in utilising the site underlying socio-economic vibrance and applying it to new infrastructures, which can complement or facilitate the existing spatial gestalt. In order to address the issue of impoverished urban space, Van Rensburg (2008:35) suggests that the architectural function must be reconsidered to allow liberation from the static "aesthetic approach" and instead support the liberalising of diversity and the establishment of hybrid cultures. For example, the Baragwanath transport interchange moves away from the static aesthetic approach to become a beacon for the establishment of hybrid cultures within the city, as seen in Figure 2.6.

This liberalising of diversity supports the creation of quality spaces due to the placemaking process, which creates spaces where people want to work, play, shop and visit. The elements of a quality place include the ease of walkability, mixed-use, creative amenities, safe and comfortable green space, choice in recreation, and respecting historical and cultural structures (Wyckoff et al. 2015:15). The culmination of governmental frameworks with placemaking principles allows for the further generation of guiding site principles, as seen below in Figure 2.19.



Recover and reintegrate underutilised space back into Khalambazo.

Inhabit and redefine the edge condition of the site.

Intervention to define the rhythm of the site in an appropriate scale.

Figure 2.19: Guiding site principles (Author 2021)

Conceptual Generators

Drawing from the understanding of Space as Ritual (2008), it is possible to articulate an understanding of the local conditions by contrasting African philosophy (collectivism) with Western philosophy (individualism), represented by Figure 2.20. Through an understanding of the space in question, the most relevant approach to establishing identity and creating architecture would be to celebrate the intricacies in both the individualism and collective philosophies. With these two contrasting world approaches, rather than taking an absolutist stance, a hybrid way forward is proposed which celebrates the approaches of the Western such as Lynch and Wyckoff, as well as acknowledge the African story, which encourages communitarianism and participation (Van Rensburg & Da Costa 2008:35) as seen in Figure 2.20. There is good in both of these worldviews, and thus, I am taking the physical elements of space from Lynch (1960), placemaking principles from Wyckoff (2015), and the philosophical notion of togetherness and future from Van Rensburg & Da Costa (2008).

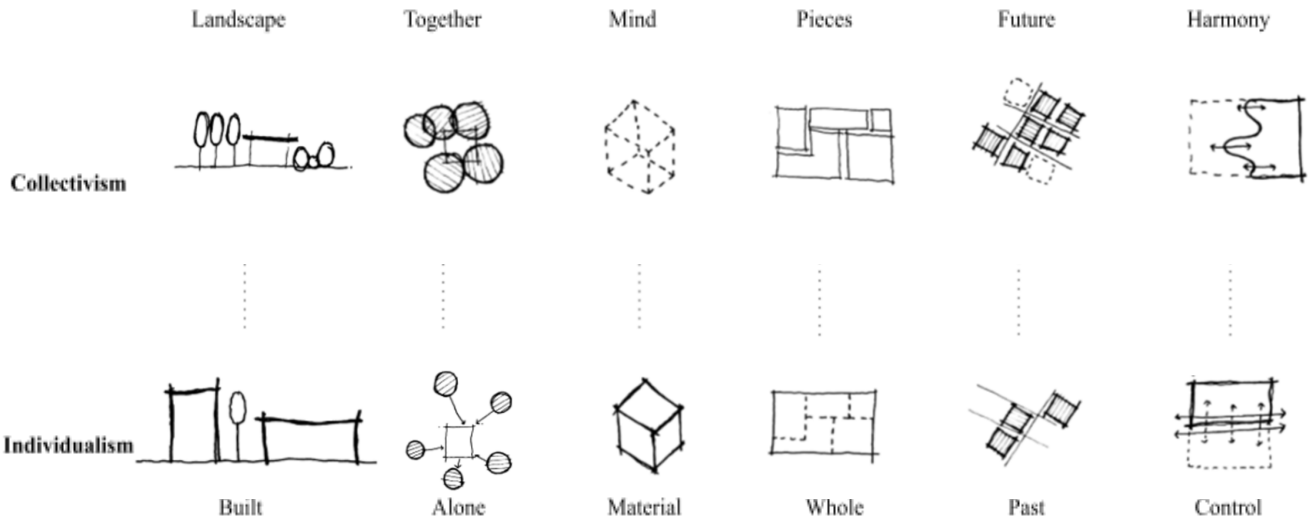


Figure 2.20: African versus Western philosophical worldview points (Adapted from Van Rensburg & Da Costa 2008)

With a multitude of informants and site nuances, the question arises as to what an appropriate architectural intervention or expression may be?. The revival of Khalambazo and the surroundings relies on an authentic place-specific intervention that is informed by the existing conditions and collectivist philosophies. An appropriate expression arises when the diversity, perceptions and viewpoints of its society are honoured. The need for space that is non-prescriptive exists, where multiple levels of identity, practices and understandings that may be negotiated are fundamental to the elastic identity of the site (Van Rensburg & Da Costa 2008:36). Lynch's (1960) analysis provides logic as to where an appropriate architectural intervention may be located and

along with the placemaking principles outlined by Wyckoff (2015), highlight the influence of the individualistic approach. Van Rensburg and Da Costa (2008) point to the notion of togetherness and future identity through the collectivist lens, with both of these worldviews it becomes possible for an identity to be created, collective emergence to take place, and the green economy be accommodated by the architectural programme.

Concept

Figure 2.21: Collective emergence concept (Author 2021)

An appropriate spatial strategy in the South African context must support spatial ability and transcend Eurocentric models of spatial definition to achieve a viable postcolonial model (Van Rensburg & Da Costa 2008:40). With the identity of the African city relying on philosophies and its existing conditions, an appropriate solution relies on the existing to inform an authentic place-specific expression. The urban expression begins with an investigation into the site (place) to extract the diverse viewpoints of its society while honouring their significance.

Drawing from an understanding of the site vision as well as the differences perceived through a comparative analysis of African versus Western philosophies, it became apparent that an appropriate architectural conceptual approach would be for a collective response (Figure 2.21). This would ensure an alignment with the spatial objectives set out by the NDP, Gauteng Township Economy Revitalization Strategy and the regionalised municipal SDF. Working in the polarising differences, as seen in Figure 2.20, between landscape and built, mind and material, harmony and control, and the notion of togetherness contrasting to be alone raises an appropriate conceptual approach as seen in Figure 2.21.

To celebrate the dynamic, active practices of the everyday ritual towards the undermining of abstract space into the creation of lived space. This strategy acknowledges and celebrates the critical difference in this culturally divergent society (Van Rensburg & Da Costa 2008:39). Space which is considered to be significant while not

necessarily being prescriptive, with multiple social uses which allow for the different interpretation of space which weaves the spatial experience into the cultural continuum (Van Rensburg & Da Costa 2008:40).

Figure 2.22: Series of images depicting the active practices of the everyday rituals (Author 2021)

Design Investigation

The design process used to approach the intervention is one of an iterative nature. Each iteration building upon the previous version generates a strong base and rich character to derive the final intervention. Iterations are springboarded by a mapping workshop whereby a series of exploratory sketches are done to derive spontaneous, intuitive responses, represented by the figures below.

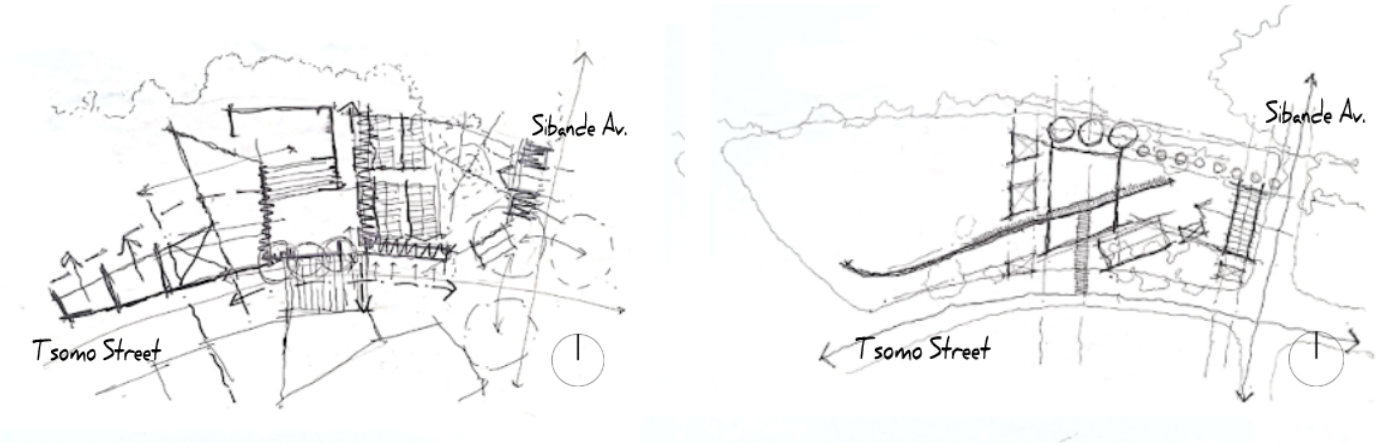


Figure 2.23: Responses generated from the mapping workshop, these two iterations do not respond to the necessary scale of its surroundings (Author 2021)

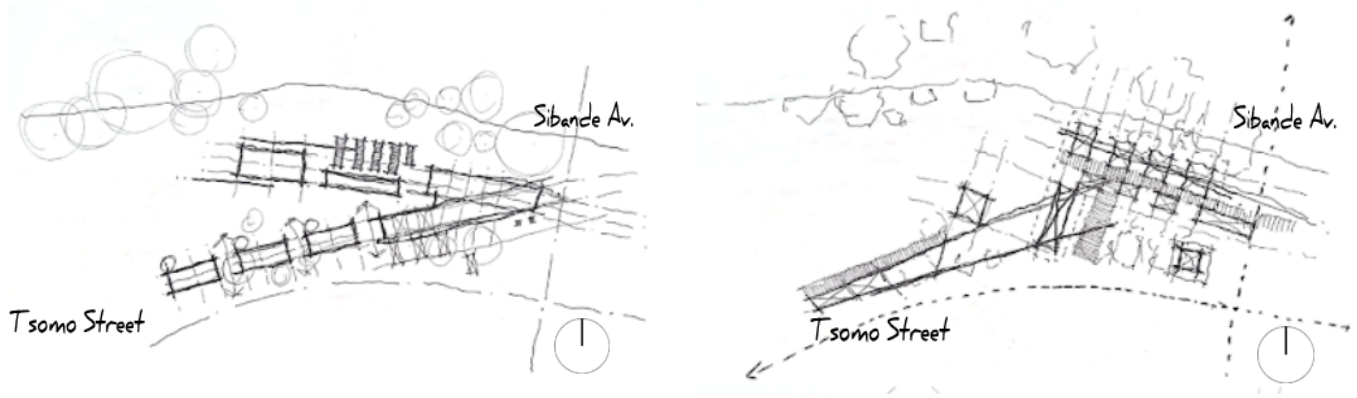


Figure 2.24: The next set of iterative responses address the scale of the intervention while maintaining site porosity (Author 2021)

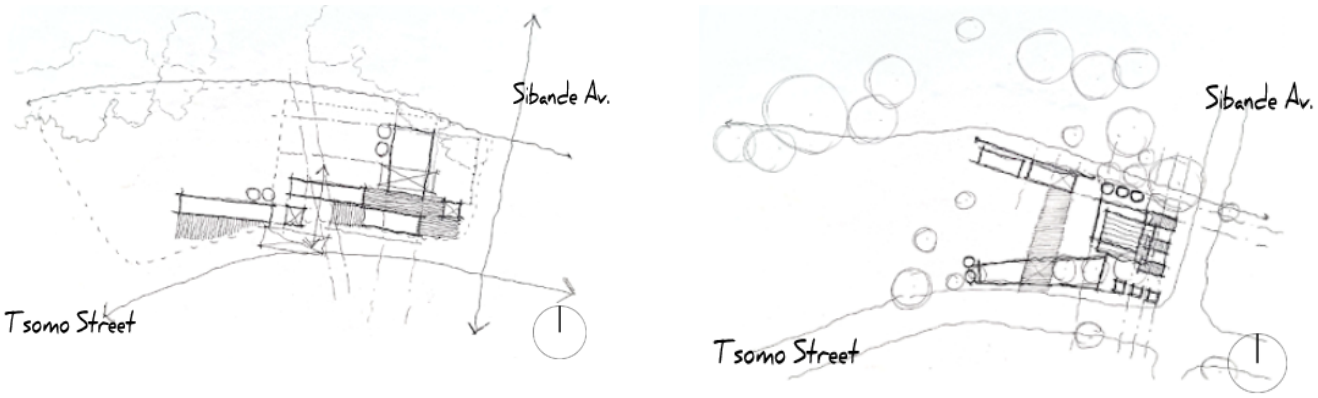


Figure 2.25: The last set of iterative drawings maintain the interventions porosity while attempting to “inhabit” the street’s edge (Author 2021)

Figure 2.26: Site asset analysis to inform formal trade space allocated in design (Author 2021)

Chapter Three: Synthesis

The intention of essay three is to continue the argument and thought process of essay two, design research. Investigation and discussion of design iterations will take place while discussing the critique associated with each iteration. This is furthered by the development of the technical concept and intentions.

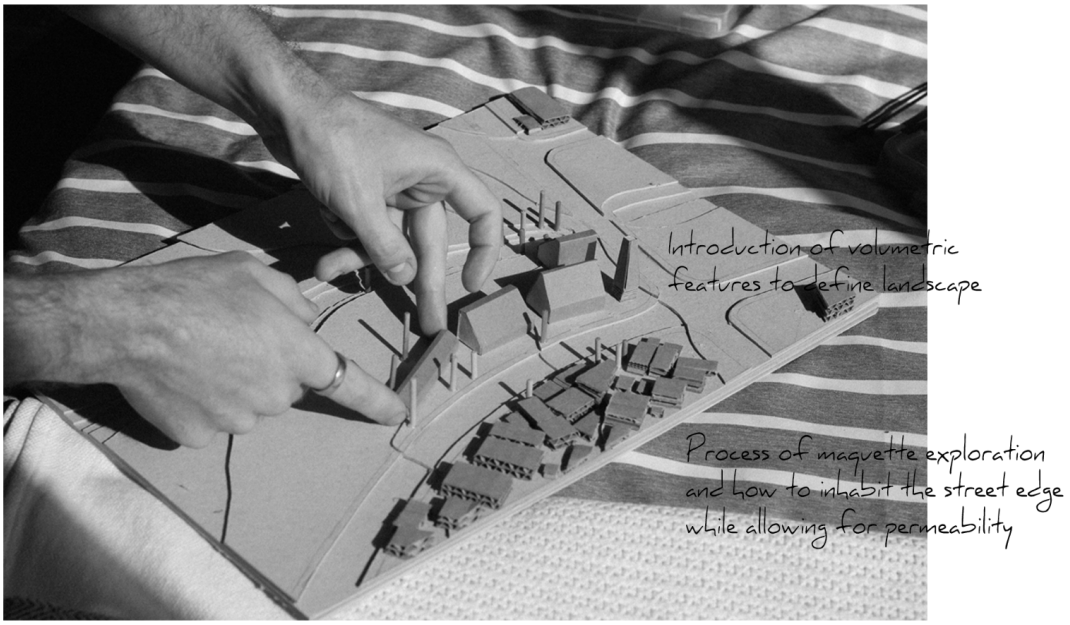


Figure 3.0: Process of site development through maquette explorations (Author 2021)

Design Process

The design process begins with moving on from the explorative process conducted in Figure 2.23 to Figure 2.25 and will be based on the understanding of the site. With a plethora of design informants present, the resultant design outcome is one of many possibilities, as seen in Figure 3.1. Therefore, the approach will develop and change throughout the process along with programmatic requirements, materiality pallet, and scale.

Each iteration building upon the previous version generates a strong base and rich character to derive the final intervention. The iterations were springboarded by a mapping workshop whereby a series of exploratory sketches are done to derive spontaneous, intuitive responses. This mapping workshop, as seen in Figure 3.1, was conducted by a group of students who are working in similar contexts and similar scales. Base maps were prepared at a scale of 1:500 in order to include external design informants. These maps were then rotated between the group of students who worked over them through an intuitive lens. Time limits were set on each rotation so that the sketch responses reflected the immediate thoughts and responses to the site and its conditions.

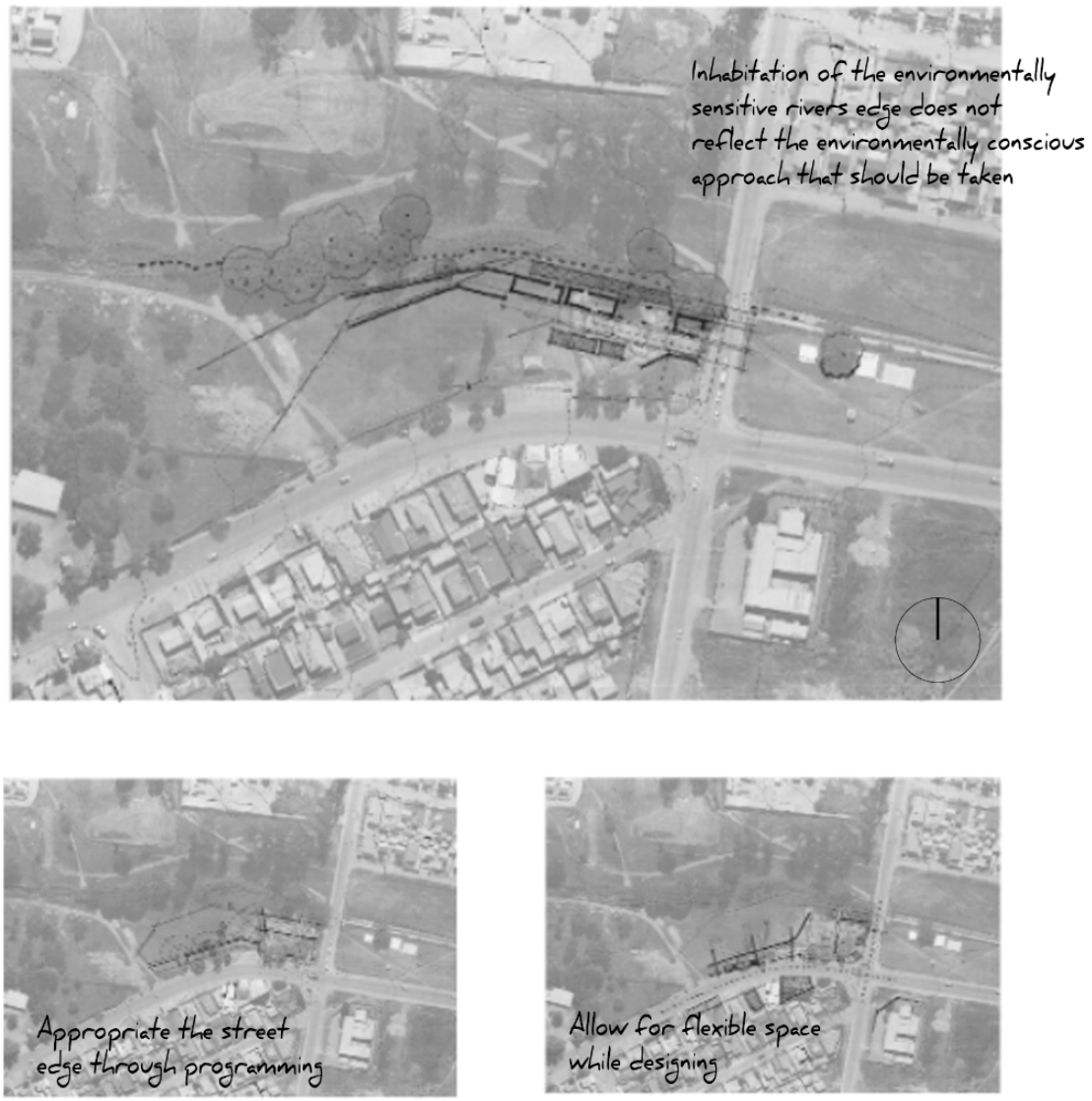


Figure 3.1: Mapping workshop conducted which reveals the design outcome can be one of many (Author 2021)

After the bumf workshop took place, each student had ample choices to work on and reflect upon. It was through the reflection of these bumf plans that a few were selected (Figure 3.1) to be refined further into

maquette explorations as seen below in Figure 3.2 to Figure 3.4. These few iterations were chosen on their ability to respond to site nuances and topography as well as their perceived ability to reflect principles set out initially. These principles reflect the design informants uncovered in the previous stage such as site permeability, rhythm and overall expression in the ability to reflect the site vision. Such principles reflect the intention of the concept of a collective emergence while creating space that is not necessarily prescriptive, with multiple social uses which allows for the different interpretation of space that weaves the spatial experience into the economic upliftment of the community.

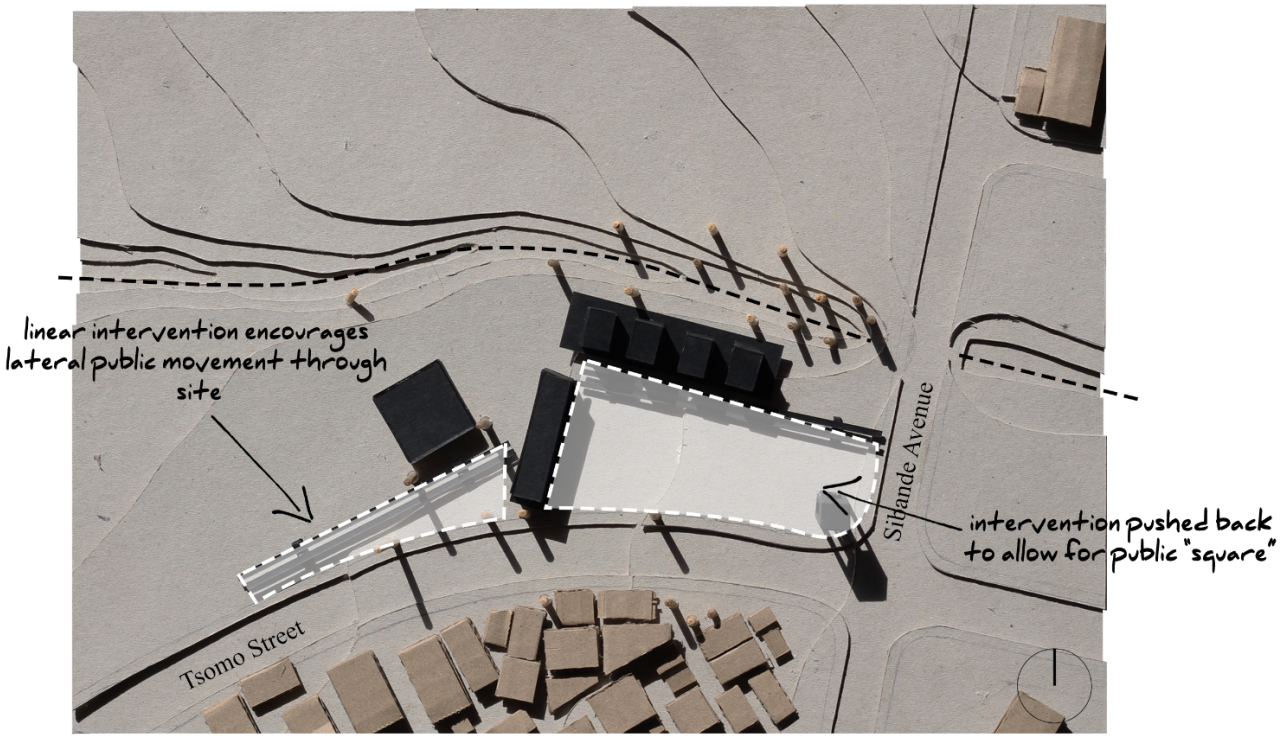


Figure 3.2: Maquette exploration of public spaces and spatial configuration (Author 2021)

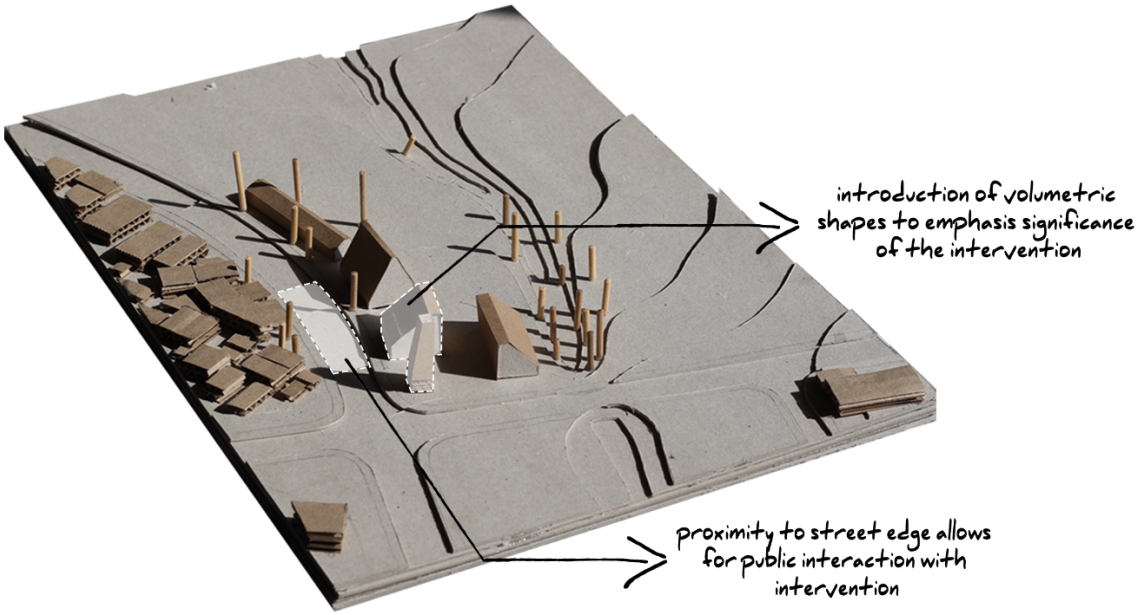


Figure 3.3: Maquette exploration of volumetric structures to denote places of significance (Author 2021)

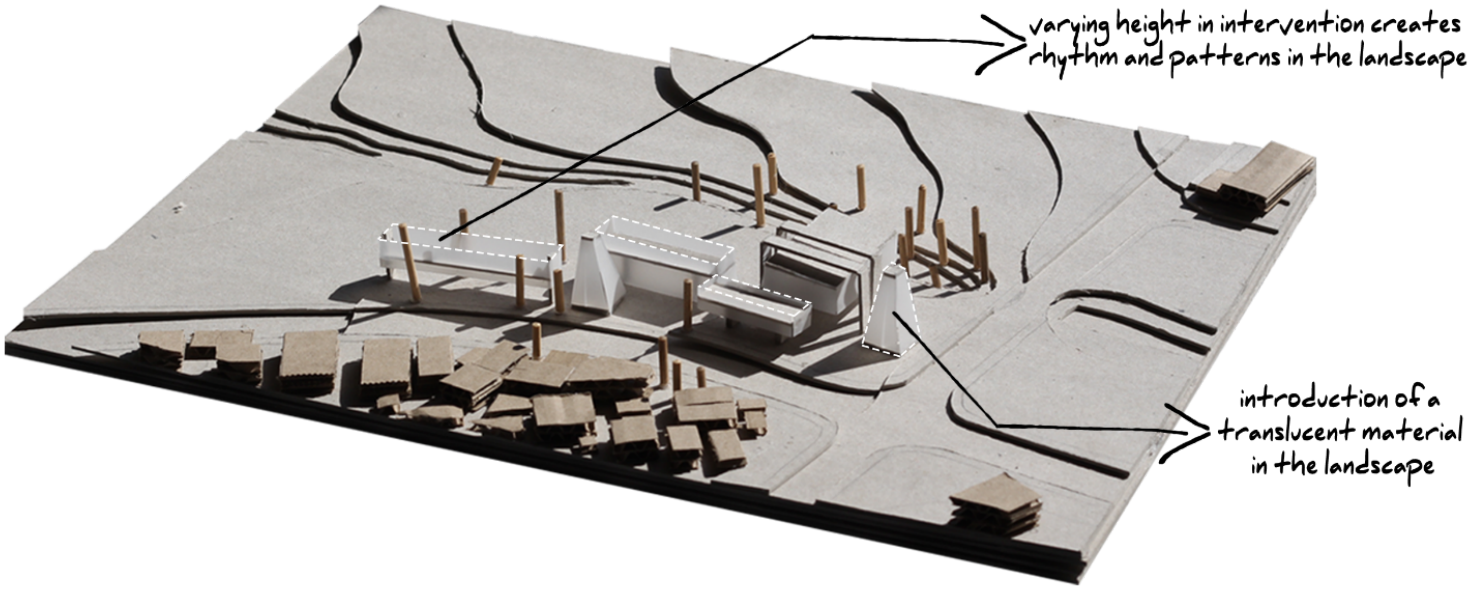


Figure 3.4: Maquette exploration of materiality and rhythm variation (Author 2021)

Even though it is not a fully resolved design yet it allows for a greater understanding of the three-dimensional spaces which are proposed. Attempts to reflect the distinct spatial characteristics of each site element previously identified, such as inhabitation of the southern street edge to promote the existing entrepreneurial trade to continue to take place and be further promoted by the intervention. Design decisions were made throughout this process such as the river's edge being restored with no thoroughfare taking place in order to both protect the site as well as improve its conditions.

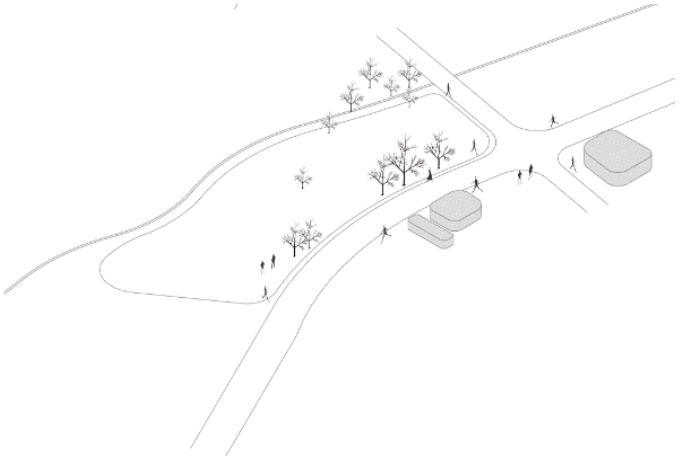


Figure 3.5: With the street intersection being identified as an active node, the intervention needs to respond to the existing urban fabric which influences design scale, these informants include the mosque as well as Fourways fashion lounge (Author 2021)

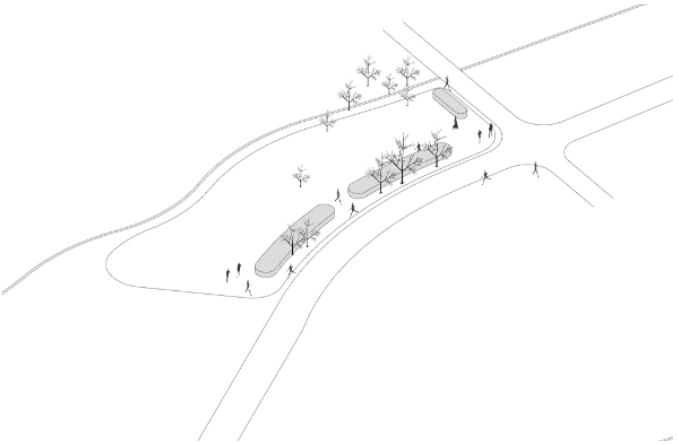


Figure 3.6: Through the inhabitation of the street edge, porosity and permeability remain important as design informants. Allow for movement through the intervention to preserve the existing rhythm of the entrepreneurial space (Author 2021)

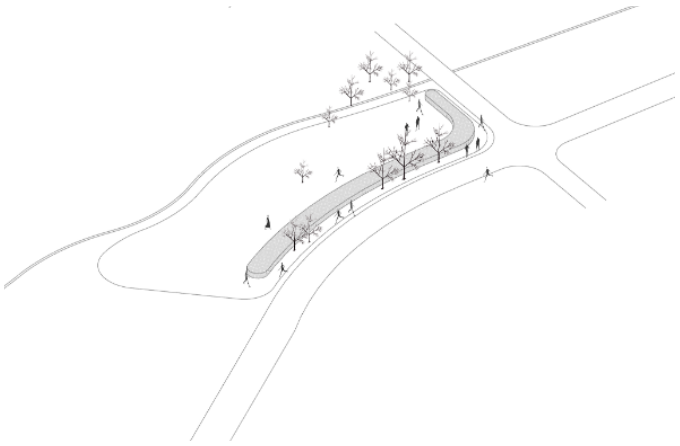


Figure 3.7: Through conceptual development, the street edge has been identified as an area of importance. Maintain and improve on the edge conditions through inhibition of linear street space (Author 2021)

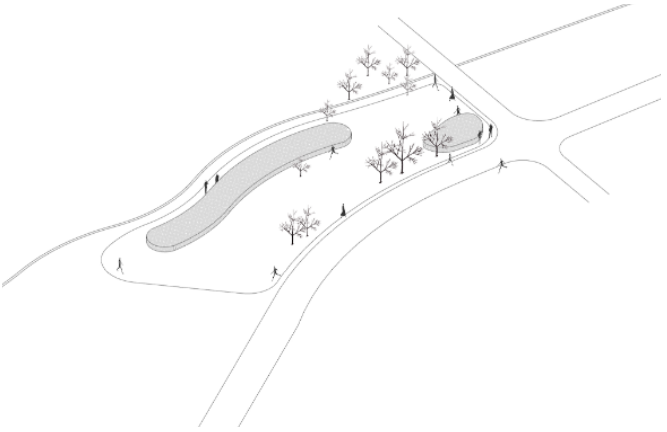


Figure 3.8: Maintain the sites current characteristics by allowing for the existing open spaces to remain open, which allows for spatial adaptation and user gatherings, this respects the existing spatial properties (Author 2021)

These design guidelines reflect the conceptual approach previously discussed as the revival of the African city relies on philosophies and its existing conditions as an appropriate solution relies on the existing to inform an authentic place-specific expression.

Iterative process

The explorations conducted through the collaborative workshop springboard into iteration one. Much like the initial bumf exploratory workshop, the design workshop took place intending to develop design iteration one. Our sites were prepared with multiple layers of bumf to inform the participants of the design principles as well as design informants to which they responded, the result can be seen through Figure 3.1.

It can be seen through Figure 3.3 the attempt to inhabit the street edge along the intersection of Tsomo Street and Sibande Avenue. This, however, does not promote the users experience on-site as it blocks off the pedestrianised ability of the street edge. Figure 3.4 furthers the initial exploration by keeping the linearity of the proposed intervention with a step back from the street edge to promote site exploration and interaction by the user. The corner space is then left open to reflect the design principles set out previously, with the recycling facility located directly where the activity is currently taking place.

Iteration One
Iteration one directly responds to the size and scale of surrounding economic stimuli which allows it to cater for current activities on site. An attempt at site porosity has been made which also allows for the existing flow of movement to still take place. Iteration one allows for multiple uses of space with some being fixed programmatic space and some adaptable space. This iteration also attempts to not entirely cover the site but rather respect existing features such as the plateau and rivers edge.

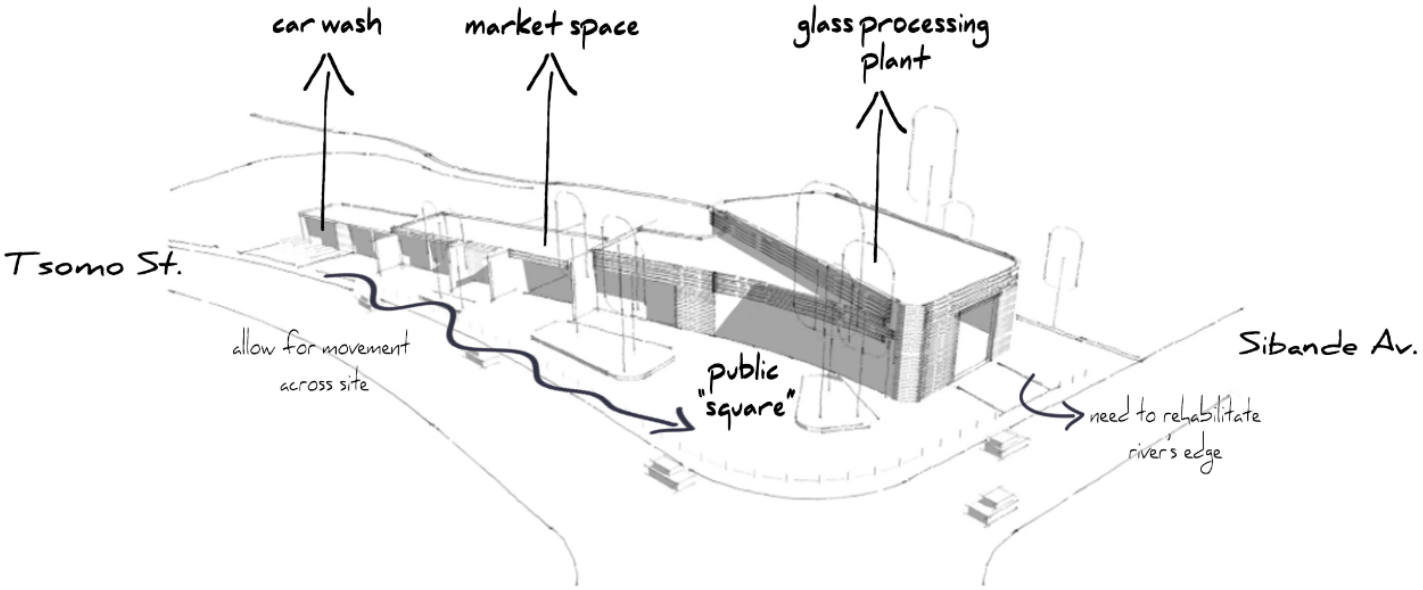


Figure 3.9: Iteration one (Author 2021)

- Iteration One Critique

Iteration one responds to the surrounding economic stimuli but does not encourage enough permeability into the site. The rhythm which is experienced throughout Khalambazo is not reflected within this iteration. The proposed walkway around the site does not focus on the existing, the conservation and rehabilitation of the river's edge would be better suited. The car wash disrupts the flow of linear movement through the site and it should be shifted to be located adjacent to the intervention. The location of the proposed store for the recycling centre is not located in the optimum position as it does not face the street edge.

Iteration Two
Iteration two furthers on from iteration one by improving the permeability of the site by splitting up the proposed structure to allow for better flow from the north and south side. The programmatic placement remains similar to iteration one with an improved location of the recycling centre storefront which engages with the public interface better as it opens up onto the public "square". The introduction of sunscreens defines public gathering and transitional space, which creates a greater sense of belonging. The movement along the river's edge has also been limited to prevent further ecological degradation, with the habitable programmes being located towards the plateau and street edge.

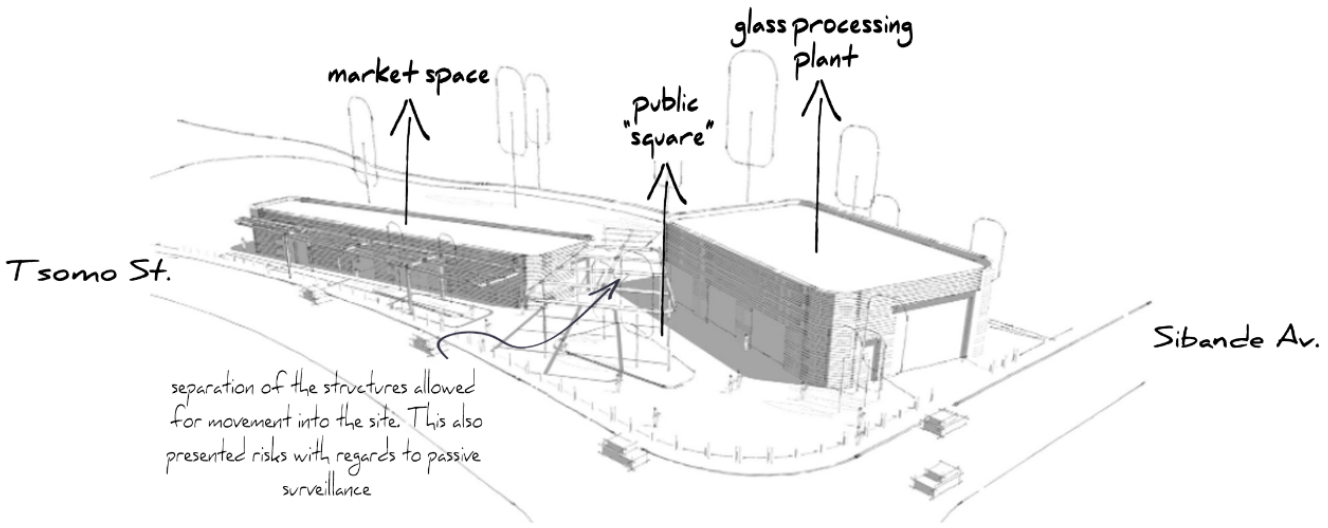


Figure 3.10: Iteration two introduces a gap in the structure that allows for permeability into the site (Author 2021)

- Iteration Two Critique

With the increased permeability of the site, a pinch point has been created between the two structures as seen in Figure 3.11. The proposed spaces are overall too big for the programmatic functions to which they serve; these spaces are not representative of the current landscape of Khalambazo. What is proposed is more spaces of smaller areas to match the density of the surrounding area. The perpendicular nature of the car wash affects the flow of movement across the site as it cuts off flow from the interior movement.

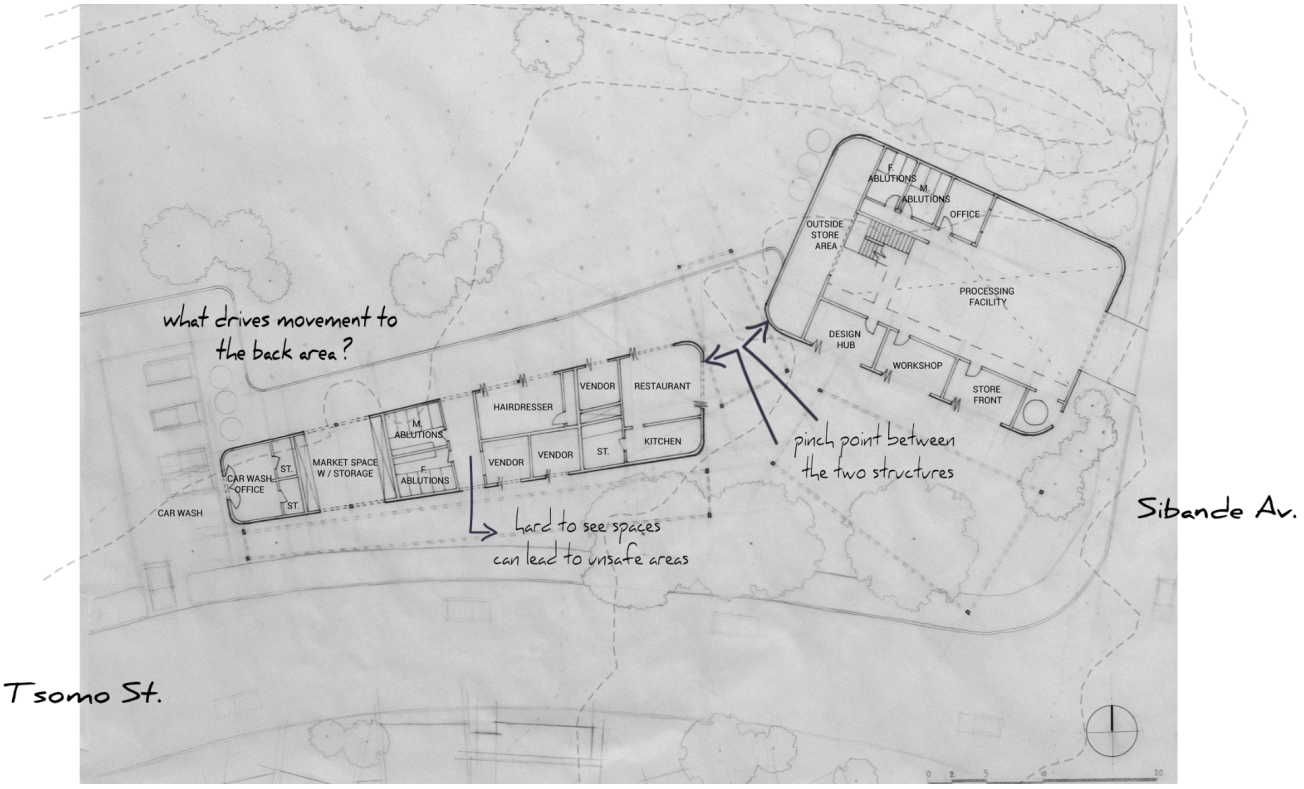


Figure 3.11: Floor plan of iteration two (Author 2021)

Iteration Three
In pursuit of an architecture which reflects the spatial imperatives of the NDP, the guiding design principles that have been established and the conceptual approach of the collective revival of the African city. Iteration three furthers on the spatial experiences developed in iteration two by refining the threshold space of the public square by raising the southern side of the pergola structure to greet the pedestrians and passers-by. This is also reflected in the facade of the two main structures with the tapering of the parapet walls.

Iteration three balances the need for densification within Khalambazo which limits the low-density urban sprawl and at the same time respects the existing urban fabric. This iteration also improves the permeability of the site, which is a direct response to the design informants. The larger spaces in iteration two have been further split up to represent the scale of the existing entrepreneurial landscape more accurately, this also allows for further densification of the programme, which will increase foot traffic through the site.

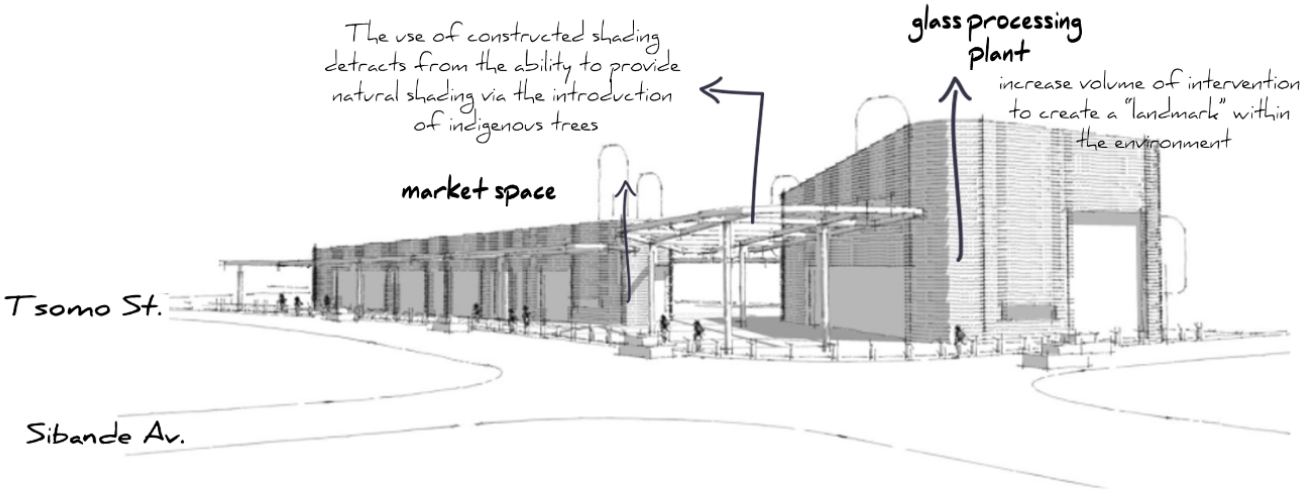


Figure 3.12: Iteration three changes are experienced volumetrically (Author 2021)

- Iteration Three Critique

With the programmatic requirement being met, the irregular nature of the proposed intervention needs to be addressed. What is proposed is to introduce a grid that will inform the placement of the structures. This introduction of a grid will allow for further logic in the structure and organisational flow of the buildings and surrounding landscape. In order to introduce a grid, be it structural or functional, materiality needs to be addressed, which will help determine the overarching size requirements. The purpose of the brick volumes is to create a recognisable landmark within the landscape of Khalambazo.

Iteration Four
Iteration four reflects the conceptual approach of a collective emergence to combat the attenuation of public architecture within Khalambazo. This will combat its inability to meaningfully contribute to the local cultural-economic futures because it was structurally and spatially limited. This intervention aims to foster collective entrepreneurship, which acts as a catalyst to generate livelihood, liveliness and longevity within communities.

This is done through the anchoring identity of place, livelihood and liveliness to celebrate the dynamic, active practices of the everyday ritual towards the undermining of abstract space into the creation of lived space (Van Rensburg & Da Costa 2008:39). Space that is considered significant while not necessarily being prescriptive, with multiple social uses that allow for the different interpretation of space that weaves the spatial experience into the cultural continuum (Van Rensburg & Da Costa 2008:40).

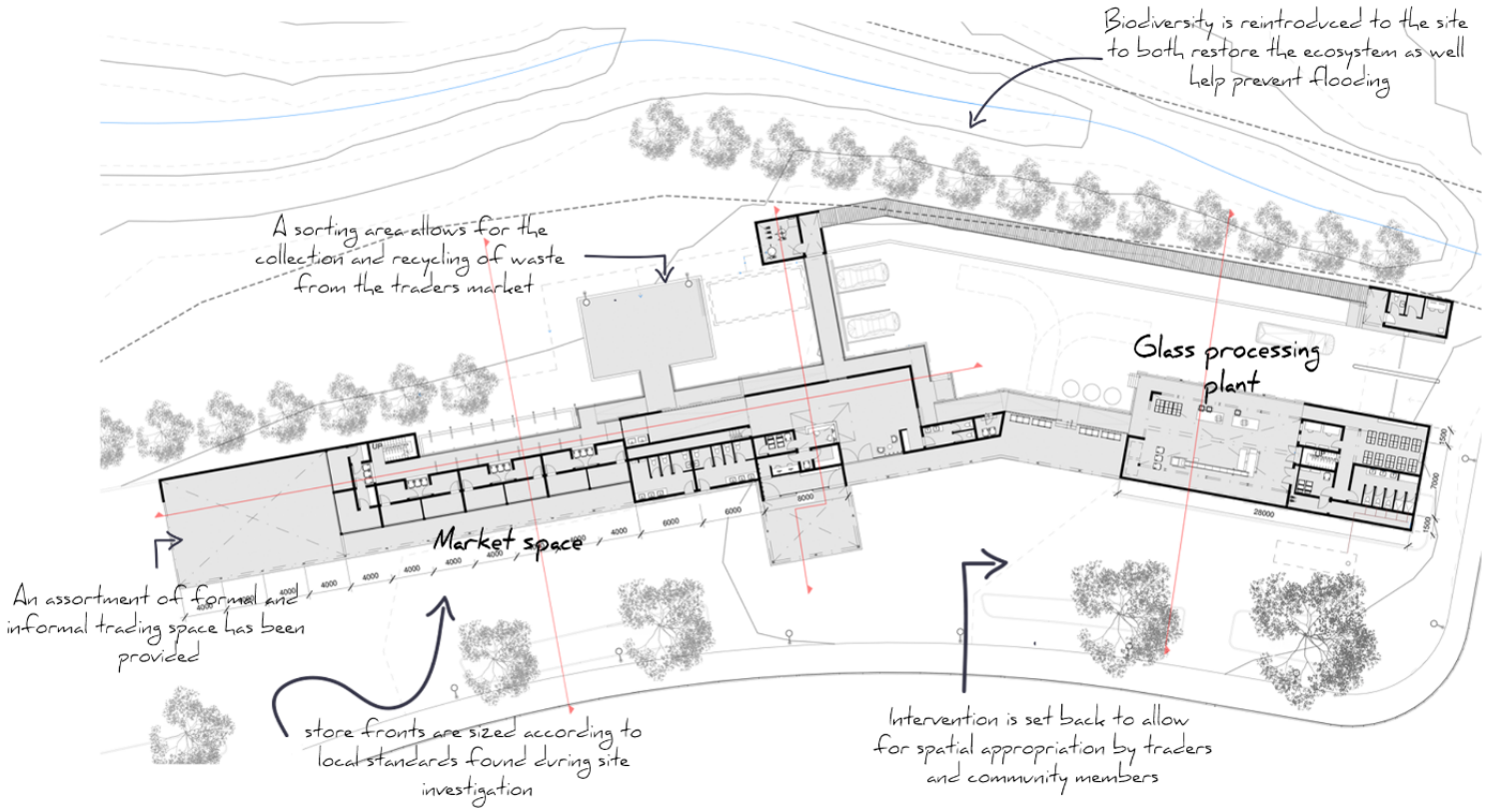


Figure 3.13: Ground floor plan of iteration four (Author 2021)

As a response to the climatic needs of the structure, seen below in Figure 3.14, photovoltaic panels will be installed on all the available roof space in order to reduce reliance on the national grid. The roof space will also collect rainwater which will be stored in underground water tanks to serve the non-potable water needs. Natural ventilation is required in the processing plant, as well as natural lighting requirements, which will be addressed through a clearstory.

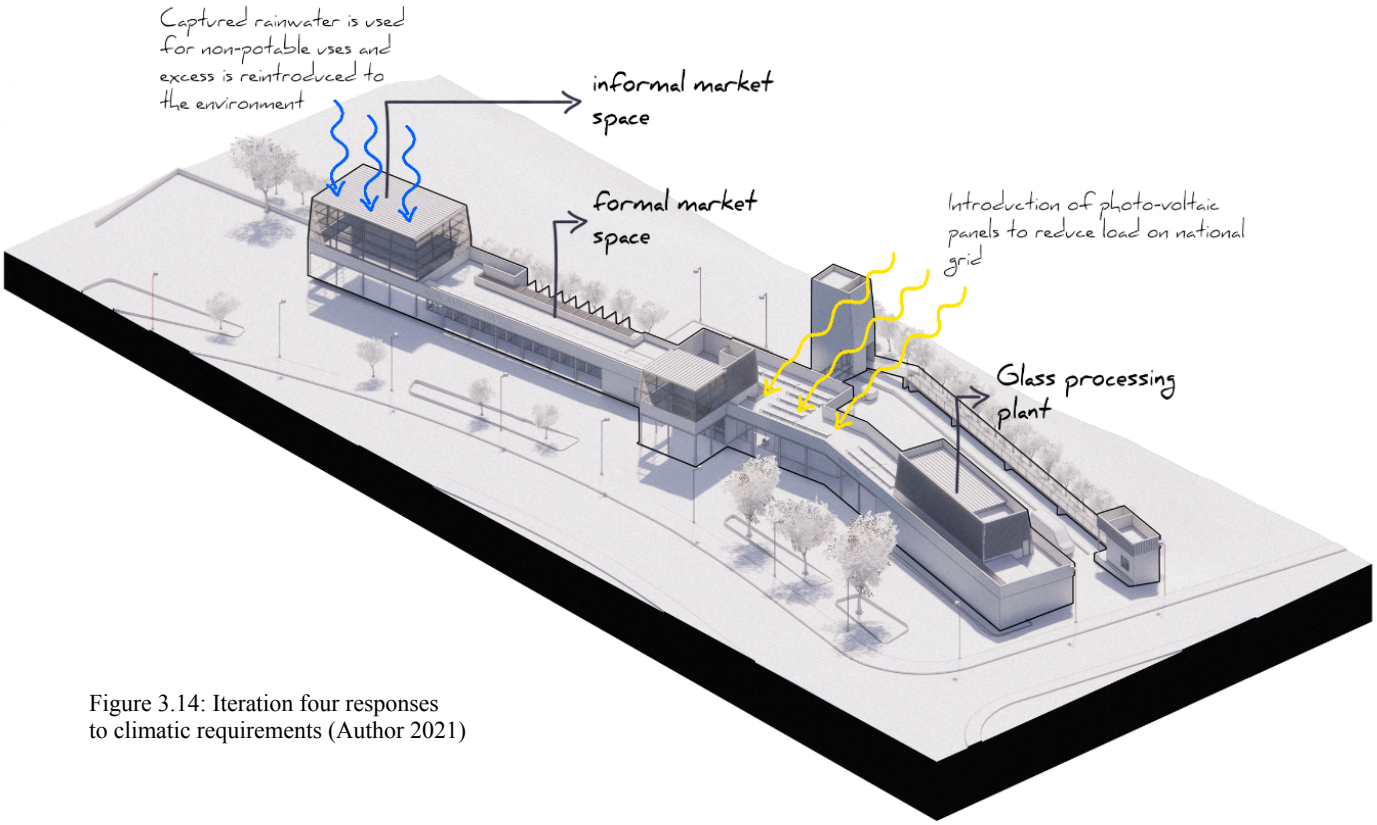


Figure 3.14: Iteration four responses to climatic requirements (Author 2021)

Techne development

With the theoretical and conceptual influences of Van Rensburg & Da Costa (2008) as well as Kevin Lynch (1960), the technical concept relates back to the undermining of placelessness into the creation of lived space by balancing the grounding stereotomic masses with the inviting tectonic public interface. The isolated nature of Khalambazo and hence the placelessness throughout Mamelodi becomes a driving informant for the stereotomic nature of the project. Located within a context which experiences continual flux of economic opportunity and spatial equality, the stereotomic nature of the architecture aims to concretize the existing economic landscape and create a gateway into the once isolated Khalambazo.

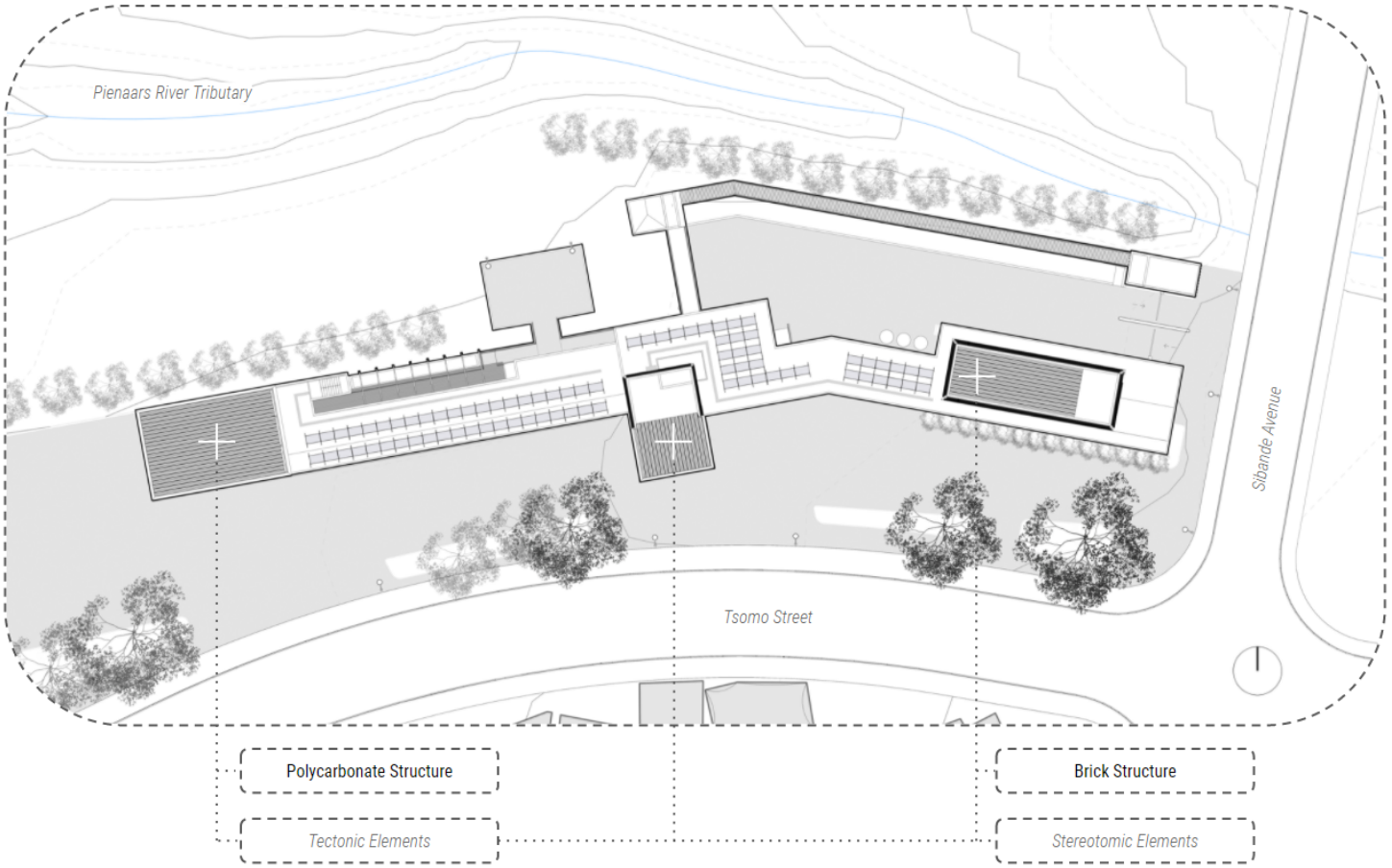


Figure 3.15 (Above): Stereotomic & Tectonic nature of the intervention.

The dialogue between the stereotomic and tectonic nature of the intervention is done through the vertical plane as a way to indicate private vs the public realm, as seen in Figure 3.17 and Figure 3.18 below. The stereotomic approach toward the intervention is derived from the ability to define a resilient landmark within the context of Khalambazo. The conversation between the public interface and private processing plant is negotiated within the structure of the intervention, allowing for a sense of flow throughout the site while maintaining both a private and public realm. This negotiation between the public and private realm can be seen through Figures 3.17 and Figure 3.18, respectively, as the public domain allows permeability into the structure while the latter does not. The tectonic role within the landscape is to soften the industrial-like stereotomic approach whilst defining the linear movement throughout the site. The culmination of the “solid” versus the “permeable” creates an intervention which not only is firmly planted within its context but also invites users to engage within the site.

Materiality

Clay Corobrik’s are used throughout this project, both as a building element as well as a device for creating texture on the building’s facade. The brick which will be used mainly through the project is the 222 X 106 X 73 mm Redwood Corobrik with a compressive strength greater than 20 Mpa. This brick is produced within Gauteng, which reduced the carbon emissions of the building due to its close proximity (Figure 3.19).

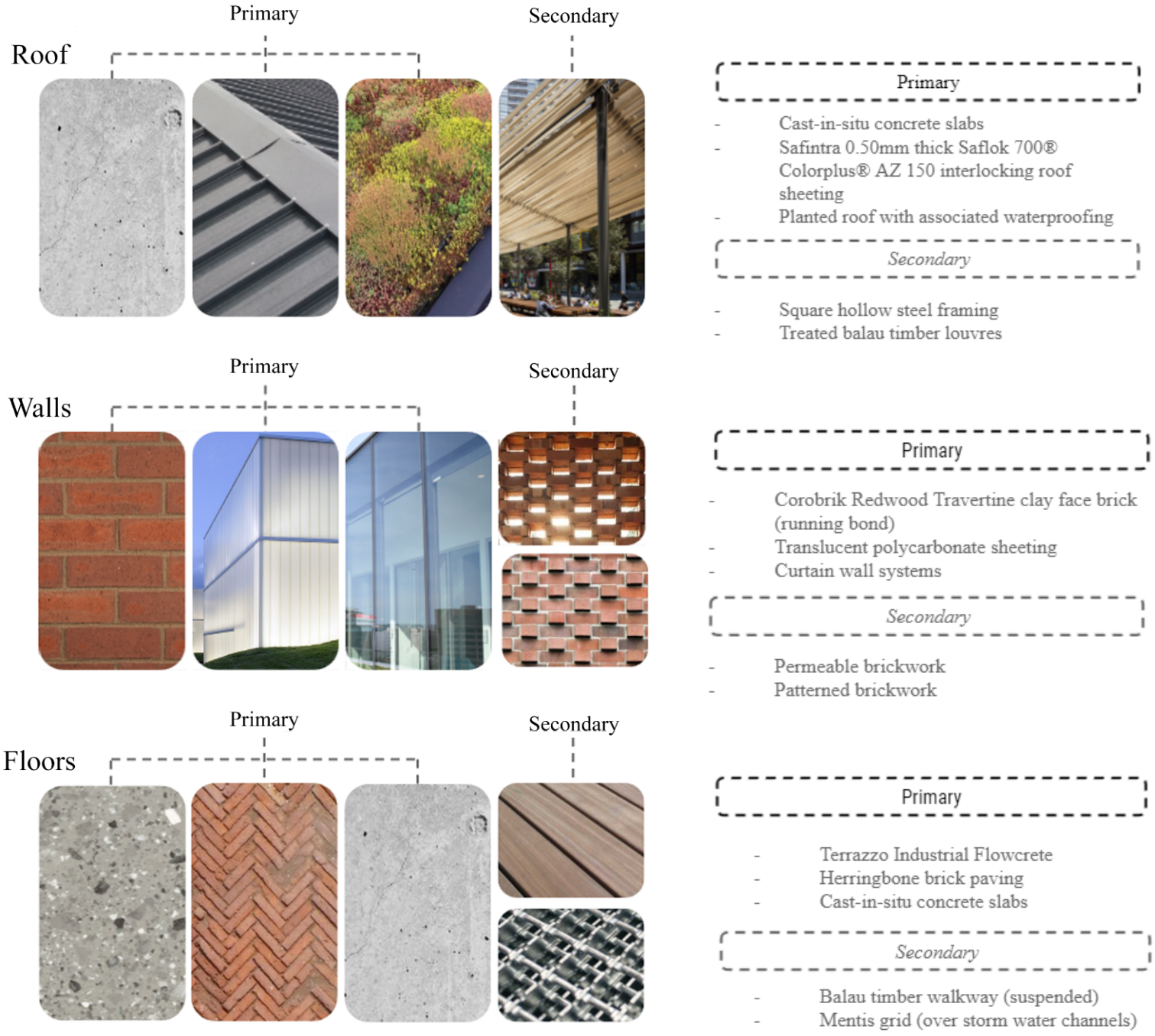
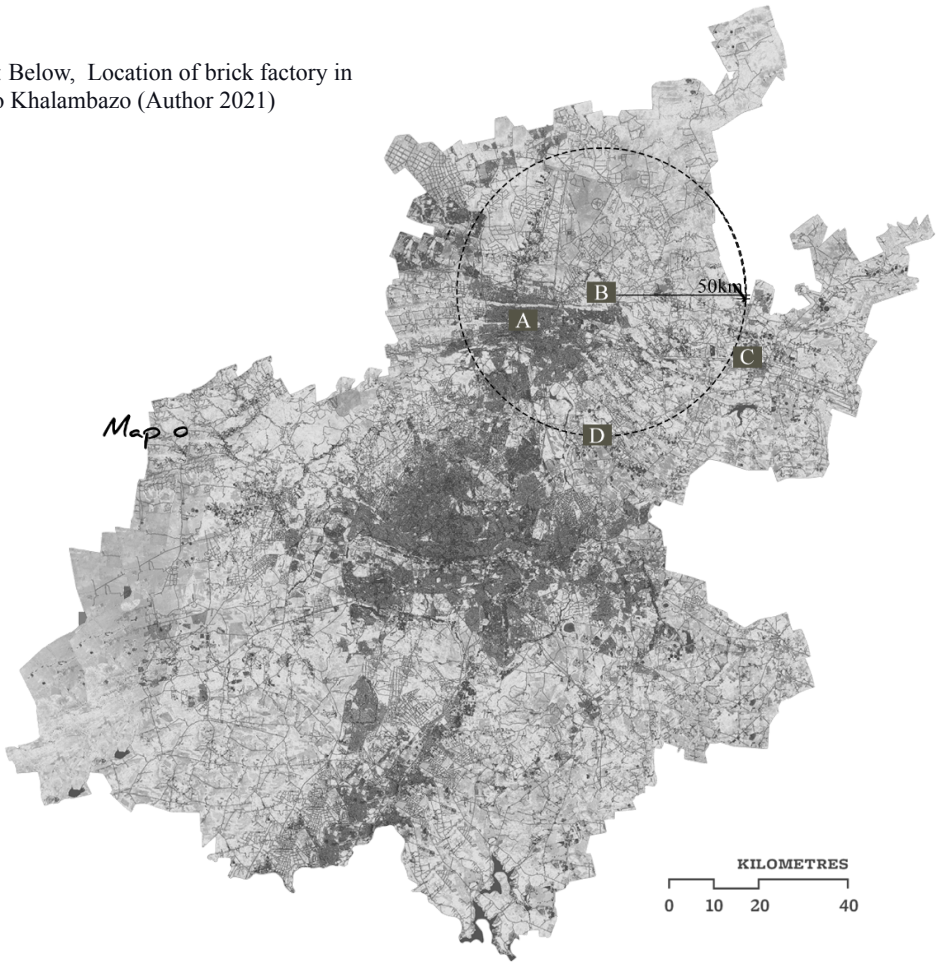


Figure 3.16: Materiality palette for intervention

Figure 3.17: Stereotomic volume in intervention indicates private areas of the processing plant (Author 2021)

Figure 3.18: Tectonic volume indicates public access to intervention (Author 2021)

Figure 3.19: Below, Location of brick factory in proximity to Khalambazo (Author 2021)



A Pretoria **B** Mamelodi **C** Bronkhorstspruit **D** Apollo Brick Yard

Sustainability Features

The intention is not only for the intervention to respond to the socio-economic needs of the community uncovered in the narrative enquiry but also to be responsible when it comes to environmental responses highlighted in Figure 3.20 below. Sitting in an already precarious site, the intervention will need to respond to:

- Passive ventilation strategies through the use of natural ventilation in combination with HVAC systems.
- The high energy demand from the machinery is required to process the glass.
- Water sensitive strategies as the site borders on one of the Pienaars River tributaries.
- And ecological needs of the long-neglected rivers edge and its associated vegetation.

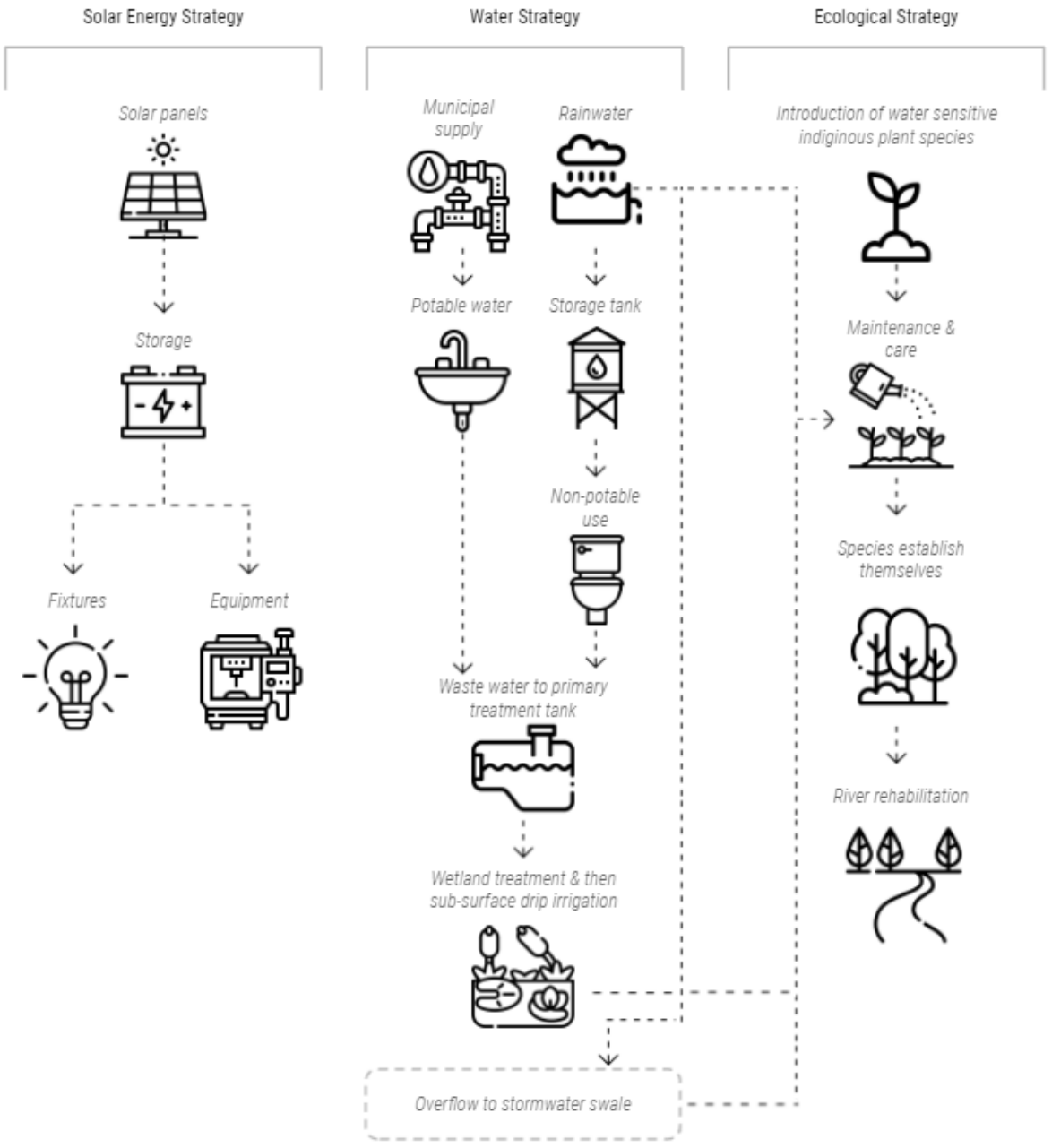


Figure 3.20: Environmental responses to the site and intervention (Author 2021)

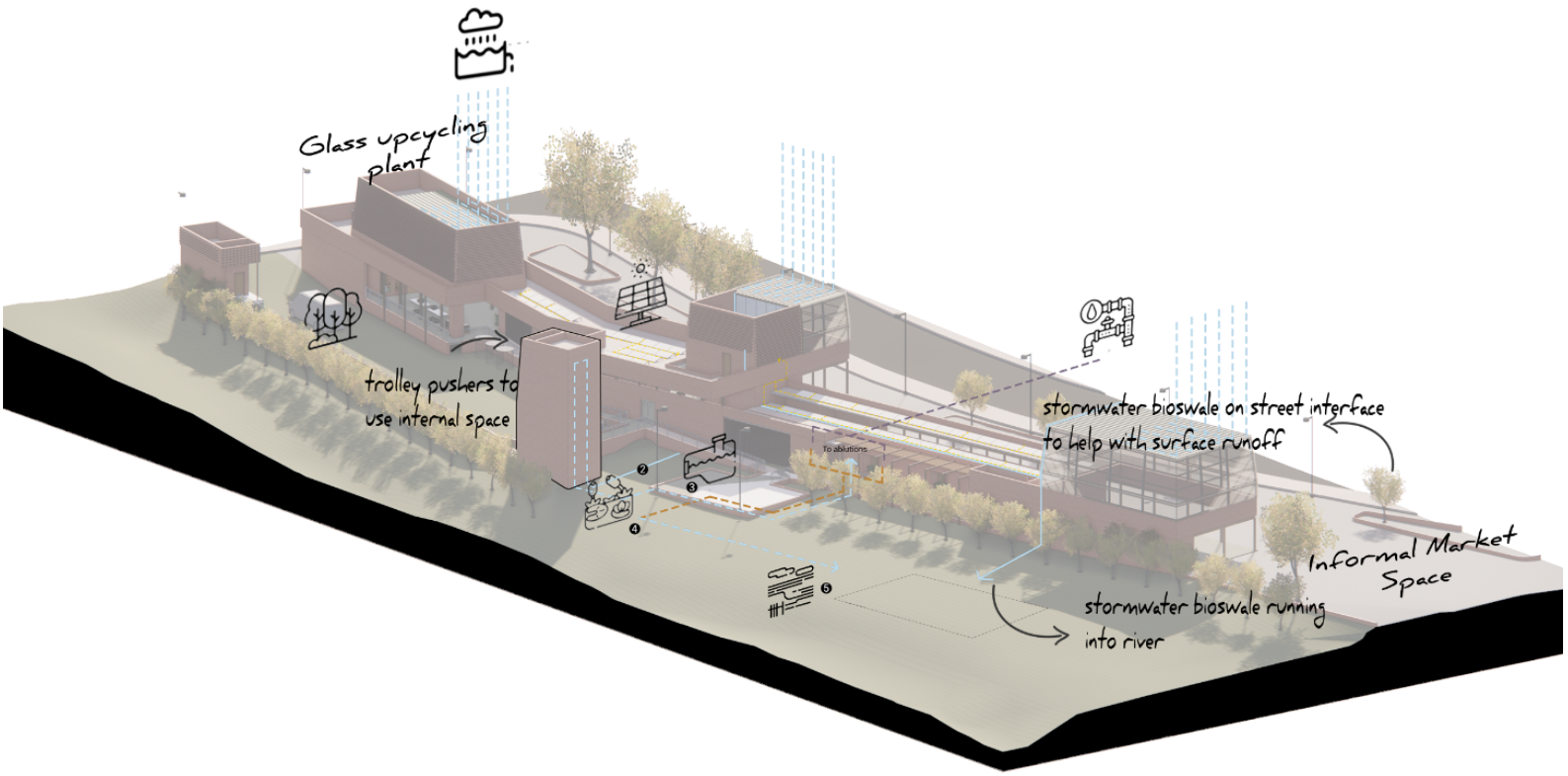


Figure 3.21: Environmental strategies implemented throughout the design (Author 2021)

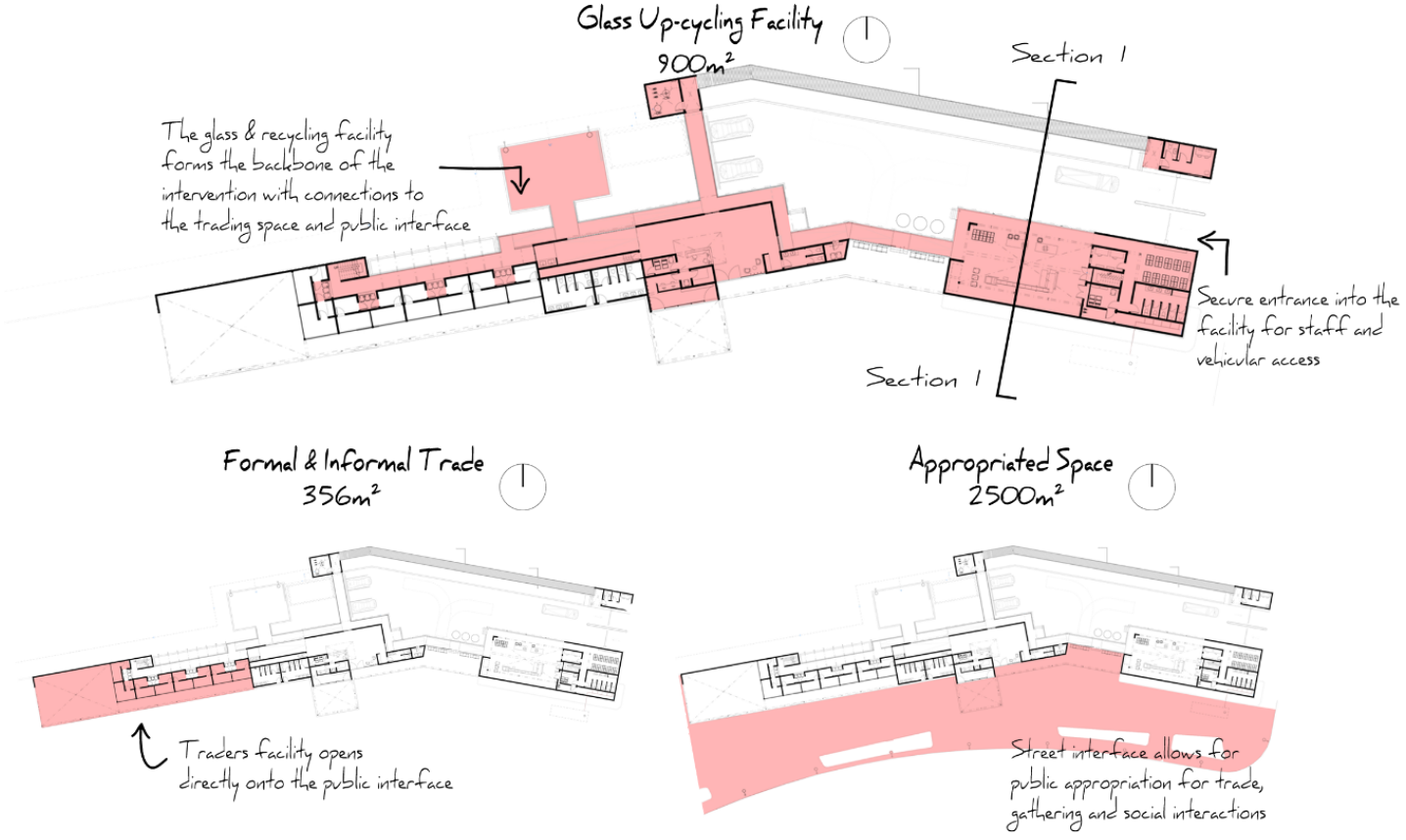


Figure 3.22: Layout of programmes within the intervention (Author 2021)

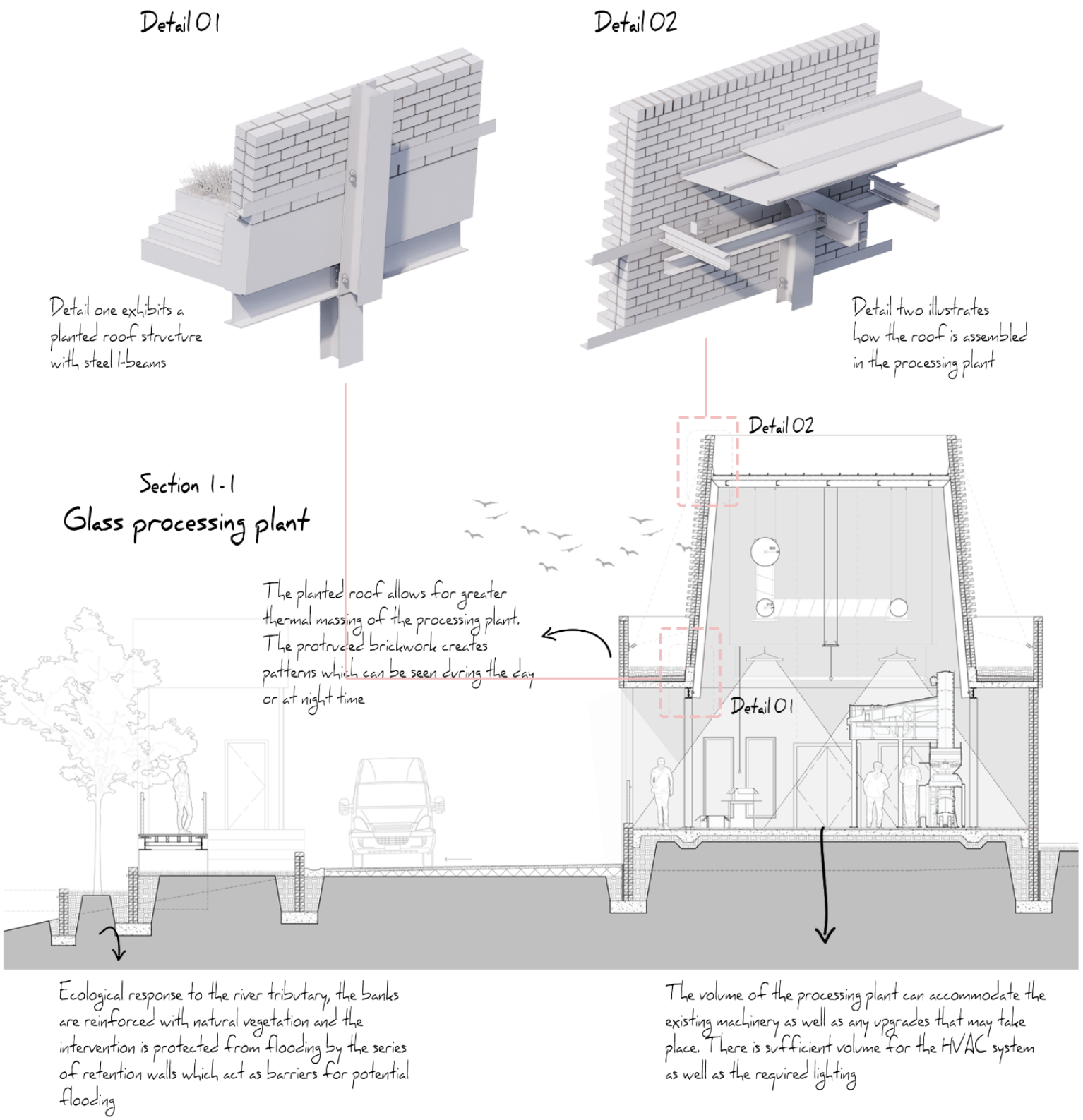


Figure 3.23: Section 1-1 indicated in Figure 3.22 illustrating the glass processing plant along with environmental responses such as flood preventative measures (Author 2021)

Chapter Four: Critical Reflection

Chapter four's intention is to provide a rational reflection on the workings of the entire dissertation process while proposing a way forward for the career.

Figure 4.0: Formal and Informal communal market space (Author 2021)

Concluding Thoughts

Introduction and Intentions

This dissertation aimed to address the fragmented urban relationships which prohibit socio-economic growth from spontaneously taking place, as can be seen in the comparison in Figure 4.1. This fragmented landscape is a result of historical practices which severely stunted Khalambazo and its community's ability to meaningfully contribute to the local cultural-economic futures because it is structurally and spatially limited.

The initial intentions of the dissertation is to develop contextually appropriate entrepreneurial space: to investigate the potential of the informal economy and how architecture can become a device for collaboration and engagement between entrepreneurs and the community within the isolated community of Khalambazo. The intentions further manifest with regards to the programmatic intention, which is to foster entrepreneurial collective emergence within the monofunctional Khalambazo while achieving the goals of the National Development Plan. The impact the intervention achieves is the emergence of a socially vibrant entrepreneurial space that serves the needs of the community, which in turn generates livelihood, liveliness and longevity within Khalambazo.

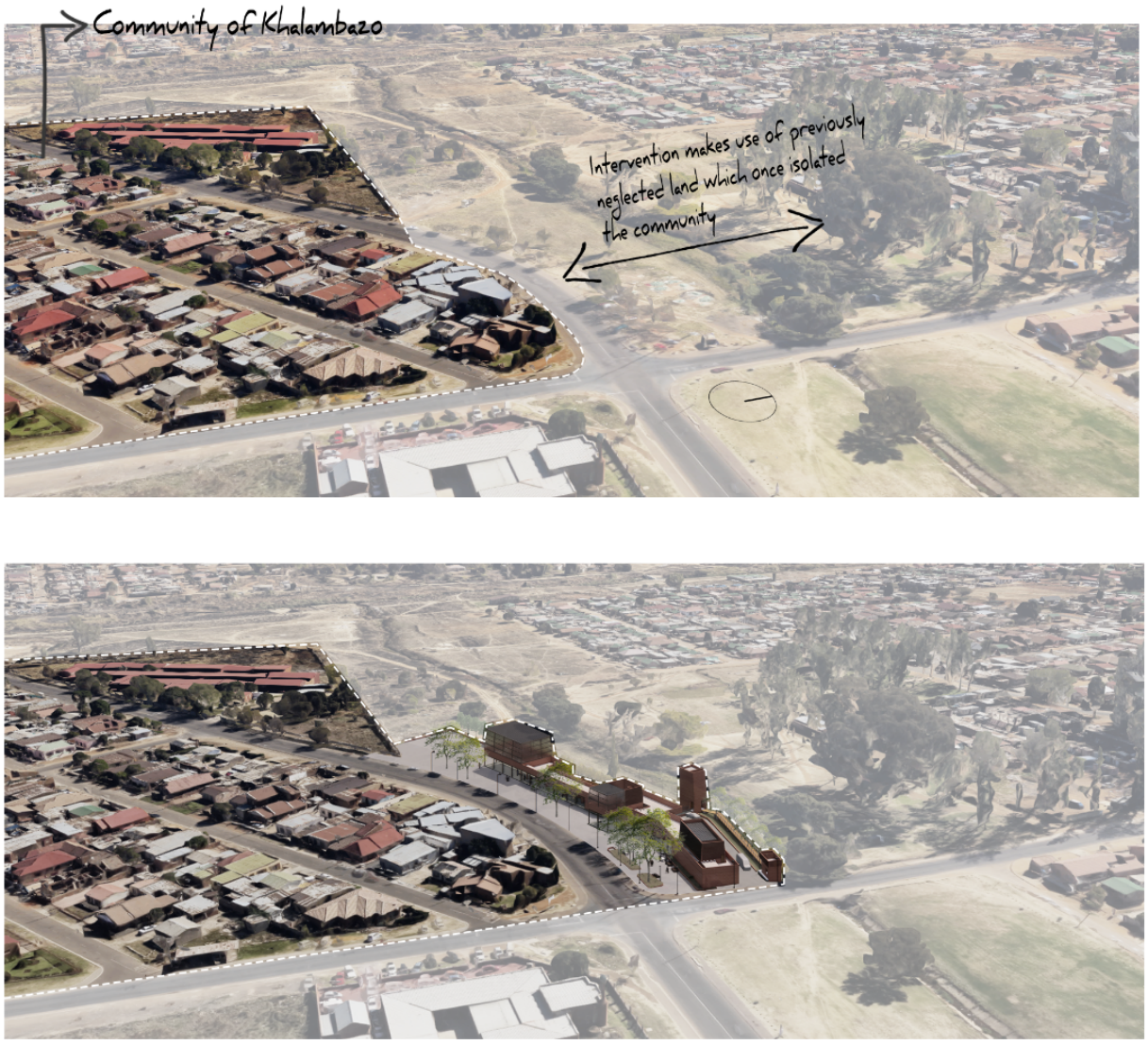


Figure 4.1: Comparison of Khalambazo before and after the implementation of the intervention (Author 2021)

Informants and Process

The dissertation was informed through contextual socio-economic drivers and responses whereby the development of the intervention was rooted in the creation of multi-functional value-laden space in the Khalambazo buffer zone. Through the use of the previously neglected buffer zone, the dissertation aims to encourage a process of engagement with the surrounding community to identify the drivers and core elements that contribute towards the continual upliftment of their surroundings. This process can easily be applied to similar surrounding contexts, which are also fragmented in Mamelodi and throughout South Africa. The process that was followed enabled the landscape's assets to be identified and reflected throughout the architectural intervention, allowing the once-neglected landscape to become a destination within the monofunctional urban fabric.

The design process used to approach the intervention is one of an iterative nature. Each iteration building upon the previous version generates a strong base and rich character to derive the final intervention. The final iteration reflects the site vision, which is informed by the guiding principles of the National Development Plan and the accompanying Municipal Spatial Development Frameworks, which cumulatively work towards creating an environment conducive to economic stimulation. The potential in the site lies in utilising the site's underlying socio-economic vibrance and applying it to new infrastructures which can complement or facilitate the existing spatial gestalt. In order to address the issue of impoverished urban space, Van Rensburg (2008:35) suggests that the architectural function must be reconsidered to allow liberation from the static “aesthetic approach” and instead support the liberalising of diversity and the establishment of hybrid cultures.

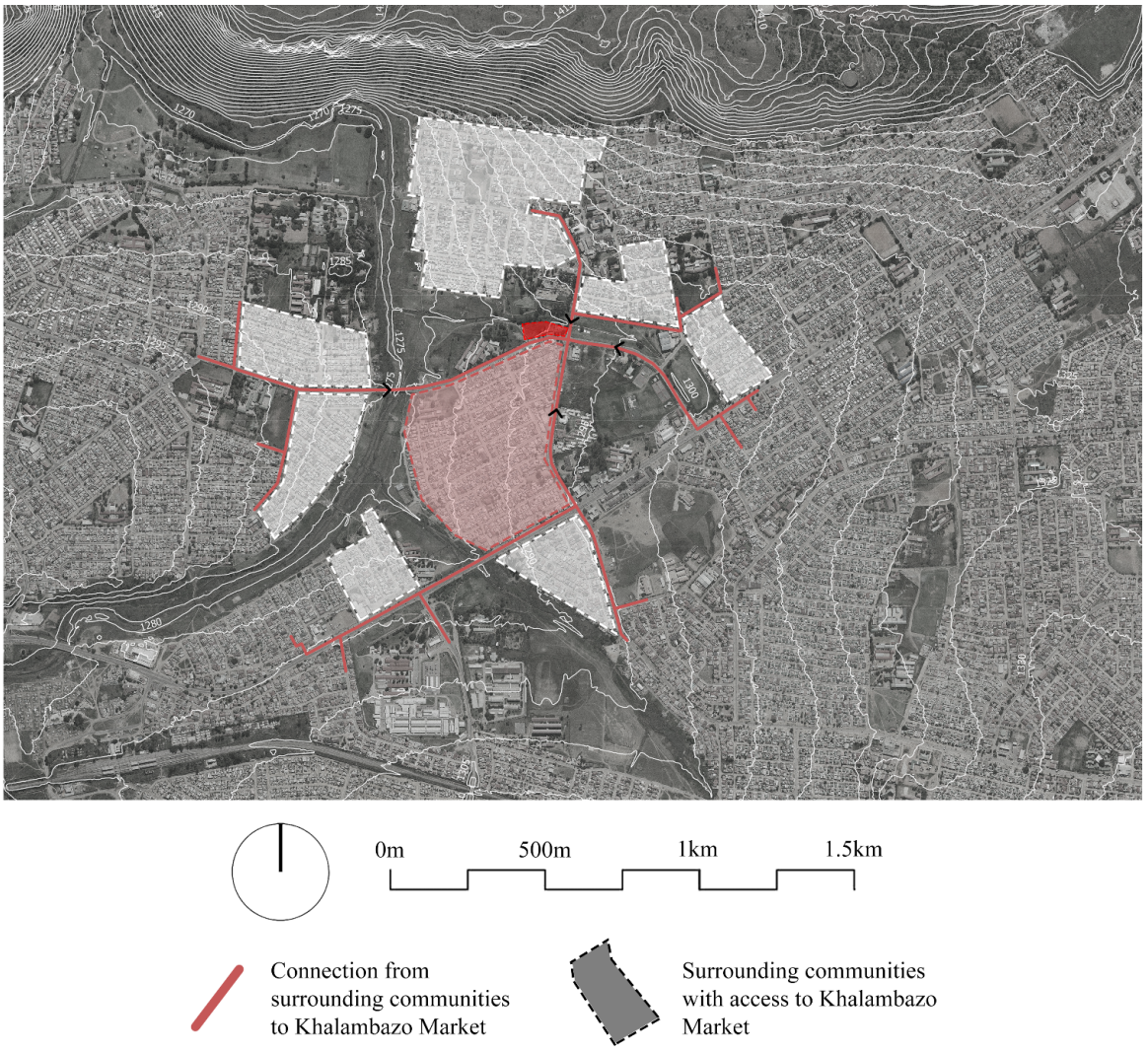


Figure 4.2: Khalambazo and Khalambazo Markets proximity to surrounding neighbourhood districts (Author 2021)

The architectural solution as a communal market and glass upcycling facility should not be considered Drthe only appropriate intervention for these fragmented landscapes but rather a contextually driven catalyst for the community. This intervention then becomes a socio-economic activator within Khalambazo while drawing in users from the neighbouring districts, thus bridging the gap which once made Khalambazo isolated from its surroundings, as seen in Figure 4.2.

Contributions and Extension

Due to the continual flux and socio-economic uncertainty experienced in areas such as Khalambazo, it is increasingly difficult to predict and plan how these spaces will develop over time. What becomes certain is the inherent need for a spatial intervention that will address the community's immediate needs while attempting to address the predicted future desires and needs of the community.

Investigation into the surrounding context became imperative to this dissertation. By including familiar socio-economic drivers, the dissertation creates shared desires and necessities for the community it serves, such as an informal gathering space for trade, formalised trade areas, and a glass processing plant to further the existing recycling process.

This dissertation contributes to the understanding of spatial rejuvenation of once-neglected communities. The dissertation has placed importance on gathering a multitude of design informants, resulting in an intervention that caters to the community's needs rather than a select few. By inhabiting spaces that were once used for separation, the buffer zones now hold potential for further investigation and intervention in similarly fragmented landscapes.

This dissertation points towards a possible solution for spatial transformation within South Africa, particularly buffer zones that physically, socially, and economically separate communities. With each community experiencing their unique successes and barriers, specific research into these communities can highlight their unique advancement into future-proofing their livelihood, liveliness and longevity.

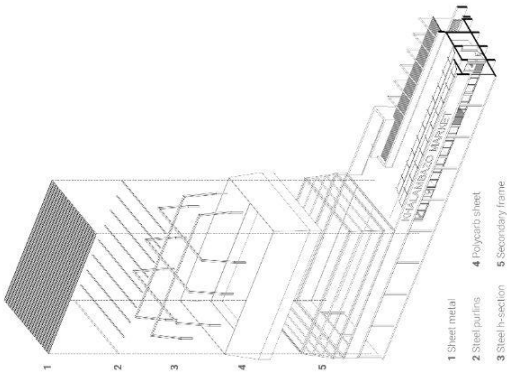
Conclusion

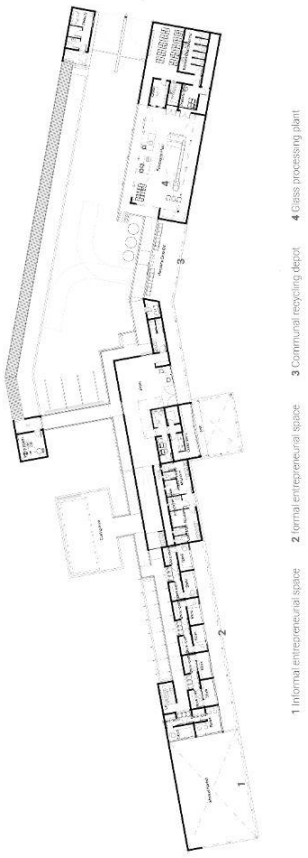
How can architecture facilitate the existing entrepreneurial knowledge system in order to overcome the crippling mono-functional urban fabric of Mamelodi?.

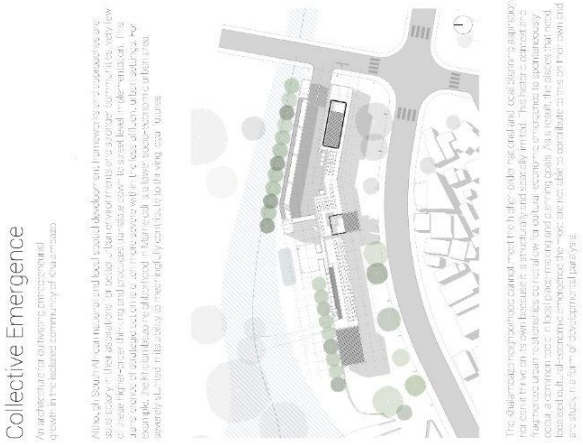
It is possible for architecture to facilitate the existing entrepreneurial systems and contribute towards placemaking within Mamelodi. The intervention's response initiates further opportunity to inhabit previously neglected space while responding to and addressing social, economic and environmental needs.

Annexure

Final Presentation



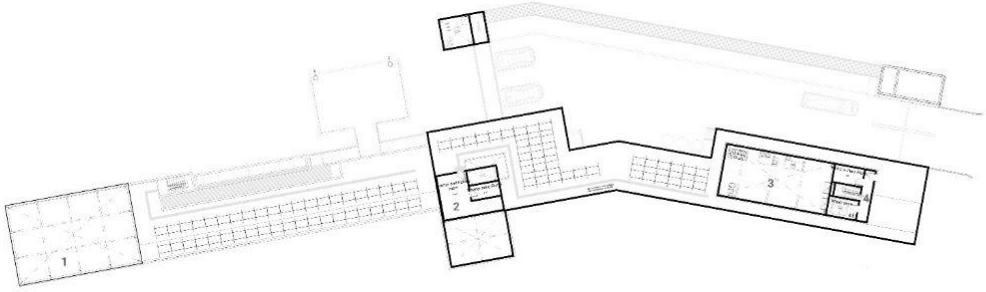




Site Locality

Through the celebration of the existing, coupled with principles of placemaking, Kevin Lynch's Elements of the city and Van Pelsburg's Spaces as Ritual, a new communal market and recycling facility within Khelambeza is proposed. This new communal facility offers perspective as to what is possible while working within the lines of the National Development Agency (NDA). This dissertation contributes to the discourse of public space making and provides insight to springboard further investigation into similar previously disadvantaged landscapes.

The site area chosen for investigation sits on the cusp of Mamelodi East and Mamelodi West. The area is isolated by both natural and man made barriers on all sides. With Tsamaya Avenue (the main arterial) on its southern edge, the Pienaars river (and accompanying buffer zones) on its northern and western, and unused open green space and 'educational' zones on the eastern edge, the site is largely isolated from its surroundings, thus making it physically and economically removed from its greater surroundings, which places the residents in a state of vulnerability and socio economic dependency.



1 Informal entrepreneurial space **2** Inverter and battery room **3** Glass processing plant **4** HVAC and plant room with vertical circulation

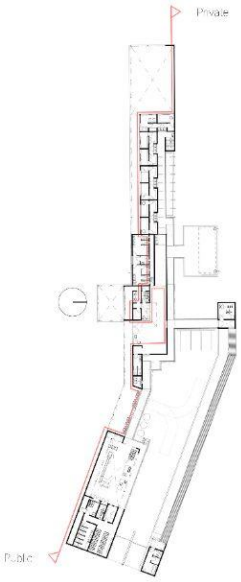
Intervention Responses

1 The introduction of indigenous vegetation enables the safer development of the intervention through the stabilization of the rivers edge. It also allows for natural shading throughout the site.

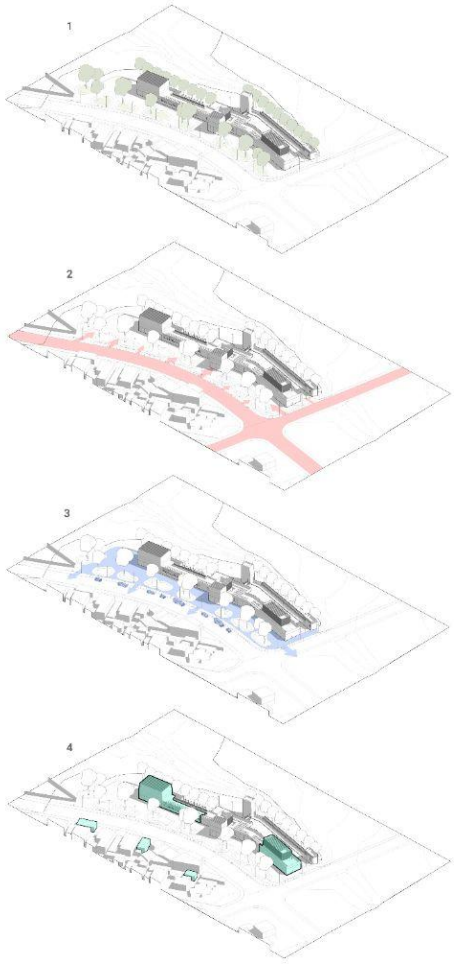
2 Reclamation of the street edge allows for the rejuvenation of the mono-functional urban fabric and the appropriation of once neglected space.

3 Tsomo Street is currently wide enough to insert parallel parking along the intervention's edge. This response allows for edge activation to encourage pedestrian movement.

4 The intervention not only facilitates the existing entrepreneurial system but also encourages economic activity via proximity to the intervention.



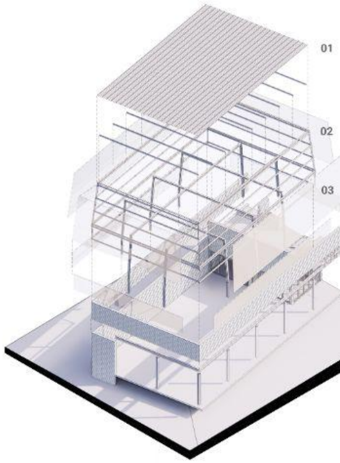
The conversation between the public interface and private processing plant is negotiated within the structure of the intervention, allowing for a sense of flow throughout the site while maintaining both a private and public realm.



Entrepreneurial Responses

Techne Development

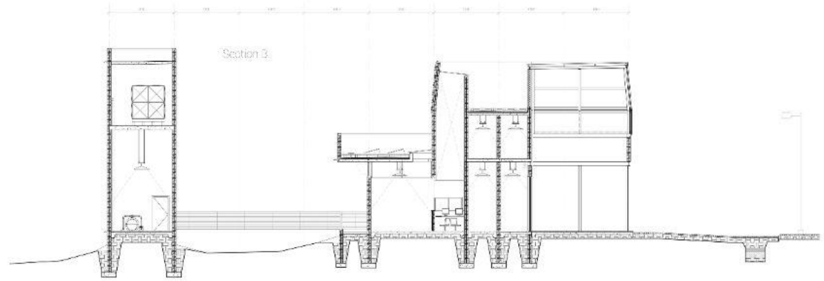
With the theoretical and conceptual influences of Van Rensburg & Da Costa (2008) as well as Kevin Lynch (1960), the technical concept relates back to the undermining of placelessness into the creation of lived space by balancing the grounding stereotomic masses with the inviting tectonic public interface. The isolated nature of Khalambazo and hence the placelessness throughout Mamelodi becomes a driving informant for the stereotomic nature of the project. Located within a context which experiences continual flux of economic opportunity and spatial equality, the stereotomic nature of the architecture aims to concretize the existing economic landscape and create a gateway into the once isolated Khalambazo.

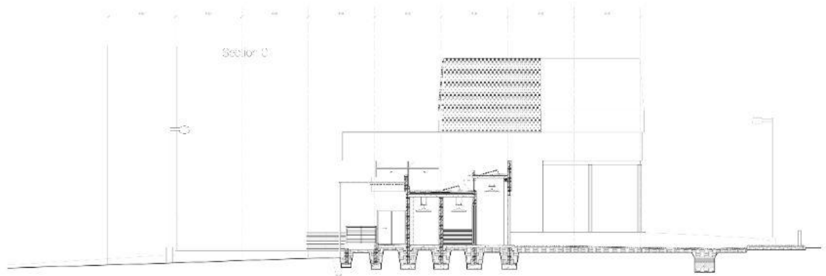


01
Safintra 0.50mm thick safrok 700 colorplus az 150 interlocking roof sheeting at a 2 degree fall supported by 125 x 55 x 20 x 3.0mm steel lipped channel purlins at 1900mm centers.

02
152 x 152 x 30mm hot rolled parallel flange h-section steel beam cranked to h-section steel column to form steel portal frame supported on concrete beam.

03
120 x 60 x 4.0mm rectangular hollow beam sections at 1250mm centers blind bolted to 60 x 60 x 6mm hot rolled equal angle. Which in turn supports 50mm thick translucent tongue and groove cellular polycarbonate panels.





Roof Notes:

Planted 150mm thick in-situ reinforced concrete roof slab to engineers specification with drainage of layers through weephole. 350mm wide mentis grid walkway secured into roof structure to provide serviceability to solar panels. Roof structure to comply with SANS 10400: Part L / 4.2.1 (General requirements)

Wall Notes:

220mm thick running bond firelight travertine facebrick wall supported on strip foundation with mortar that is class II that complies with the requirements of SANS 2001-CM1 & SANS 10400: Part K / 4.2.1.

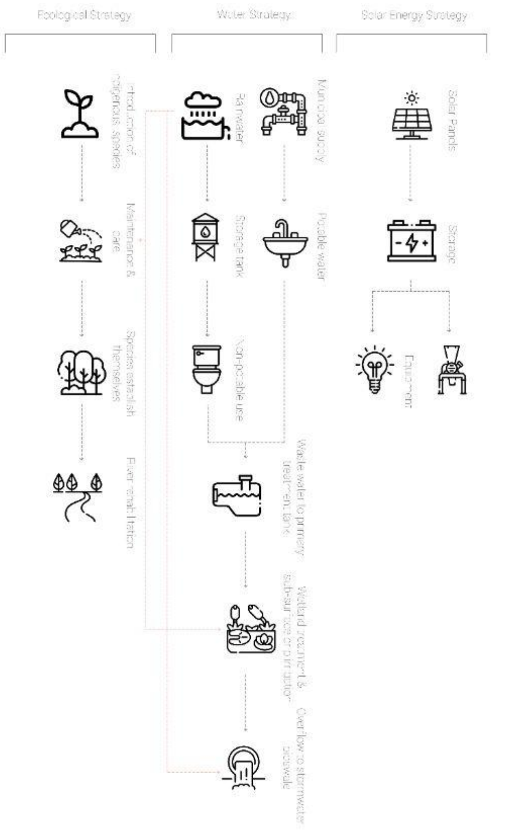
Floor Notes:

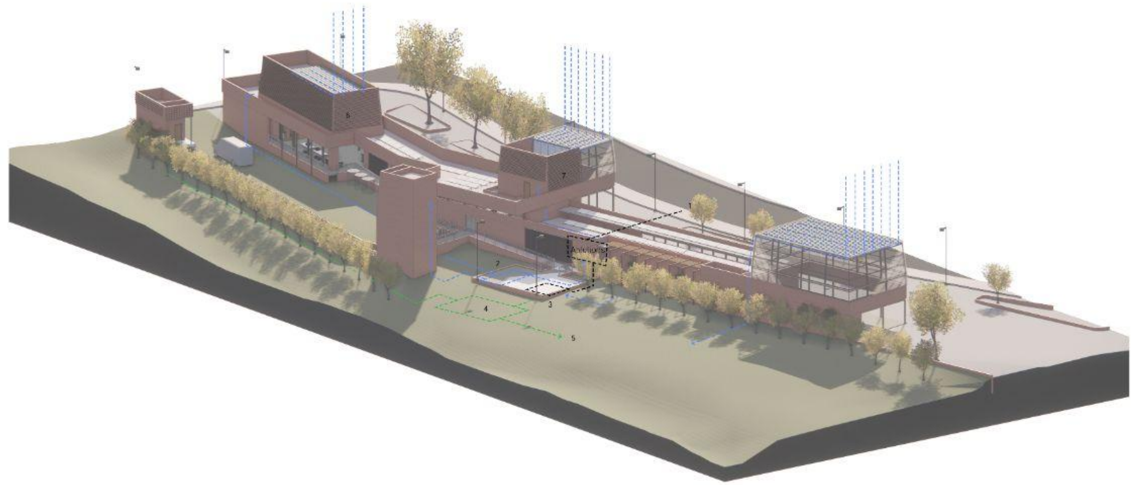
150mm reinforced in situ concrete slab laid on 0,375 micron polyolefin DPM on hardcore fill compacted in layers of 150mm with 40mm thick eco screed with glass aggregate to fall away from structure. Floor to comply with SANS 10400: Part J / 4.2 (Water resistant floors) & 4.4 (Floors supported on ground or filling)

Systems

The intention is not only for the intervention to respond to the socio economic needs of the community uncovered in the narrative enquiry but also to be responsible when it comes to environmental responses. Sitting in an already precarious site, the intervention will need to respond to:

- Passive ventilation strategies through the use of natural ventilation in combination with HVAC systems.
- The high energy demand from the machinery is required to process the glass.
- Water sensitive strategies as the site borders on one of the Pienaars River tributaries.
- And ecological needs of the long neglected rivers edge and its associated vegetation.





01 Potable water travels to the public restrooms from the municipal source.

02 Rainwater is collected in underground tanks which prevents light from causing algae, tanks provide for non-potable uses such as sewage conveyance and irrigation needs. It is pumped up into a raised tank for further storage.

03 Greywater from the sinks and blackwater from the toilets is transferred to storage tanks for initial filtration.

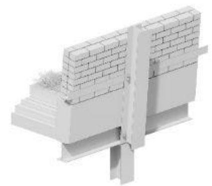
04 Water circulates through the constructed wetland several times, cleansed by the wetlands plant roots and gravel.

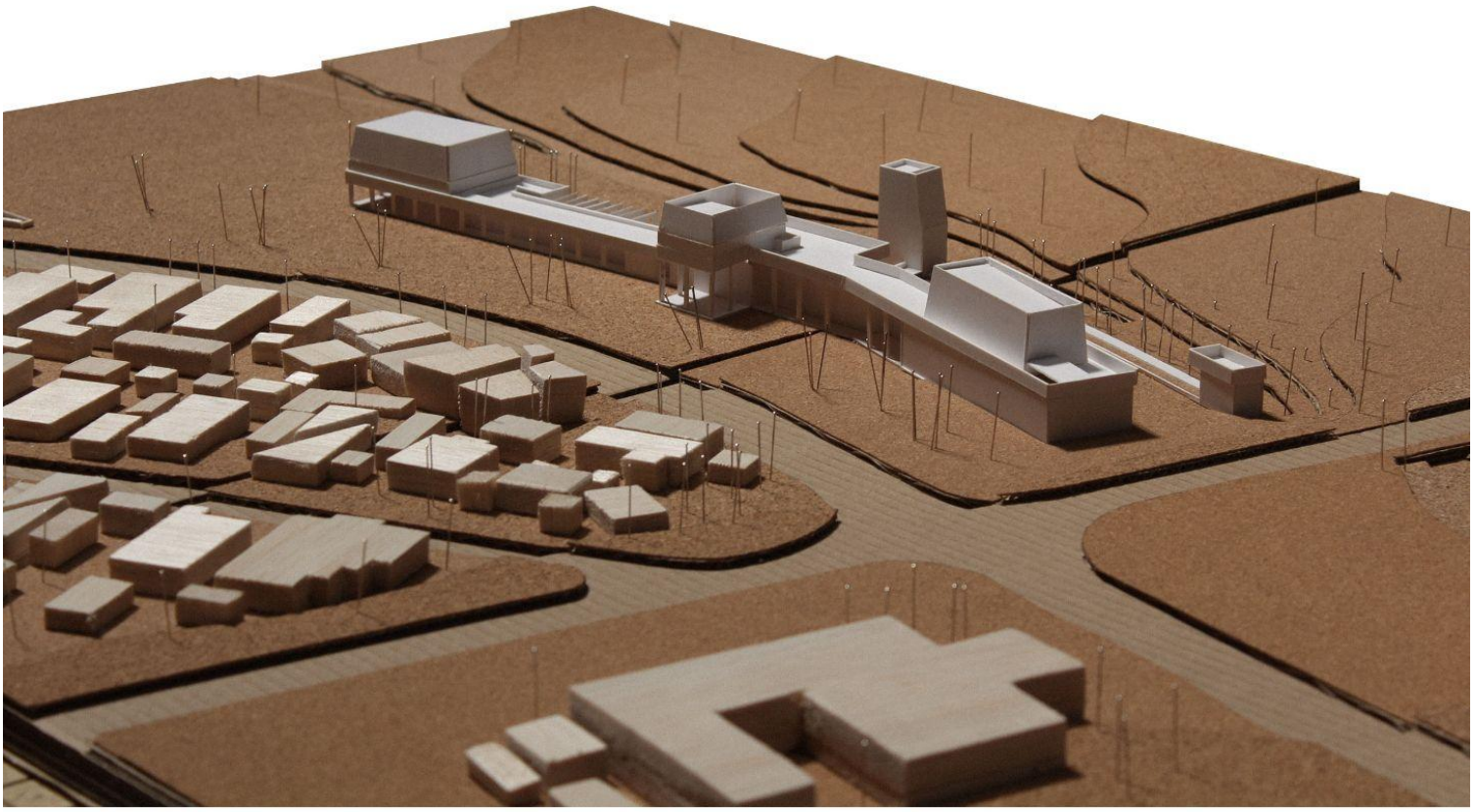
05 After the water has been cleaned, it is pumped to a drip field which returns the cleansed water through the earth and back into the tributary.

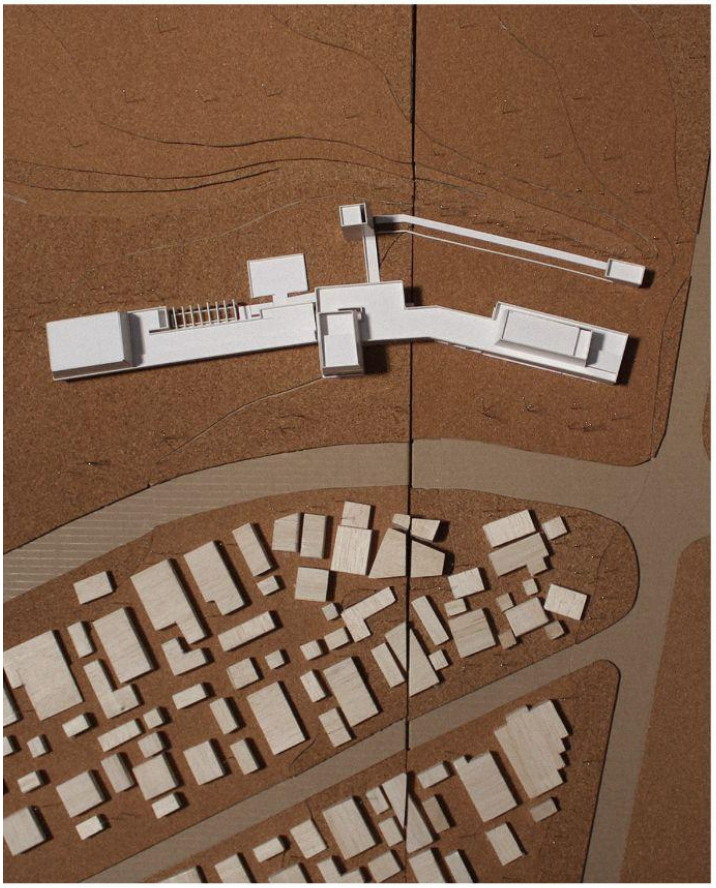
06 The rainwater collected from processing plant roof is used throughout upcycling process, from cleaning to industrial tumbling.

07 Solar battery bank room & gardening room to serve the needs of the solar panels and planted roof.

08 The intervention also responds to the local economic infrastructure and stimulates other economic activities within Khelambazo.







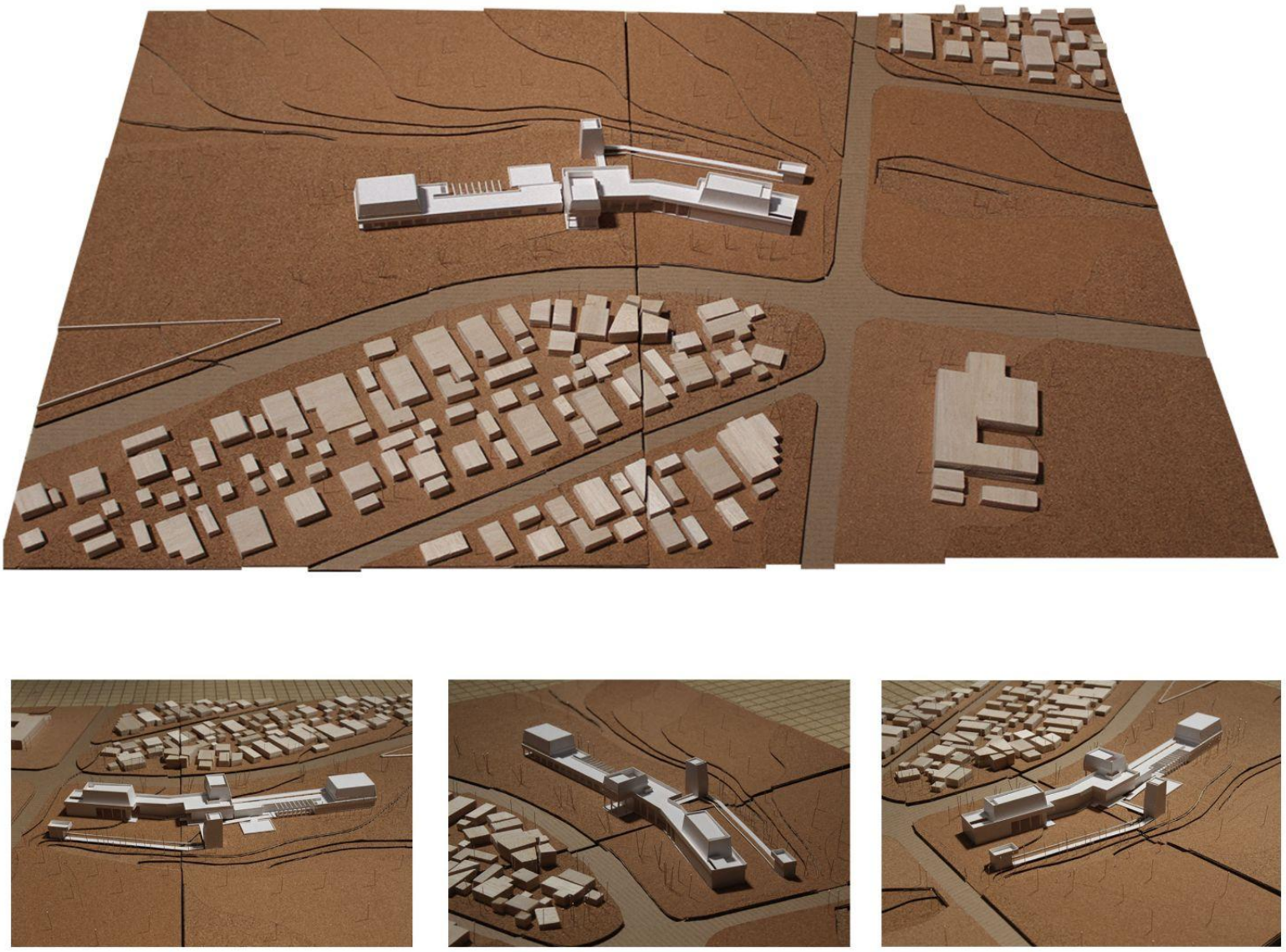


Figure 5.1: Final model collage

Final Crit

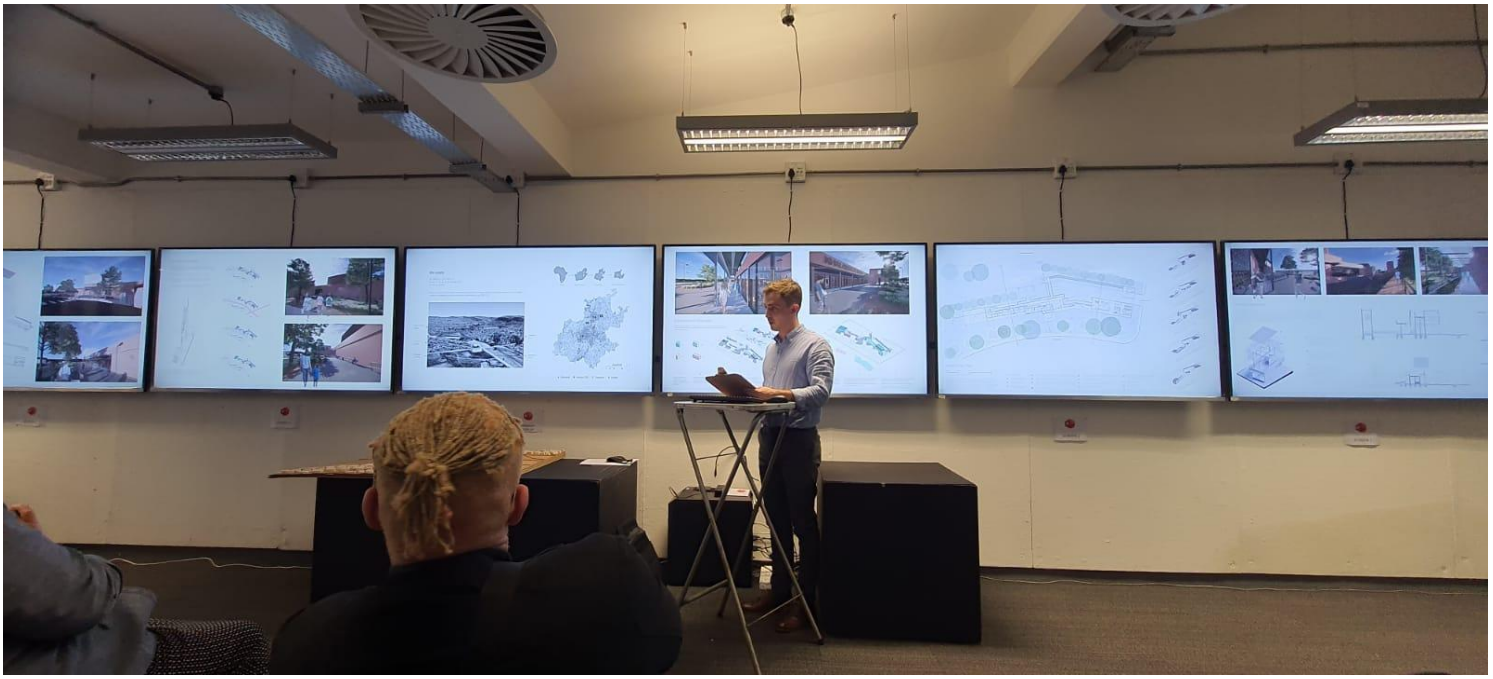


Figure 5.2: Final crit presentation, the first full digital presentation for Boukunde MArchProf

Ethics clearance

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

Reference number: EBIT/259/2020

Dr C Combrinck
Department: Architecture
University of Pretoria
Pretoria
0083

Dear Dr C Combrinck

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 "Urban Citizen Studios: Public Interest Design" is approved under the strict conditions indicated below. If these conditions are not met, approval is withdrawn automatically.

Conditions for approval
Conditional approval on the understanding that:
- Applications from each student (including application forms and all necessary supporting documents such as questionnaire/interview questions, permission letters, informed consent form, researcher declaration etc) will need to be checked internally by the supervisor. A checklist will need to be signed off after the checking.
- All of the above will need to be archived in the department and at the end of the course a flash disc / CD clearly marked with the course code and the protocol number of this application will be required to be provided to EBIT REC administrator.
- Any personal and demographic data (eg gender, income, education) have provided the motivation that is acceptable based on the supervisor's evaluation.
- Students using organizations data not publicly available or collecting data from employees have the permissions in place.
- 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.
- Images and observation of people will require consent. Images and observation of minors are prohibited.

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

Figure 5.3: Ethical clearance for the Unit for Urban Citizenship from Dr. C Combrinck

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

9 June 2021

Reference number: EBIT/79/2021

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

Dear Ms A van Aswegen

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Conditional approval is granted.

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

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

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

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

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

The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Kai-Yip

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

Figure 5.4: General ethical clearance for the Unit for Urban Citizenship from Ms A van Aswegen

Rainwater calculations

01) Monthly Rainfall Yield

Roof Catchment (845m²)		
Month	Ave. Rainfall (m)	Yield (m³) (Yield = Rainfall x Area x 0.9)
January	0.154	117.117
February	0.081	61.6005
March	0.08	60.84
April	0.051	38.7855
May	0.02	15.21
June	0.01	7.605
July	0.01	7.605
August	0.01	7.605
September	0.05	38.025
October	0.07	53.235
November	0.11	83.655
December	0.15	114.075
Total	0.796	605.358

Ground Surface Catchment (540m²)		
Month	Ave. Rainfall (m)	Yield (m³) (Yield = Rainfall x Area x 0.9)
January	0.154	74.844
February	0.081	39.366
March	0.08	38.88
April	0.051	24.786
May	0.02	9.72
June	0.01	4.86
July	0.01	4.86
August	0.01	4.86
September	0.05	24.3
October	0.07	34.02
November	0.11	53.46
December	0.15	72.9
Total	0.796	386.856

Month	Average Rainfall (m)	Municipal Water Source (m³)	Yield total (m³) (Roof+Ground)	Total Yield (m³)
January	0.154	11	191.961	202.961
February	0.081	11	100.9665	111.9665
March	0.08	11	99.72	110.72
April	0.051	11	63.5715	74.5715
May	0.02	11	24.93	35.93
June	0.01	11	12.465	23.465
July	0.01	11	12.465	23.465
August	0.01	11	12.465	23.465
September	0.05	11	62.325	73.325
October	0.07	11	87.255	98.255
November	0.11	11	137.115	148.115
December	0.15	11	186.975	197.975
				1124.214

Table 5.1: Total yield per month from municipal connection and harvested rainwater (Author 2021)

02) Monthly Demand

Builidng demand				
Fixture	Usage (L)	Quantity	Times used per month	Total usage per month (m³)
WC	7.5	13	125	12.187
Shower	75	2	50	7.5
WHB	1	16	110	1.76
Machinery	150	3	25	11.25
Processing	125	1	25	3.125
				35.822

Landscape Demand				
	Area (m²)	Coef	Usage	Total usage per month (m³)
Summer Demand	2250	0.125	31	8.718
Winter Demand	2250	0.16	31	11.16

Total demand	
Months	Demand (m³)
January (S)	44.540
February (S)	44.540
March (W)	46.982
April (W)	46.982
May (W)	46.982
June (W)	46.982
July (W)	46.982
August (W)	46.982
September (S)	44.540
October (S)	44.540
November (S)	44.540
December (S)	44.540

Table 5.2: Total monthly water demand (Author 2021)

03) Monthly Budget

Month	Yield (m³)	Demand (m³)	Balance (m³)
January	202.961	44.540	158.421
February	111.9665	44.540	67.427
March	110.72	46.982	63.738
April	74.5715	46.982	27.590
May	35.93	46.982	-11.052
June	23.465	46.982	-23.517
July	23.465	46.982	-23.517
August	23.465	46.982	-23.517
September	73.325	44.540	28.785
October	98.255	44.540	53.715
November	148.115	44.540	103.575
December	197.975	44.540	153.435
Annual Av.	93.7	45.76	

04) Minimum Tank Size

Month	Yield (m³)	Demand (m³)	Balance	Vol. water in tank (m³)
January	202.961	44.540	158.421	474.414
February	111.9665	44.540	67.427	541.841
March	110.72	46.982	63.738	605.579
April	74.5715	46.982	27.590	633.169
May	35.93	46.982	-11.052	622.117
June	23.465	46.982	-23.517	598.6
July	23.465	46.982	-23.517	0.0
August	23.465	46.982	-23.517	-23.517
September	73.325	44.540	28.785	5.268
October	98.255	44.540	53.715	58.983
November	148.115	44.540	103.575	162.558
December	197.975	44.540	153.435	315.993

The minimum tank size is equial to the maximum amount of water in tank = 634m³ (634 000 litres)

Table 5.3: Water budget and minimum tank size (Author 2021)

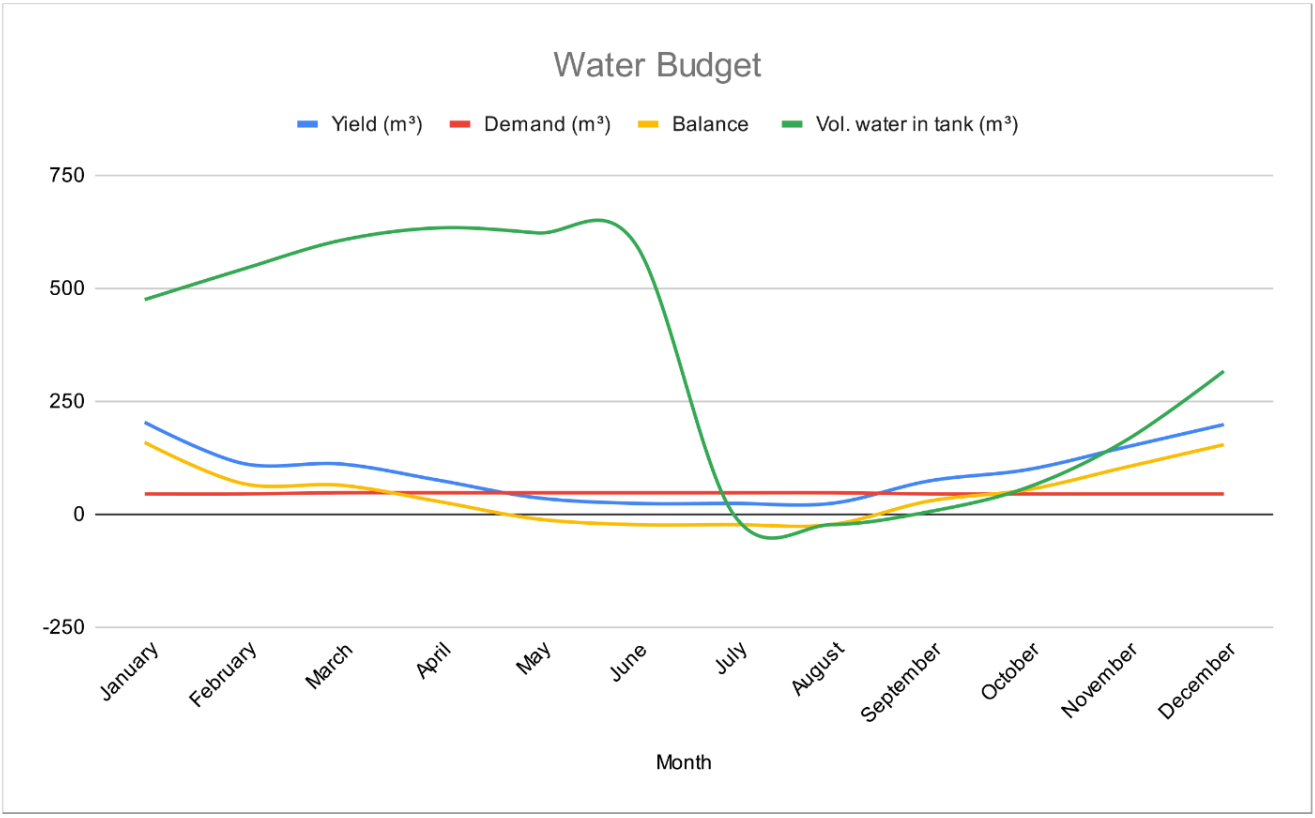


Table 5.4: Annual water budget and storage capacity (Author 2021)

Solar Panel Calculations

Solar Panel Output *(78* × JA Solar 335W Solar Panels Poly QC4) (5.5 hours sunlight a day)

1) 78 panels × 335 watts = 26.15 kW solar panel system.

2) Multiplied by the 5.5 hours of sun a day × 75% efficiency rate = 107.85 kWh of electricity produced per day.

3) Multiply 107.85 by 365 = 39 365 kWh of electricity produced in a full calendar year from a rooftop array of 78, 335 W solar panels.

*efficiency is increased in this system due to the planted roof underneath the photovoltaic panels, this reduces the temperature experienced by the panels and thus the efficiency increases.

Figure 5.5: Energy produced annually from the solar panels located on the interventions roof, Dr which will be used to power general appliances as well as machinery located in the glass processing plant (Author 2021)

Sefaira

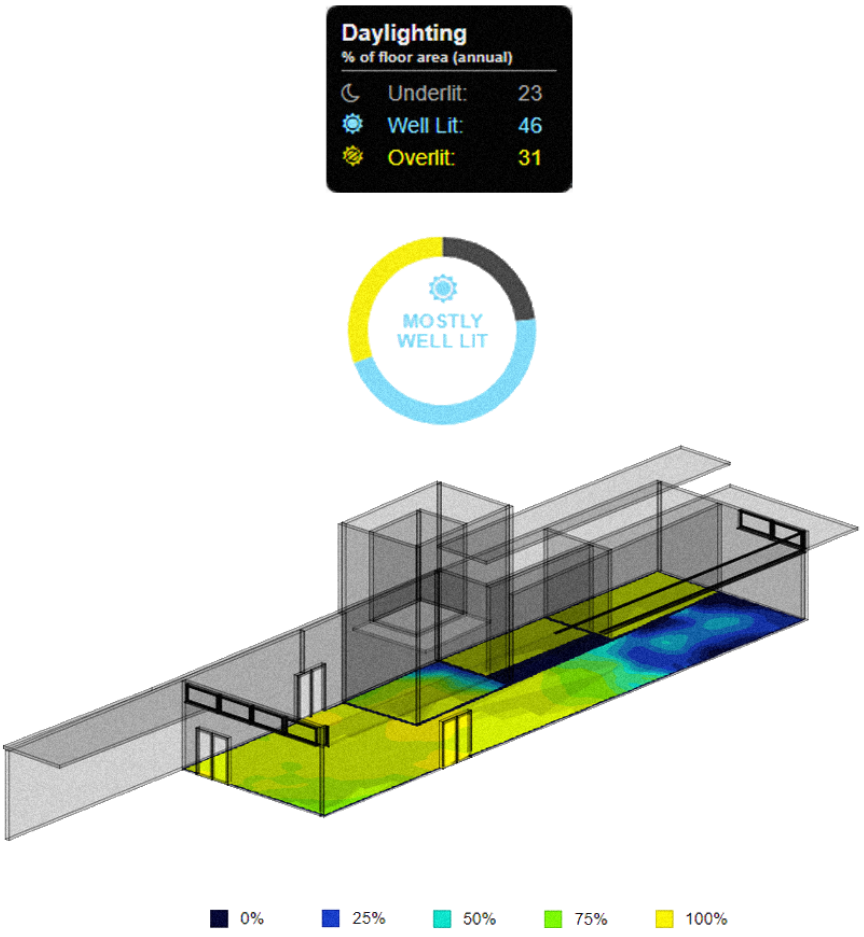


Figure 5.6: Sefaira daylight analysis of foyer space of recycling plant indicating a majority well lit internal conditions (Author 2021).

SBAT

	Achieved
SB SBAT REPORT	**4,4**

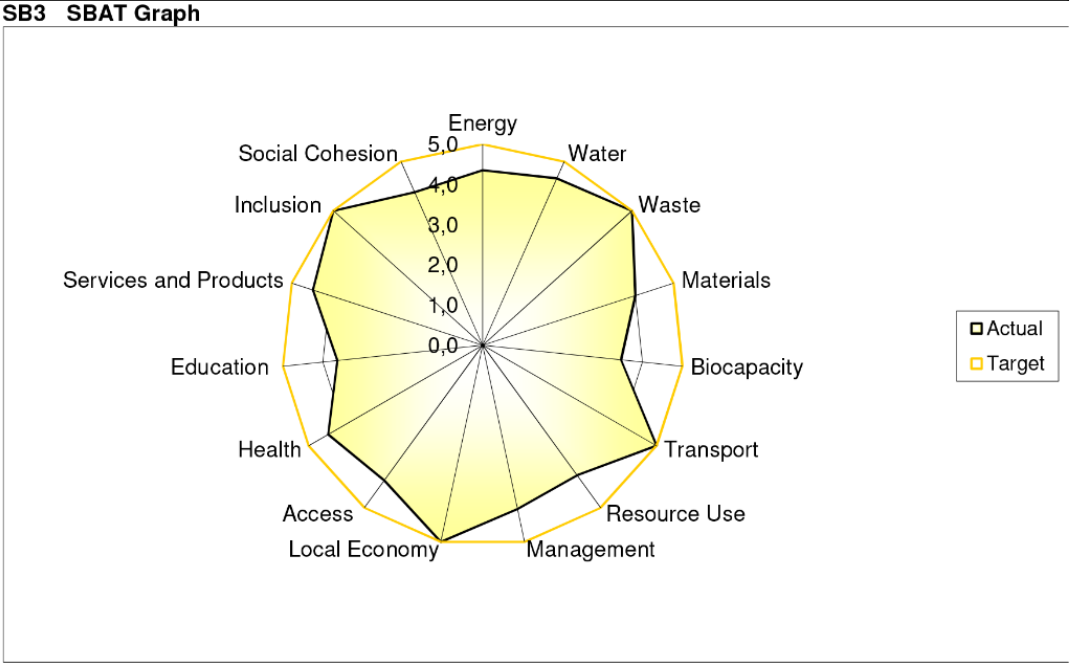
SB1 Project

Khalambazo Precinct

SB2 Address

Mamelodi, Khalambazo

SB3 SBAT Graph



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

SB5 EF and HDI Factors	Score
EF Factor	4,3
HDI Factor	4,5

SB6 Targets	Percentage
Environmental	85
Economic	89
Social	87

Figure 5.7: Sustainable Building Assessment Tool report achieving a 4,4 out of 5 with room for improvement located within the materiality sector.

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