STITCHES + EXCHANGES

Connecting health and social exchange through architecture as facilitator in Mamelodi East

STITCHES AND EXCHANGES

Connecting health and social exchange through architecture as facilitator in Mamelodi East

Simoné Senekal
2018

Stitches: verb - "*make, mend or join something with stitches.*"
Exchanges: verb - "*give something and receive something in return.*"

The dissertation explores the potential of architecture as instrument in health exchanges, and illustrates the role of the physical environment in health settings on the health and wellbeing of those that these spaces are predicated to anticipate. It is investigated through a paediatric health screening facility and shared resources hub situated within Mamelodi East.

SITE ADDRESS

16024 Hinterland Avenue, Mamelodi, Pretoria, 0122
GPS Co-ordinates: 25˚43'19.2" S ; 28˚23'11.8" E

PROGRAMME

Paediatric screening facility and shared resources hub

CLIENT

Department of Basic Education, Department of Health, Department of Public Works

Course Co-ordinator: Prof Arthur Barker
Study Leader: Dr Carin Combrinck
Study Field: Human Settlements and Urbanism

Submitted in partial fulfillment of the requirements for the degree of Masters in Architecture (Professional) in the Faculty of Engineering, The Built Environment and Information Technology at the University of Pretoria, 2018.

Edited by Genevieve Wood

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
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Abstract

The formative years of a child play a crucial role in unlocking his or her life-long potential. During this period, factors such as adequate health care, good nutrition and stimulating environments have an impact on their growth and development. Thus, the role of the physical environment within child health care cannot be ignored. Although various policies in South Africa advocate the reformation of child-centered health, not much attention is given to the spatial settings and how it could possibly contribute to reach the set out objectives. The spatial experience of public health care buildings have resulted in people having an aversion to such visits as it has become more of an institutional experience rather than a facilitating experience. The intention of the dissertation is to re-imagine the impact of the architectural environment on health care facilities through exploring a child-centered approach. It explores salutogenesis as theoretical premise, illustrating how the built environment can play a significant role in the promotion of health as well as development. Situated in the context of Mamelodi East, the architecture explored aims to stitch together and integrate the fragmented, define and celebrate meaningful public space, consider experience and possible exchanges and facilitate a public service that ensures inclusion and empowerment. Ultimately, the dissertation suggests a salutogenic approach as pivotal axis for positive change in school-based health settings – from built environment, to users, to the greater society. Fottler (2000:95) states, "*a health care facility should provide evidence of thoughtful concern for human needs and should be responsive, and alive.*" The dissertation illustrates the possible role of architecture as facilitator in providing welcoming, stimulating and nurturing health care environments.

KEYWORDS:
Child health, school-based health care, salutogenesis, sensory design, physical environment.

Tse sa utloahaleng

Kgale-kgale go be go le boima. Go se bonolo go ngwana a nang le mengwaga e tlase, gore a ka ithuta ka go bapala. Mohlala go be go sena se ngwana a ka se bapadišago. Ka nako tšeo go be go sena mefelo a tša bophelo bjo botle. Ka go fela tšeo di bile le kgahlamelo e mpe Afrika-Borwa. Gobane melao ya kgale e be e sa re dumelele go ba kgauswi le dinyakwa tše botse, go swana le dipetlele le mešomong.

Lebaka le dirago gore go be le dinyakišišo ke go nyaka go tseba ka sekgatla seo maduto a rena a bileng le kgatlamelo go ngwana. Ke go batlišiša mabaka a bophelo bjo botle. Dibatlišišo tšeo di tla thuša go aga mafelo a senang kgahlamelo go ngwana bophelong bja gagwe.

Bofelong bja ditaba mmatlišišo o eletswa gore mabaka a dirago bophelo bjo botle bjo bo nang le diphetogo tše lokileng dikolong. Go ageng ga mefelo a bodulo go batho ka kakaretšo. Fottler (2000:95) a re tša bophelo bjo botle bo leketše go fana ka bopaki. Dipatlišišo di bontša bokgoni bja gore meralo ya go aga elokela go bontša ka megato e mofutho e fanang ka bophelo bjo botle mo kgodisong ya ngwana.

KEYWORDS:
Bophelo bo botle ba bana, Tlhokomelo ea bophelo bo botle sekolong, Moqapi oa boikutlo, Salutogenesis, Tikoloho ea tlhaho

Samevatting

Die vormingsjare van 'n kind het 'n bepalende invloed op die ontsluiting van sy of haar potensiaal. Gedurende hierdie tydperk het die volgende faktore 'n invloed op sy of haar groei en ontwikkeling: voldoende gesondheidsorg, gebalanseerde voeding en 'n stimulerende ruimte. Die bou omgewing speel dus 'n belangrike rol in die kind se gesondheidsorg en kan nie buite rekening gelaat word nie.

Alhoewel daar baie roepstemme opgaan vir die hervorming van die gesondheidsorg van kinders in Suid-Afrika, word daar min aandag aan ruimte as bydraende faktor geskenk. Mense sien gewoonlik op na besoeke aan geboue wat gesondheidsorg huisves. Hulle beleef die ruimtelike omgewing negatief en dit word as 'n instelling ervaar, eerder as 'n opbouende ervaring. Die doel van hierdie verhandeling is om die invloed van argitektuur op gesondheidsorgfasiliteite te ondersoek deur van 'n kindergebaseerde benadering gebruik te maak. Salutogenesis word voorgestel as teoretiese uitgangspunt en daar word ondersoek hoe die bou omgewing 'n bepalende rol in die bevordering van gesondheid en ontwikkeling kan speel. Binne die konteks van Mamelodi-Oos, ondersoek die argitektuur moontlikhede om die verskillende dele te integreer en 'n betekenisvolle ruimte te definieer waar ervaring en moontlike interaksies ingedagte gehou word. Daar word gestreef na 'n inklusiewe ruimte wat die gemeenskap bemagtig.

Ten slotte stel die verhandeling 'n salutogeniese benadering voor as keerpunt vir positiewe verandering in die skoolgebaseerde gesondheidsomgewing. Dit sluit die bou omgewing, gebruiker en die groter gemeenskap in. Volgens Fottler (2000:95) moet 'n gesondheidsorgfasiliteit bewys moet kan lewer van 'n weldeurgedagte besorgdheid vir die individu se behoeftes en tasbaar behoort te wees. Die verhandeling lig die moontlike rol van argitektuur uit as fasiliteerder in die skep van verwelkomende, stimulerende en versorgende ruimtes vir gesondheidsorg.

SLEUTELWOORDE:
Kindergesondheid, skoolgebaseerde gesondheidsorg, salutogenies, sensoriese ontwerp, bou omgewing.

DECLARATION

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

Simoné Senekal

“The essence of all beautiful art, *great art*, is gratitude.”

Friedrich Nietzsche

Thank you to all the giants whose shoulders I stood on during this dissertation - you know who you are.

ABSTRACT

EXPRESSION OF THANKS

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Stating my bias

"Architecture is coming to terms with the realization that we have largely ignored how the majority of human beings live."

Alfredo Brillembourg (Design Indaba 2012)

UNDERSTANDING RESPONSIBILITY WITH EVERY LINE I DRAW

After four years of architecture school, my standpoint within the field of architecture is strongly influenced by the idea of social impact, the importance of community and how it can be integrated within the confines of architecture. Architecture needs to allow for a people-centric society and enable the user to coexist with, learn from and participate in the narrative created the designer. Liz Ogbu (2014) states that we as designers are expert citizens that can create an impact through design, but it is vital to understand that the people we design for are citizen experts. Both are equally imperative to the process of making architecture.

I understand architecture as a relationship between different layers that respond to man as well as nature. Influences are collected from various perspectives and scales, whether micro or macro, from the way the building sits within the landscape to the experience of the user. With the creation of space comes the responsibility of ensuring a sustainable future for not only the building but also its environment and the systems within it. My approach to architecture is a conscious hybrid of modern and postmodern; the indigenous and the universal; existing and new, man and landscape - to achieve a synthesis between opposing approaches to create a reconciling identity.

I have come to understand that in the process of making architecture, I am not only impacting the community I design for, but the community is also impacting me as designer. As Jim Rohn (Art of Selfhood, 2016) said, "*Whatever good things we build end up building us*". For my final year of studies I hope to create architecture that connects community, identity and responsibility in an innovative way that exists symphonically with its users and environment. I hope to create responsible place that encourages enhanced living for others and highlights the impact that architecture can have in our society.

Figure 1.1: Dwelling in the play park we built in Mamelodi East that in return built us. (Photograph by Porter 2017)

Setting the scene

Introducing Mamelodi East

"At every instant there is more than the eye can see, more than the ear can hear, a setting or a view waiting to be explored."

(Lynch 1960:3)

DISCOVERING THE MOTHER OF MELODIES

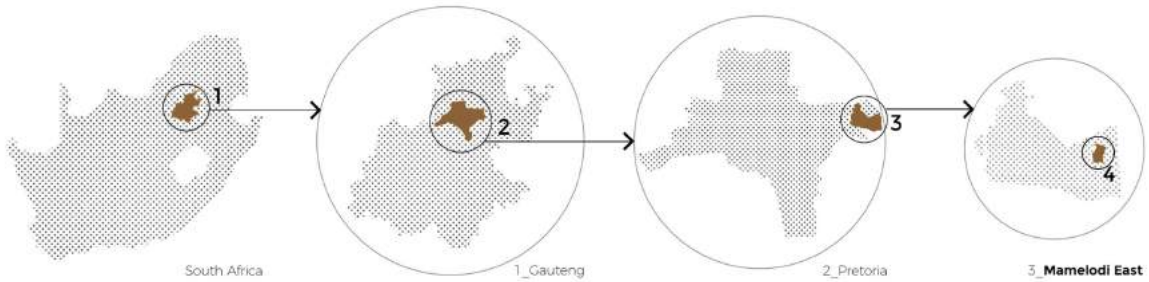


Figure 1.2: Locality map of Mamelodi East (Author 2018)

I found myself exploring the streets of the well-known Mamelodi – also known as Mother of Melodies - that is located on the outskirts of Pretoria as an outsider. I was new to the hustle and bustle, the sounds, the energy and the smells surrounding me. The streets were alive with people. Friendly smiles from local traders hoping you will find interest in their products, hooting of mini taxis in search of passengers, crowds of school children making their way home after a day of schooling. But Mamelodi did not see me as an outsider. I was invited into the house of local crèche owners as family - offered a drink and fed with a bowl of home cooked food without asking. Hours and hours of conversation passed filled with stories and laughter. A layer of existing networks and connections scattered all over. The sense of community intrigued me. The observation of children as important role players caught my eye. It revealed the opposite of what I assumed about this community and the way media portrayed it. In this collage of brick, children and columns, somehow, I sensed an invisible growth within a community that is attempting to co-exist within the fragmented consequences it inherited. There is hope and determination to move towards a better future. I needed to find out more of this layered city, how it came to be and what it has become.
(Author 2018)

Figure 1.3: Exploring the mother of melodies (Author 2018)

CHAPTER ONE

Introduction

1.1.1 Health care, the child and Mamelodi

As long as human beings exist, the demand for their health care will always be present. It is a known fact that access to basic health care is a global concern, and continuing challenge. The United Nations (2018) lists "*good health and wellbeing*" in the top three goals for sustainable development as part of their 2030 vision. Children are not excluded from this right, where various international and national policies have formed a solid foundation over the years to ensure access to basic health care for children. Early Childhood Development is central to various development initiatives and is based on a continuously emerging body of evidence. It confirms the importance of early childhood development to unlock the potential human capital inherent within the very youngest population to contribute to a nation's development (Republic of South Africa 2015:18).

Within South Africa, children under the age 15 make up 30% of the total population, with median ages at 25% and elderly over 60 years at 7% (WHO 2012:166). It is clear that early childhood development is a potential opportunity in our society which can contribute to a better future.

Policies implemented in South Africa, such as the recent National Integrated Early Childhood Development Policy in 2015, aim to provide children with an early start to a better future (Republic of South Africa 2015:7). Although these developments have improved the lives of many young children in South Africa, various gaps and deficiencies in the implementation of these strategies still leave a number of young children deprived of their basic right. Within Mamelodi East, children under 18 make up for 27% (Wazimap 2018) of the increasing population in the area.

Figure 1.4: Children in Mamelodi East on their daily exodus after a day of school (Author 2018)

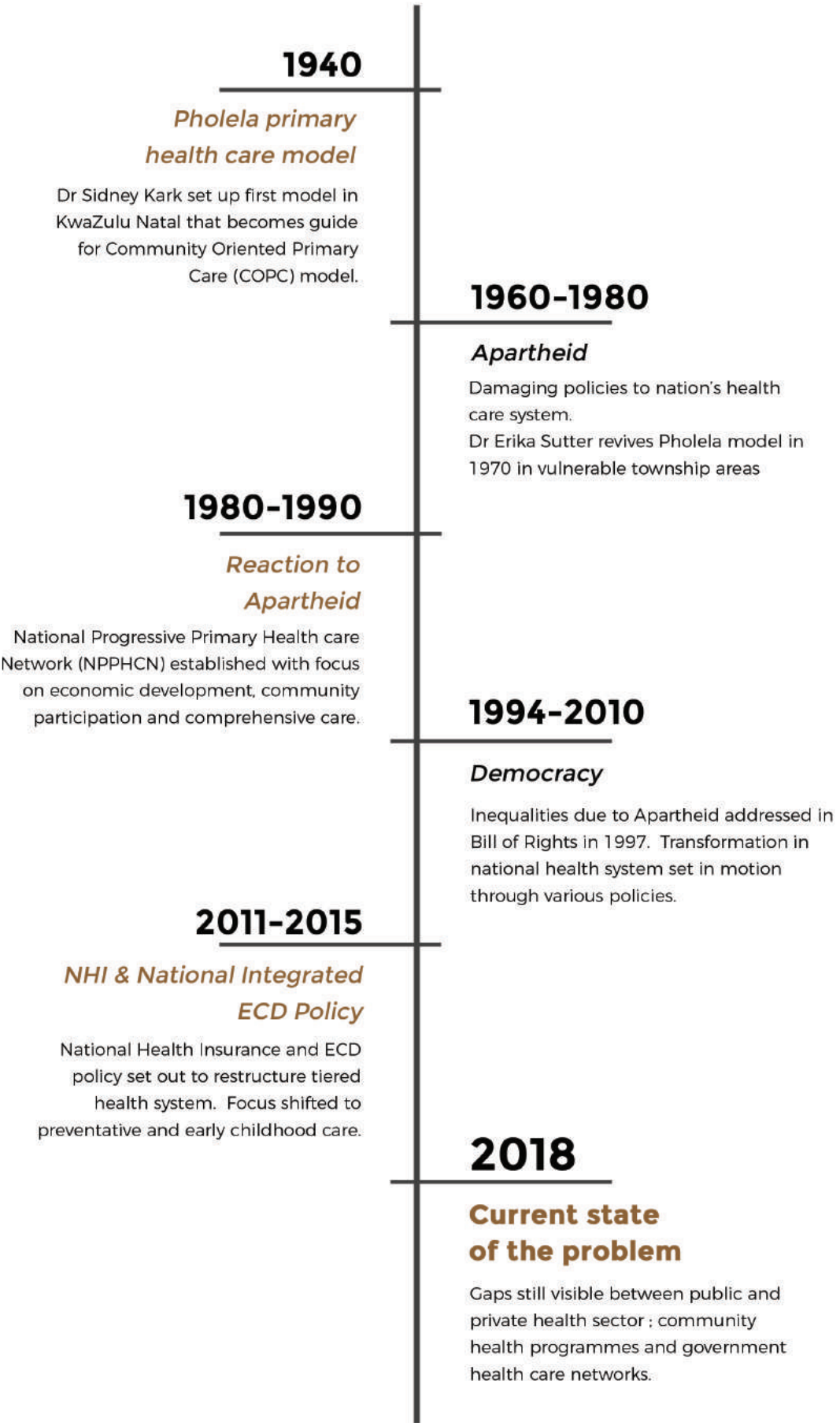


Figure 1.5: Brief overview of the history of health care in South Africa (adapted by Author 2018 from Whitaker 2016)

1.1.2 General Issue: The road to equal access in South Africa

"The Constitution of the Republic of South Africa, 1996, places obligation of the state to progressively realise socio-economic rights, including access to health care."
(Department of Health 2015:11)

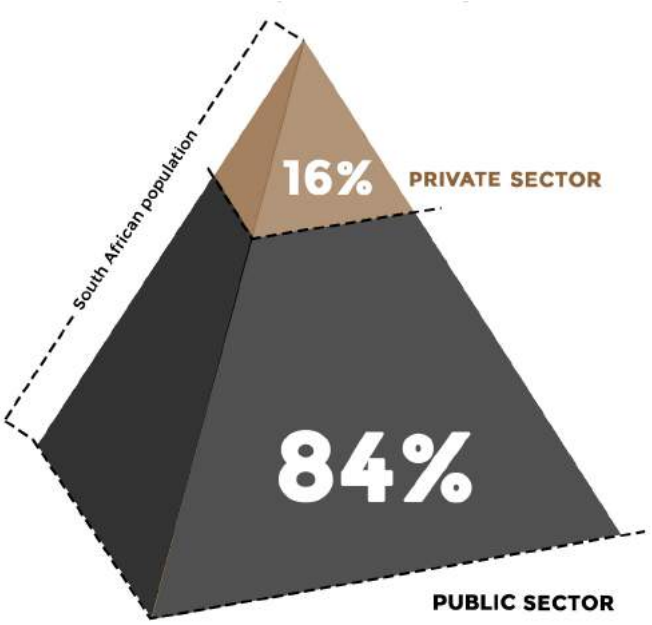


Figure 1.6: Citizens with the greatest need for health care have the least access (Author 2018)

South Africa has a complex history with regard to primary health care provision. Dating back to 1940, with the introduction of the groundbreaking *Pholela Health Care Model*, health care in South Africa embarked on the journey to reach the worldwide goal of *Health for All* (Barron & Pillay 2011:1). However, with the rise of the Apartheid regime, division started to set in, creating a gross inequality in public and private health services. Yet in this biased health system implemented by government, international missionaries and NGOs acknowledged the resilience of the Pholela Health Care Model and implemented primary health care services, especially in vulnerable communities that were disadvantaged (Whitaker 2016:33).

To counteract the inequality set in motion by Apartheid, the *National Progressive Primary Health Care Network* (NPPHCN) was developed by numerous organisations and individuals. The main objective was to promote progressive primary health care, as well as to provide a platform where government policies could be openly challenged (Whitaker 2016:34). As a result of democracy in 1994, past inequalities in terms of health care access were addressed through a set of policies and frameworks that proposed a reformation of the existing health system. The journey to equal health care access already commenced in the new democracy, yet the tiered health system and associated inequalities are still visible today, especially for citizens that rely on the public health sector. The private sector only serves a mere 16% of the population, resulting in 84% of citizens making use of public sector services (Bam et al 2013). This is a clear indication that citizens with the greatest need for health care have the least access. Increasing population growth only intensifies the problem by creating a greater demand for health care.

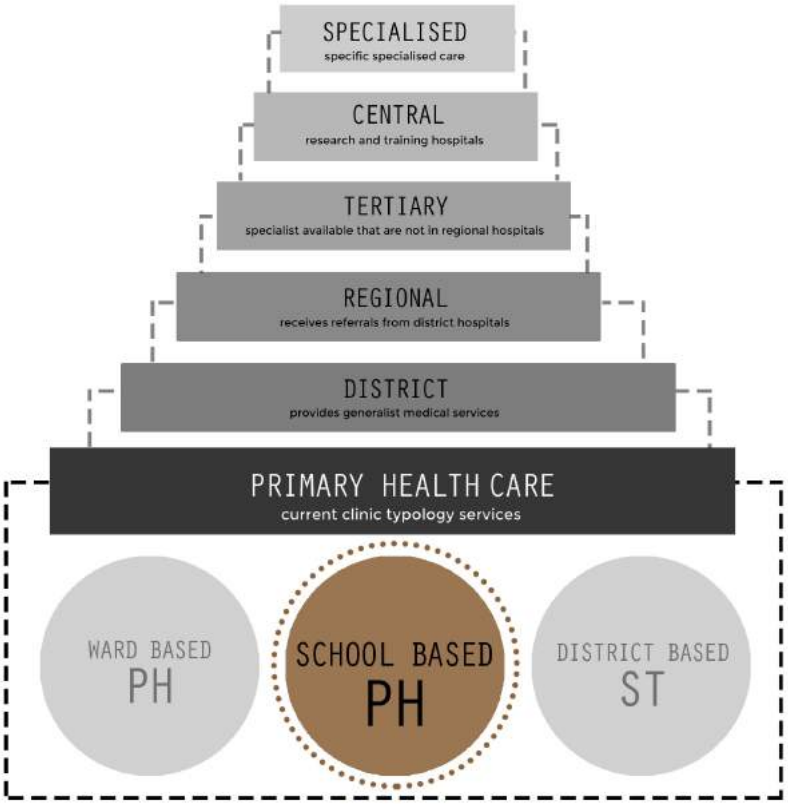


Figure 1.7: Proposed restructured model by National Health Insurance (adapted from Department of Health 2015:39)

A recent documentary titled *DOC-U-MENTALLY* depicts the crisis in the public health sector in South Africa, especially within previously disadvantaged communities. The documentary illustrates the reality of current hospitals and clinics being overcrowded, underfunded and understaffed (Carte Blanche 2018). To begin transforming the current tiered health care system the Department of Health's National Health Insurance policy proposes a restructured model that places greater emphasis on primary health care. The restructured health care model aims to re-engineer the health care system through placing focus on a preventative approach rather than the traditional curative approach. Primary health care (PHC) facilities, such as clinics and community health care (CHC) centres, are those points of care closest to the community and are usually the first point of contact at a health establishment. It then further extends into a continuum of care through regional and tertiary services such as hospitals and specialised care (IUSS 2014:13). To achieve the desired outcome of a "*health for all*", the system relies on effective referral relationships between the various tiers (IUSS 2014:15). Three possible streams of primary health care provision are suggested in the restructured model, namely municipal ward-based primary health care, school-based primary health care and district-based specialist teams (Department of Health 2015:39). The school-based primary health care stream is explored in more detail to understand the strengths, shortcomings and opportunities of the approach.

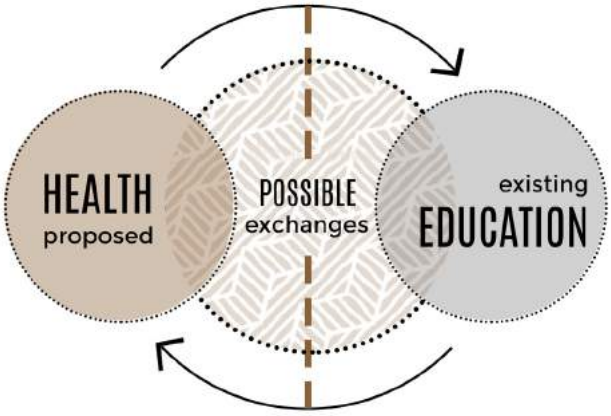


Figure 1.8: Possibilities in overlapping health and education sectors (Author 2018)

1.1.3 School health is public health: School-based health care

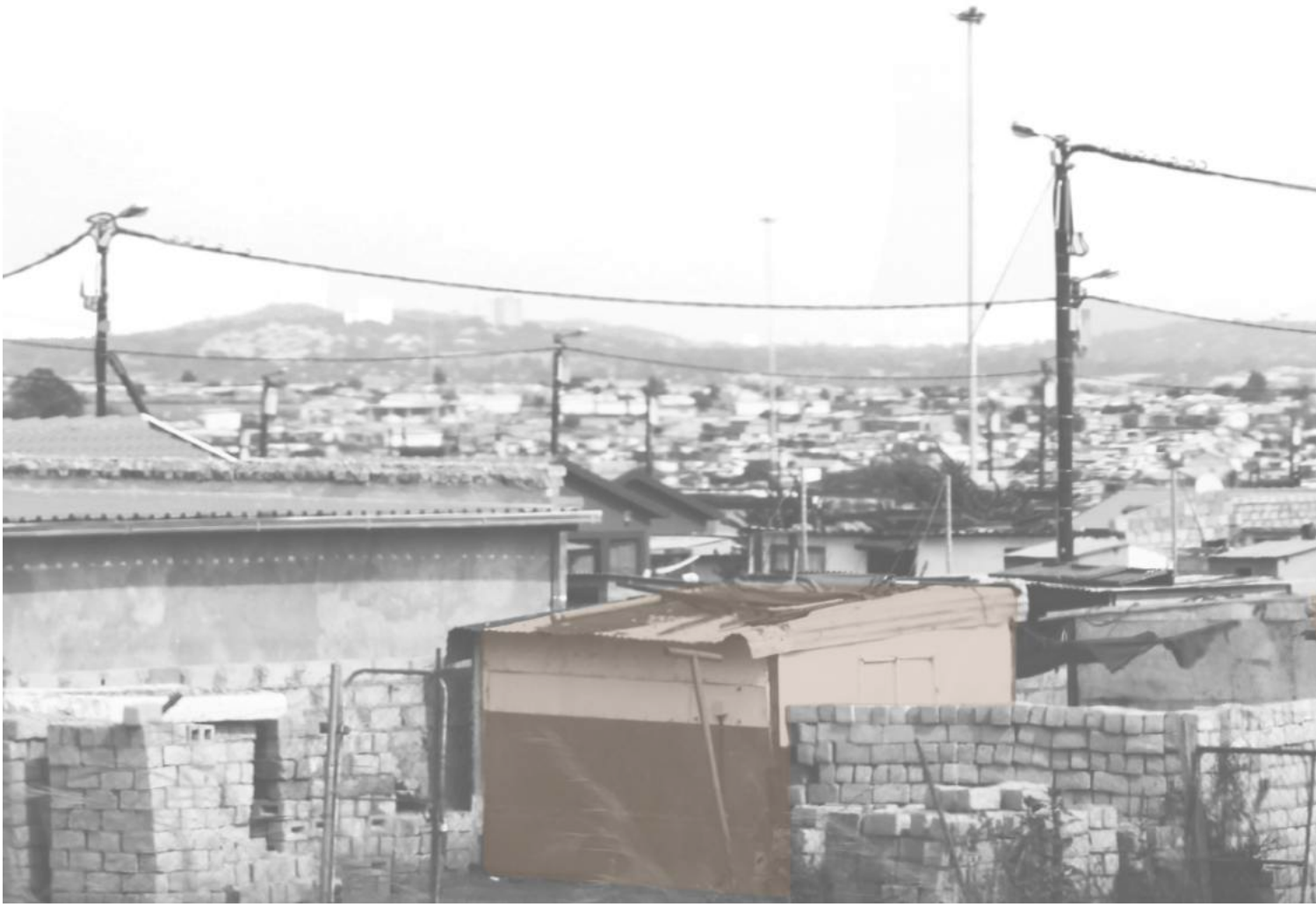
Reformation of our health care provision system has resulted in a constant battle to provide cost-effective and accessible primary health care for those still excluded from this basic right. Schools have been identified as effective settings for the provision of primary health care services to start addressing these issues (Broussard 2002:235). The reciprocal relationship between health and education as opportunity in public health is receiving increasing attention across the globe. This connection between two sectors creates the opportunity to be an important component in health care reform. Gene Carter (in Birch 2017:840) has summarised the opportunity in the reciprocal relationship between health and education by stating that it is a symbiosis, that is, in such case that one fails or succeeds, so does the other (Birch 2017:840). Brellochs and Fothergill (1995) define a school-based health centre as on-site provision of comprehensive primary medical, social and mental health services. School-based health care offers the opportunity to provide primary health care to children that is accessible, convenient, continuous and comprehensive (Larson & Chapman 2014:163).

During the Apartheid era, school health services in South Africa operated as a vertical programme characterised by racial, socioeconomic and geographic inequalities (Shung-King 2013). As a result the first National School Health Policy (NSHP) was developed in 2003. After evaluation in 2009, the performance of the 2003 NSHP presented numerous challenges that hindered successful implementation. The evaluation revealed that coverage of the policy implementation was as low as 10% in some districts, whereas other areas attained 100% coverage, indicating persistent inequalities in accessing health (Shung-King 2013). In 2012 a revised policy titled Integrated School Health Policy (ISHP) was released, which fundamentally resembles its predecessor, but placed more focus on the overall implementation context, as well as the strength in collaboration and integration between key stakeholders, such as the National Department of Health, Department of Basic Education, and the Department of Social Development (Shung-King 2013).

The ISHP proposes a health promotion and preventative school-based health service to optimise the health of children. It forms one of the components in the continuum of child health care, placed between the infant years and adulthood. This approach addresses health barriers to learning and as result increases the possibility of optimal learning and development. The service provides a safeguard for children who were not exposed to the necessary early childhood interventions. By starting to promote healthy lifestyles at primary school level, children are better equipped for healthier adulthood.

"Cities are made out of people -they are the result of countless decisions, ideas, habits and histories."

(Future Cape Town 2015)



1.1.4 History of Mamelodi

Mamelodi is one of many post-apartheid consequence settlements established in Gauteng during the Apartheid regime. Oppressive separation became evident in South Africa with the 1913 Land Act, which prohibited black citizens from owning land outside reserves established for them on a mere fraction of the country's land, as determined by the white minority population. Mamelodi, also known as the "*mother of melodies*", was established in 1945 on Vlakfontein Farm 329JR. Under the Group Areas Act of 1950, black people were removed from newly proclaimed white regions, and relocated to the settlement (Van der Waal 2001:1).

The urban planning strategies of the Apartheid government were intended for residential segregation. Therefore, the planning did not allow for public infrastructure. It merely provided a commuter railway to transport workers into the city and was controlled with restricted access. The first form of public infrastructure in Mamelodi was a school, built in 1953, with the first hospital and hospice only built in 1983. Since then, public infrastructure has become interwoven within the urban fabric of the ever-expanding Mamelodi. However, the current urban condition in Mamelodi East has various social and spatial challenges, due to rapid urbanisation and population growth.

1.1.5 Current urban condition

To gain a deeper understanding of the social, urban and spatial challenges in the community of Mamelodi East, the 2018 Mamelodi master's research group investigated the current urban condition of the area through mapping, observation and urban analysis. The findings revealed that the manifested spatial legacy within Mamelodi East not only creates complications regarding access and movement, where that the inherited landscape is still deprived of access to adequate health care and education. With the focus of the dissertation on primary health care provision, a closer look was taken at the existing public infrastructure, and whether as well as the way in which it might spatially contribute to the community (or not).

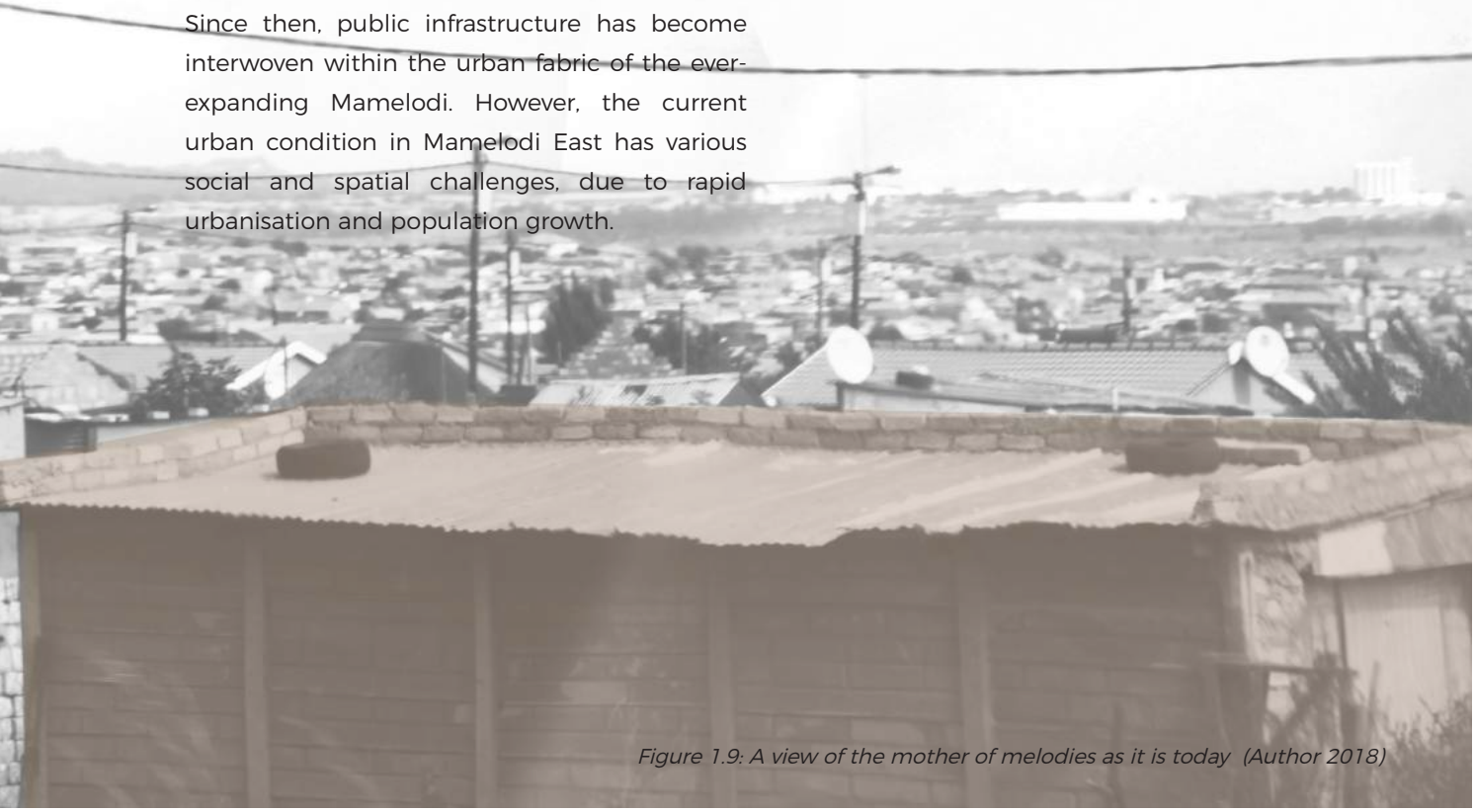


Figure 1.9: A view of the mother of melodies as it is today (Author 2018)

Delagoa Bay Railway Line built from maputo to Pretoria. First stop at Eerste Fabriek Station

1890

Location of Railway led to decision to declare area Black Residential Area

1913

Vlakfontein Industrial School set up to train workers in skills to build houses

First school built in Mamelodi

Formally declared a Black Township

1953

First Crèche opens

1957

Squatter camp full. started to expand to the east. Settlement is officially named MAMELODI

1960

1855
Pretoria established

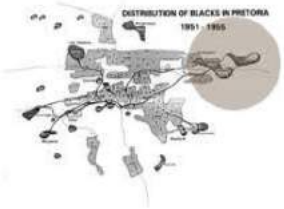
1860
Settlement established for indigenous people looking for employment in the new city - Pretoria.

1883
H. Nellmapius opens Eerste Fabriek Liquor Factory on the Hatherley farm

1897
Liquor laws prohibit the sale of alcohol to non-whites. Distillery is greatly affected. Closes in 1900.

1950
Group Areas Act introduced

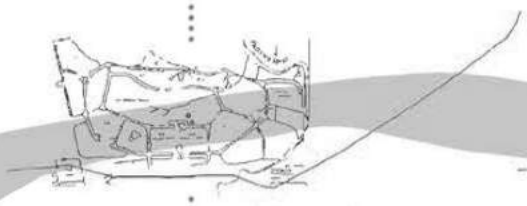
Sundowns Soccer games brought families together.

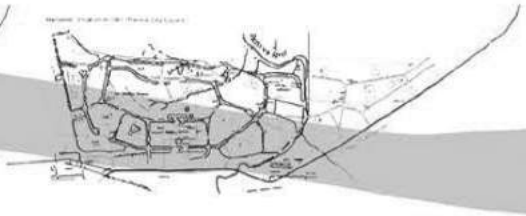


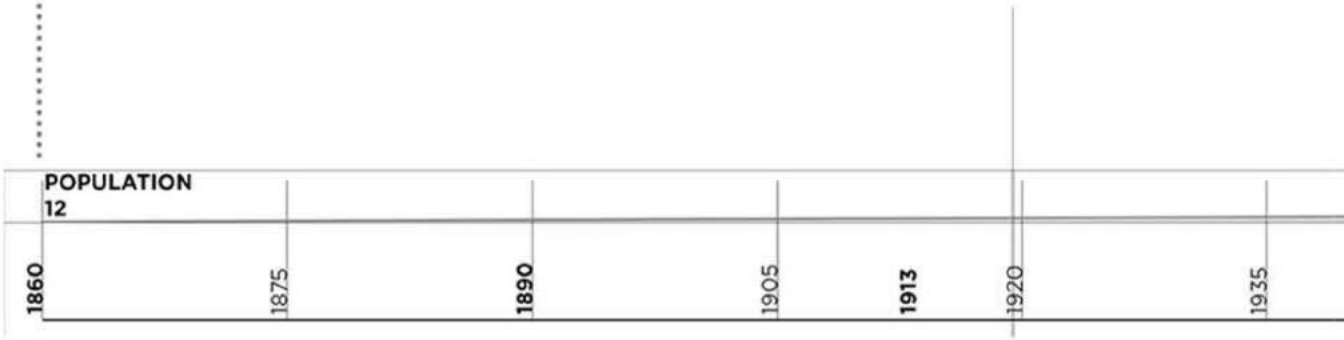
1958
Post War Industrialisation and Job seeking caused squatter camps forming on the Northern and Western farms

Squatter camps became full and started to expand to the East

1968
First squatter camp in Mamelodi East named Mandela Village







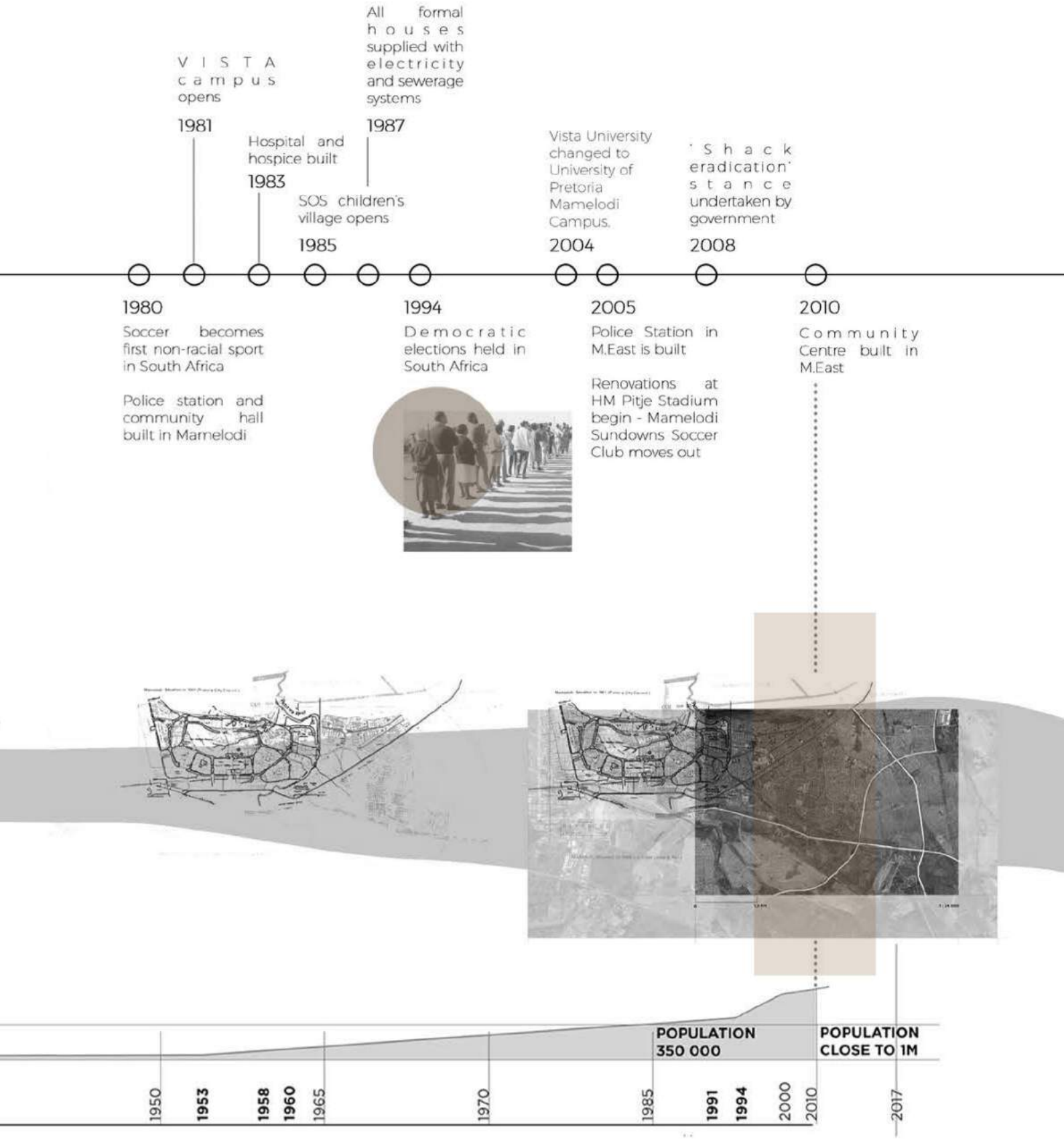


Figure 1.10: Historical timeline of Mamelodi (Porter, Senekal and Smit 2018:6)

Figure 1.11: Aerial view of Mamelodi East (Author 2017)

Figure 1.12: Aerial view of constant expansion of Mamelodi East (Author 2017)

Population density in Mamelodi East

Mamelodi East is well known for its high population and overcrowding; aspects that have led to various social and spatial challenges in the area. A comparative analysis conducted in population densities of different cities within South Africa indicated a clear contrast between formal cities such as Sandton and settlements such as Mamelodi East and Khayelistha (World Population Review 2018). The presence of both formal and informal urban fabric is clearly noticeable. The urban sprawl and increase in population consequentially places pressure on the existing public infrastructure to support the cumulative demand relating to public services such as education and health care provision.

Figure 1.13: Comparative population density mapping in Mamelodi (Porter, Senekal and Smit 2018:14)

Figure 1.14: Daily exodus in Mamelodi East (Author 2018)

Figure 1.15: Public transport in Mamelodi East (Author 2018)

Access and movement in Mamelodi East

As a result of pendulum migration taking place in Mamelodi East, the majority of movement and access is located on the main routes to exit the settlement early in the mornings and only returning late in the evenings. As a result, many residents do not get the opportunity to visit health care facilities as they only return to Mamelodi East after the closing hours of clinics for consultations. Taxi and bus networks are the main means of transportation for residents of Mamelodi East. Formal and informal transport stations are located on main intersections and routes of the area. A large network of pedestrian movement also exists around schools and the central parts of Mamelodi East.

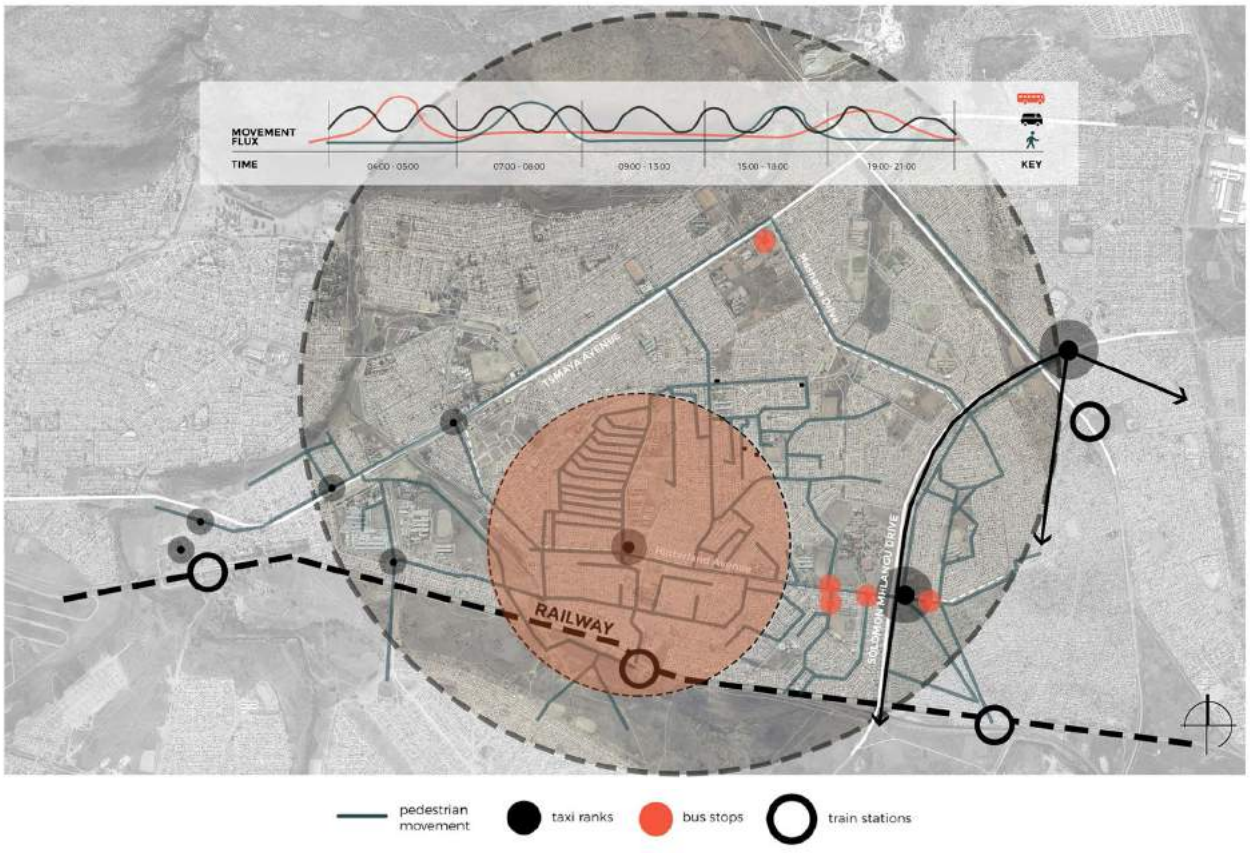


Figure 1.16: Access and movement mapping in Mamelodi (Porter, Senekal and Smit 2018:8)

Figure 1.17: Clinic in Mamelodi East exhibiting hard barriers (Author 2018)

Figure 1.18: University in Mamelodi East exhibiting hard barriers (Author 2018)

Public infrastructure in Mamelodi East

It is evident that Mamelodi East is home to a number of public amenities. From observations and urban analysis in the area, it was noted that public buildings in Mamelodi East are excluded from the public realm and functions in contrast to the private spaces. Photographic documentations (Author 2018) illustrate the lack of ownership by residents in terms of public buildings, and how it functions in isolation from the rest of the city, clearly displaying public buildings that are fenced off and replete with security features. This illustrates a lack of maintenance, with overgrown sidewalks and gardens. As result of this, there is a lack of trade and social activities, as these spaces are perceived as unsafe and unwelcoming.

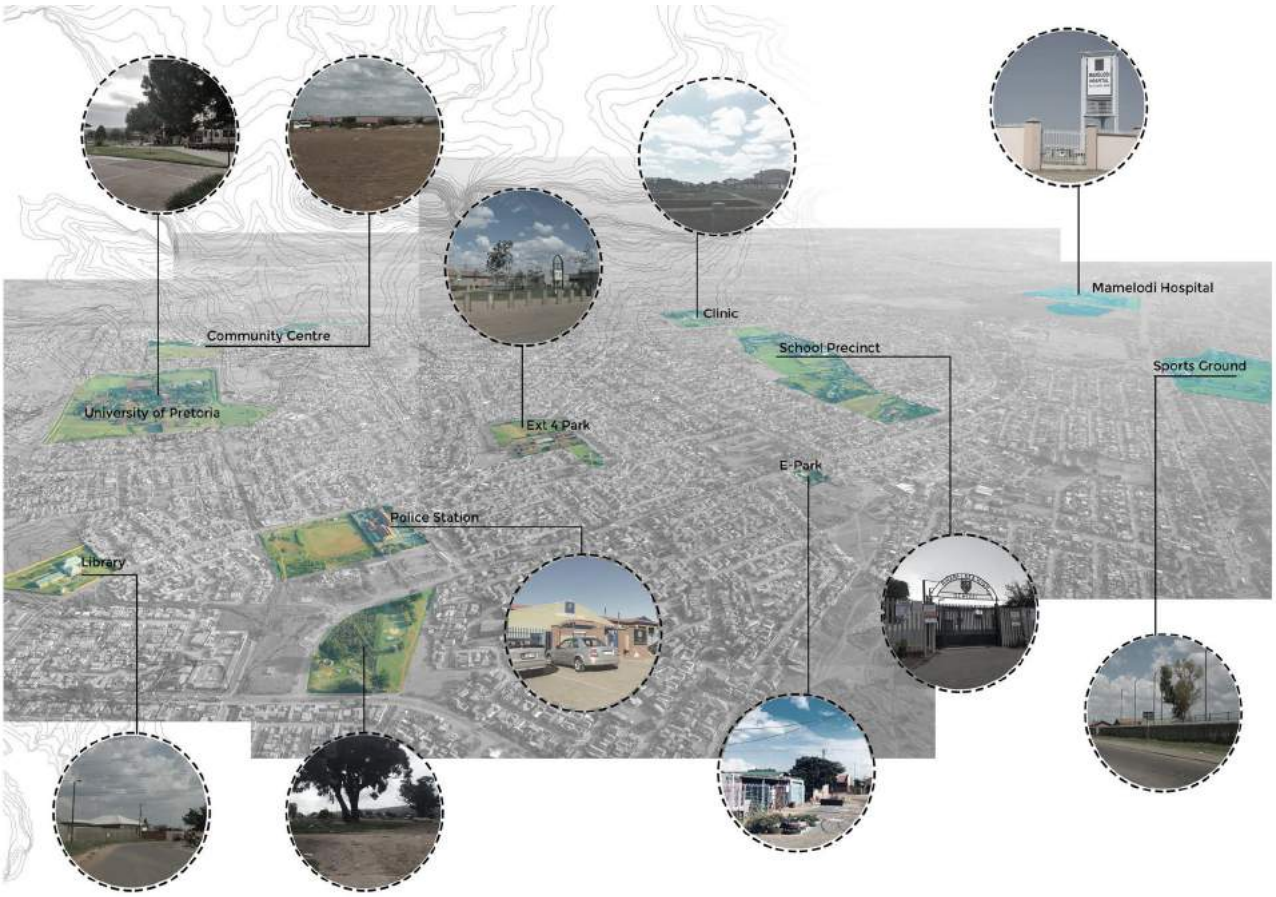


Figure 1.19: Public infrastructure located in Mamelodi. (Porter, Senekal and Smit 2018:12)

Figure 1.20: Unwelcome Mamelodi Hospital entrance (Author 2018)

Health and education in Mamelodi East

Mamelodi East already has an existing network of health care facilities, yet it is still not enough to serve the high demand, due to rapid urbanisation and population growth in the area. Only nine health care facilities service Mamelodi East. Statistics indicate that each of these health care facilities are obliged to serve a total of 13 300 citizens (Wazimap 2016). In contrast to the health care network, the education network is almost four times its scale. As a result of Apartheid planning still visible today, schools in Mamelodi East are placed in close proximity, creating clusters. These educational cores were created to provide shared resources, limit government spending, and cater for the diverse population.

Figure 1.21: Aerial view of school cluster located in Mamelodi East (Author 2017)

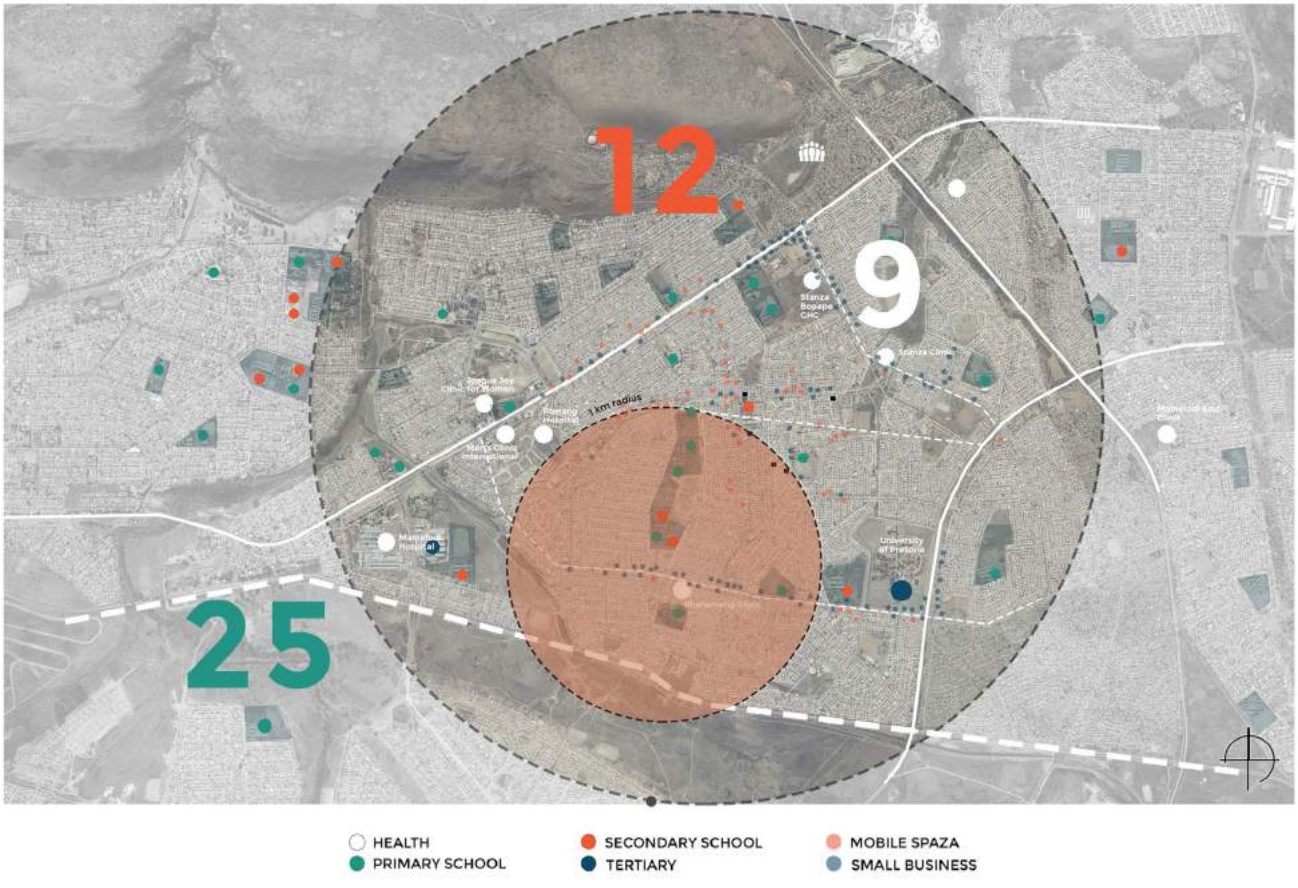


Figure 1.22: Current health and education networks in Mamelodi. (Porter, Senekal and Smit 2018:9)

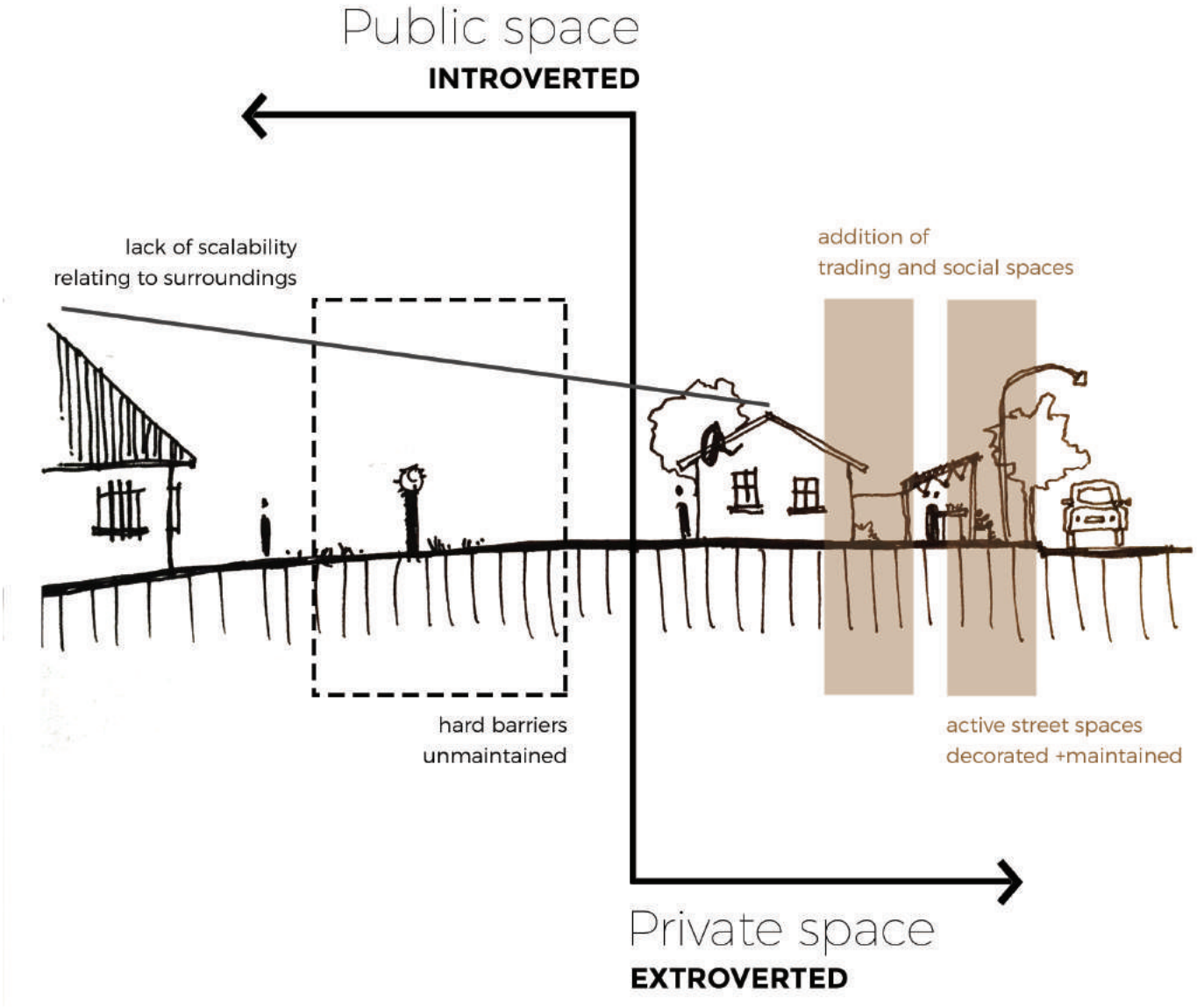


Figure 1.23: The visible contrast between public and private spaces in Mamelodi East (Master's research group 2018)

1.1.6 Urban issue

Of the total population in South Africa, more than 60% live in urban areas (World Health Organization 2012:166). Within the formal and informal urban fabric of Mamelodi East, the notion of place-making is present, but also absent in some spaces. The findings from the current urban condition analysis reveal multifaceted spaces. It became evident that a clear contrast is visible between the use of public and private spaces within Mamelodi East.

Public spaces

Public buildings, such as clinics, schools and hospitals, are divided from the community and only strive for basic service provision. These buildings are fenced off, resulting in hard barriers that rarely respond to surrounding buildings or activities. Likewise, the scale of public buildings in Mamelodi East also fails to respond to its surrounding context. As a result, these spaces have become unsafe, isolated, unmaintained, and undesirable. In terms of health care buildings in Mamelodi East, an introverted approach is displayed, removing the potential interaction with the community beyond building boundaries. Clinics and hospitals in the area evidence the above-mentioned, confirming the spatial tension observed.

Figure 1.24: Fenced-off high school in Mamelodi East (Author 2018)

Figure 1.25: Neglected spaces located next to University in Mamelodi East (Author 2018)

Figure 1.26: Street space in front of private houses as trading platform in Mamelodi East (Author 2018)

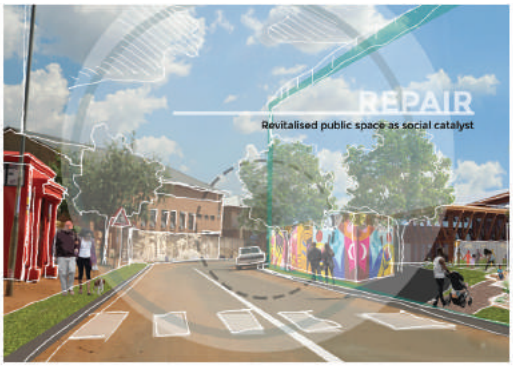
Figure 1.27: Maintained sidewalks and streets in front of private spaces in Mamelodi East (Author 2018)

Private spaces

In contrast, private spaces reveal a more extroverted approach. These spaces display decorated and well-maintained spaces, with high activity levels and various social and economic platforms. Street sidewalks are appropriated to become trading platforms; household carports are transformed into daycare spaces for children; street-side trees become the local card-playing scenery. These spaces are constantly changing, being added to or moved. They also serve as several connections along main movement routes that result in safe and constantly active areas. It is evident that "*street*" becomes the city of Mamelodi East, leaving behind public buildings excluded from the public realm.

1

Creating activation nodes that strenghtens existing networks through revitalizing unwanted open space.



4

Creating multi-functional public infrastructure that contributes to a meaningful public realm for the community.

2

Public, civic infrastructure that encourages multi-functional buildings that improves the quality of life.

5

Celebrating the uniqueness of Mamelodi by allowing spaces for expression.

3

Increased connectivity to, and within, Mamelodi by upgrading nodes.

6

Creating mix-use activation nodes through densification and diversification that creates a sense of place.

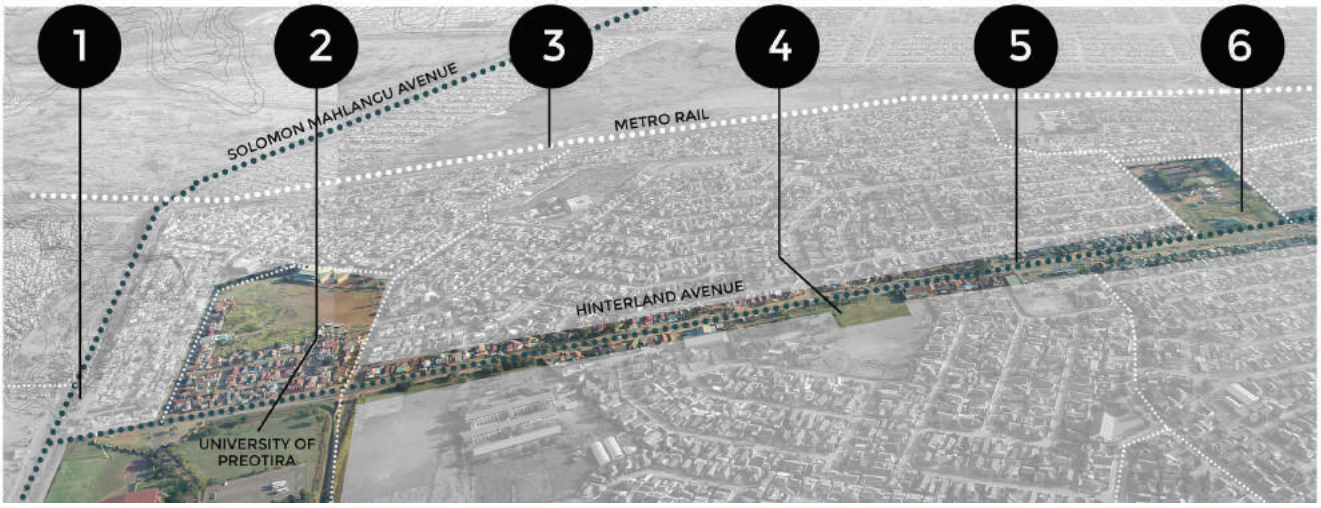


Figure 1.28: Vision collages proposed for the urban vision within Mamelodi East. (Porter, Senekal and Smit 2018:31)

PROPOSED URBAN VISION

Figure 1.29: Highlighting the opportunity of urban civic upgrade in Mamelodi East (Porter, Senekal and Smit 2018:31)

From the analysis of the current urban condition the 2018 Mamelodi research group identified public infrastructure not only as a problem but also as an opportunity in the community of Mamelodi East. To address the issues identified on urban scale, an urban vision is introduced as initial approach for intervention within Mamelodi East on a larger scale. This will create an overall framework, which will serve as platform for architectural intervention proposed in this dissertation.

1.2.1 Urban civic space within Mamelodi East

With public infrastructure identified as an opportunity and not only a problem, the proposed urban vision places emphasis on urban civic upgrade through architecture as tool. This is explored through qualities that, according to Steyn (2005:2), make a good African neighbourhood: viz., one that is compact, walkable, and mixed-use, with a high level of economic self-sufficiency. It is not only important to repair urban civic space for informal settlement residents, but also to initiate the process of weaving together the informal and formal city (Hers 2015). An opportunity exists within Mamelodi East to transform existing public spaces into useable spaces with multiple and mixed uses. In parallel, these spaces must encourage residents to utilise them and take ownership. Kounkuey Design Initiative (KDI) refers to these spaces as "*productive public spaces*" (Hers 2015).

1.2.2 Proposed approach

The approach for the proposed urban vision is based on the seven aspects that Steyn (2005:3) identifies as necessary for a '*good city*':

1. medium-sized, compact cities
2. urban villages in super blocks
3. appropriate boundaries and streets
4. mixed-use main streets as interfaces
5. self-sufficient, walkable neighbourhoods
6. low-rise, medium-density, robust buildings with courtyards
7. small-scale and local interventions

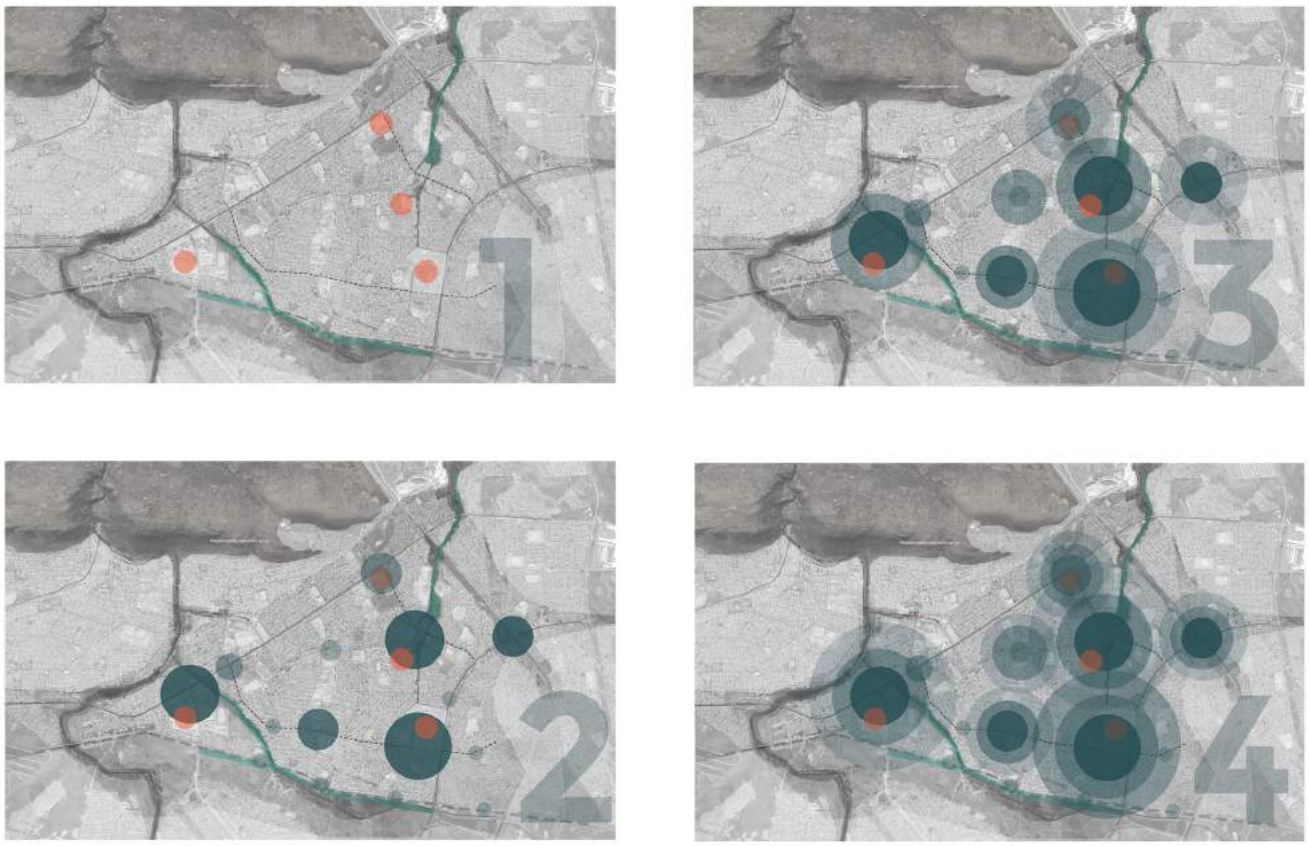


Figure 1.30: Implementation strategy of nodal development for proposed urban vision in Mamelodi East (Porter, Senekal and Smit 2018:49)

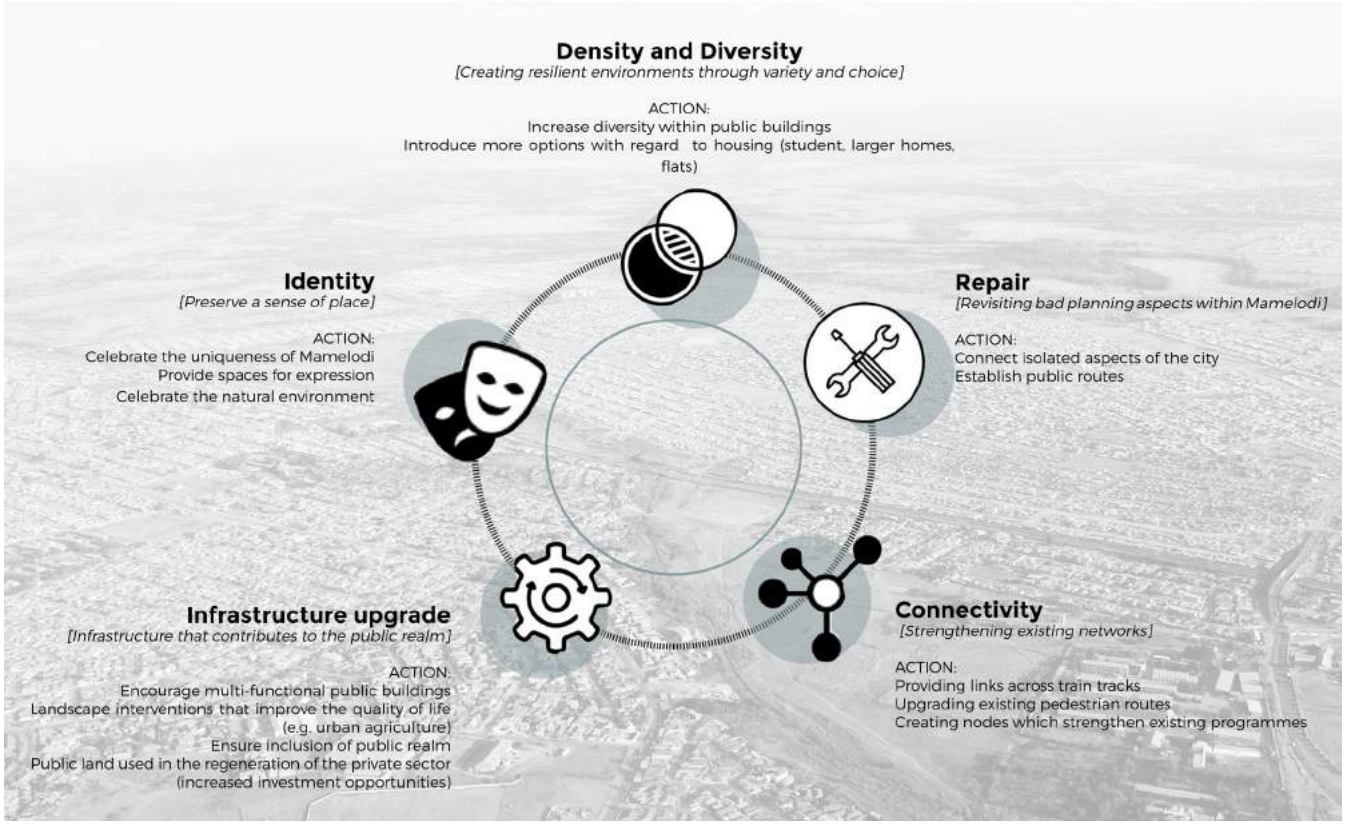


Figure 1.31: Proposed urban vision principles with respective actions (Porter, Senekal and Smit 2018:21)

1.2.3 Concept for intervention

"Growth, as one of the important characteristics of living organisms, is used as a frame for research into systems and principles that deliver innovative and sustainable solutions in architecture."
(Gruber & Imhof 2017:1)

Faced with the consequences of spatial legacy in our cities, principles learned from biological growth can be useful tools for transforming our future cities into more integrated and sustainable settings. The slime mould, for example, is an adaptable system that interacts as an intelligent organism by learning, adapting and solving problems. It creates networks that are optimal in efficiency and sensitive to its environmental conditions (Gruber & Imhof 2017:8). The concept of activation nodes that create emergence is evident within a slime mould system. Its patterns are predictable and its behaviour can be anticipated.

From the slime mould organism, the idea of upgrade and further anticipated development is used as model for the proposed urban civic upgrade in Mamelodi East. Nodal development will enhance emergence in the community and activate further development surrounding these nodes. As designers, it is important to understand that we cannot control growth, yet we can anticipate it and create provision for this occurrence. Upgrading urban civic space is argued in this urban vision proposal to be a useful tool by means of which to anticipate and plan for the future growth that is inevitable within Mamelodi East.

Figure 1.32: The slime mould organism (Galperina 2012)

1.2.4 Urban intention

"The simple social intercourse created when people rub shoulders in public is one of the most essential kinds of social 'glue' in society."
(Alexander 1977:489)

The intention of the proposed vision is urban civic upgrade through architecture that is, firstly, diverse, that celebrates a sense of place, that is resilient, and that will contribute to a community that is more integrated and independent. To achieve the previously mentioned intention, five urban principles are introduced to address the identified issues within Mamelodi East. Each of the five principles includes an appropriate set of actions to achieve the principle (refer to Fig 1.31).

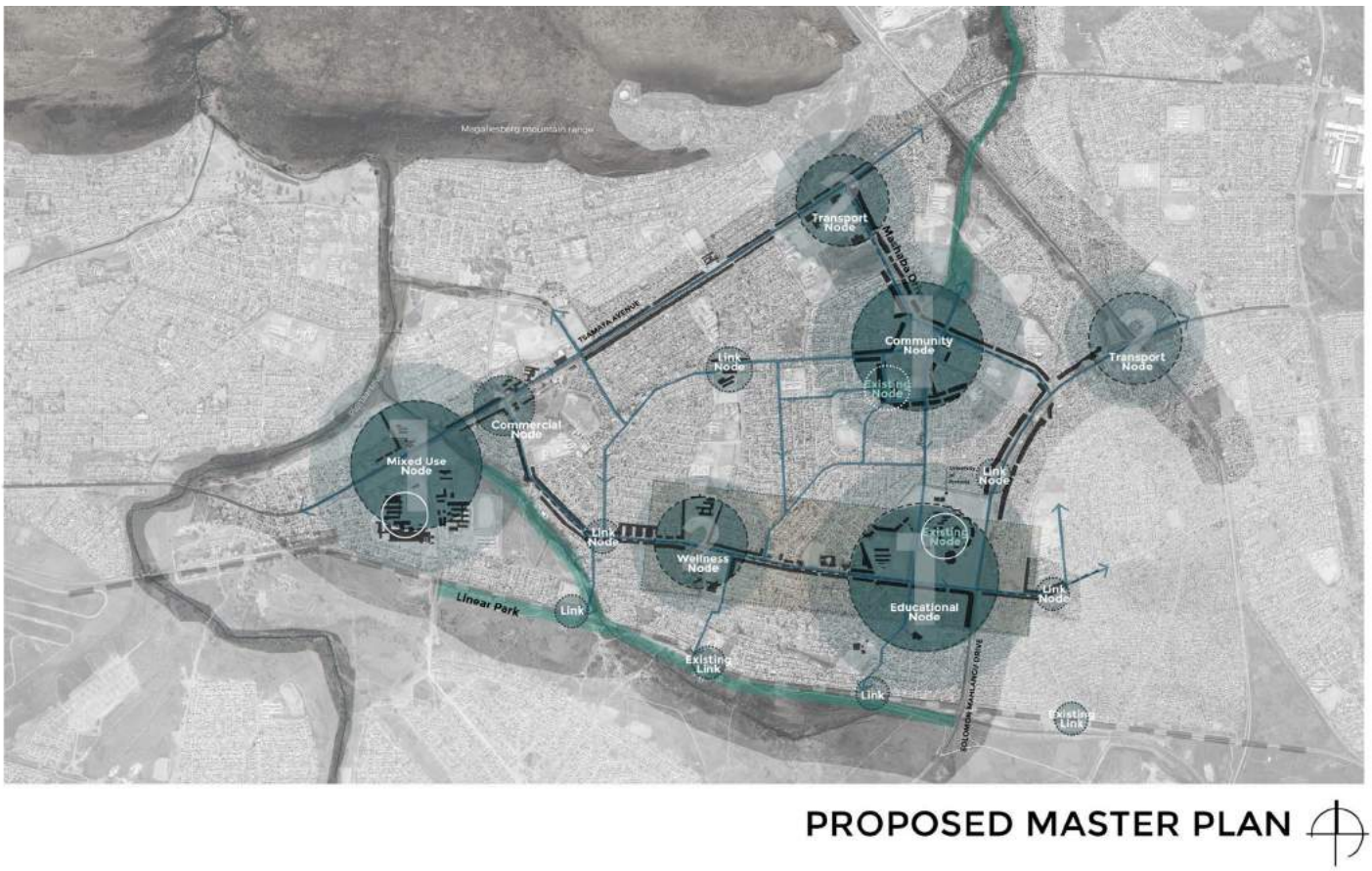


Figure 1.33: Proposed master plan for urban civic upgrade in Mamelodi East (Porter, Senekal and Smit 2018)

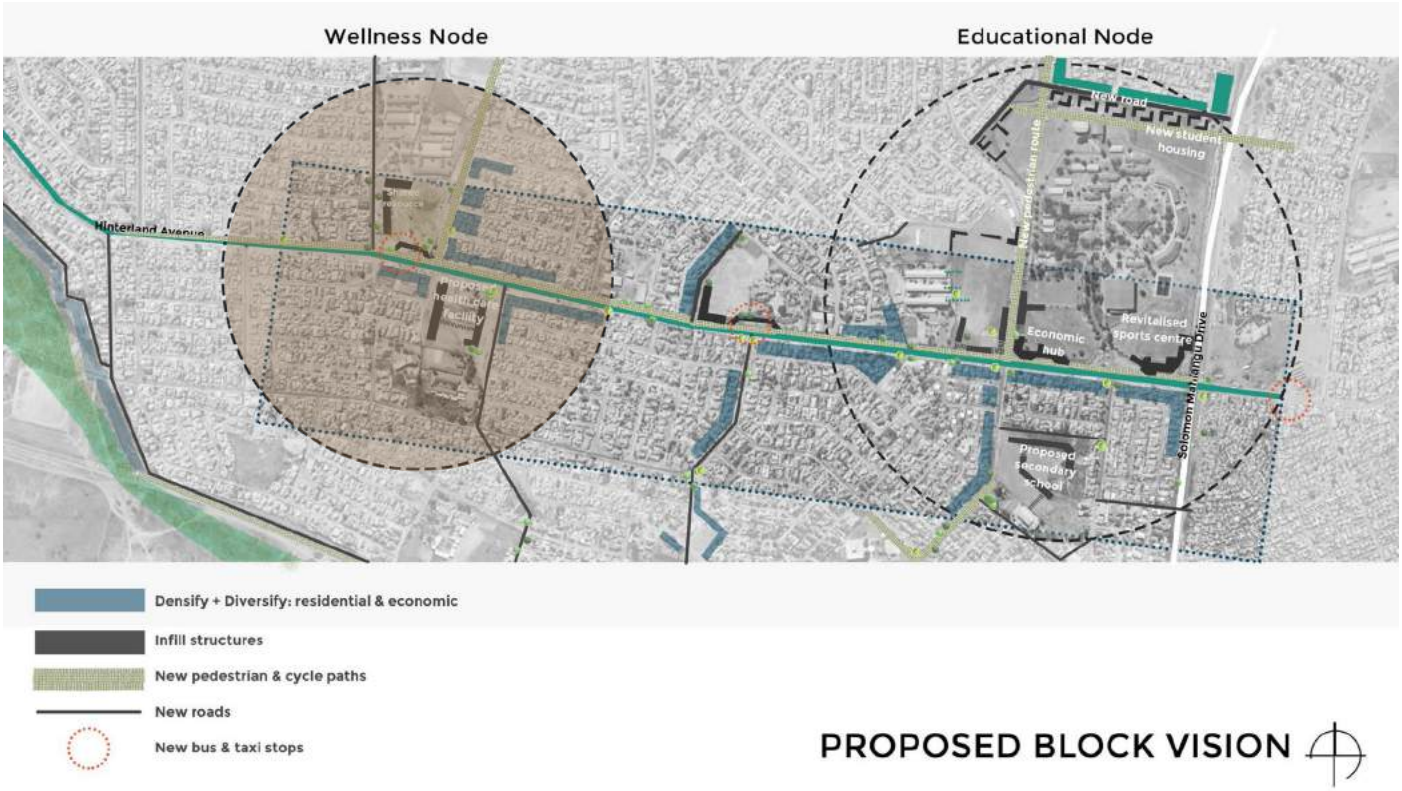


Figure 1.34: Proposed block vision that focuses on Hinterland Avenue in Mamelodi East. It also indicates the wellness node on which the dissertation will focus (Porter, Senekal and Smit 2018)

1.2.5 Precedent study

Emthonjeni Initiative
LOCATION: *Monwabisi Park, Khayelitsha*
IMPLEMENTED BY: *VPUU*

The strategy to upgrade informal settlements through urban scale interventions is starting to take the forefront on global as well as national scale. Similar interventions are being implemented in the Western Cape by VPUU (Violence Prevention through Urban Upgrade).

One example to highlight is the Emthonjeni initiative devised by the VPUU within Monwabisi Park. Similar to the urban issue in Mamelodi East, public space in Monwabisi Park is perceived to be unsafe, excluded from the public realm, and therefore it is also unoccupied, leading to wasted space. The aim of the Emthonjeni initiative is to promote safe public space that provides a platform for multiple activities. For the most part, the space accommodates Early Childhood Development Centres (ECDs), allowing them to have a safe and supervised space for children to play and learn but it also becomes a gathering space for adult socialising and the provision of basic services, such as water and washing points (VPUU 2016).

The Emthonjeni initiative highlights the opportunity of public space, noting how it can be transformed into useful as well as meaningful space by simply creating a multi-functioning platform. By serving the community with basic services, it creates a public space that is under constant passive surveillance, enabling a safe and active area in which children are able to play. The proposed urban vision for Mamelodi East creates a similar approach that aims to create meaningful public space that is integrated and resilient.

Figure 1.35: Areas identified in Monwabisi Park to implement Emthonjeni. (VPUU 2016)

Figure 1.36: Completed Emthonjeni project. (VPUU 2016)

Figure 1.37: Activated Emthonjeni in the community. (VPUU 2016)

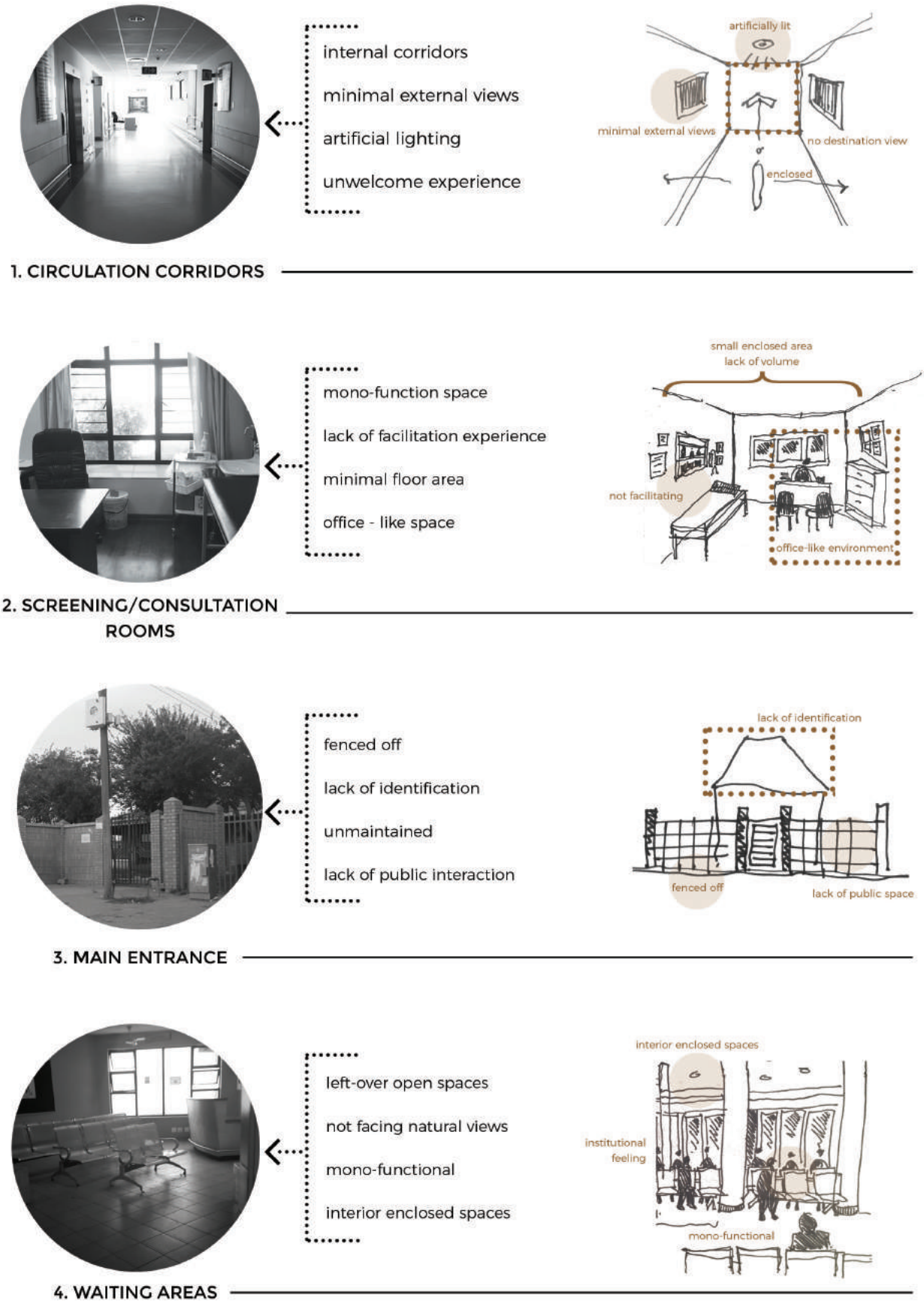


Figure 1.38: Spatial settings observed in existing clinics and hospitals (Author 2018)

1.3.1 Architectural issue

Even though the Bill of Rights states that access to basic health care is a right in South Africa, access to good architecture is unfortunately not (Viviers 2015). The image of health care is shifting globally, moving towards health care that does not only offer efficient and affordable health-care facilities, but also sustainable, people-oriented healing environments (Boluijt & Hinkema 2005:4).

The health system's historical socio-economic fragmentation is causing gradual transformation towards a primary health care, with constant pressure to meet the demands of equal and uniform health access. In terms of infrastructure provision, designers are pressured to deliver quality and healing environments within allocated budgets and restricted resources (Boljuit & Hinkema 2005:24). Designers are expected to provide quality spaces that actively contribute to patient and staff wellbeing, work within tight construction schedules and policies and in addition, still facilitate a combination of government influences such as the Department of Health and the Department of Public Works. Viviers (2015) therefore compares the process of designing a health care facility to the process of "*doing open-heart surgery with a spoon*".

As a result of the above-mentioned complexities, most health care facilities in South Africa have become more of an institutional experience, rather than a facilitating experience, with the result that people have an aversion to visit health care facilities due to the negative experience and related stigmas. A survey (Harris et al. 2011:15) exploring the acceptability of public health care concluded that most patients in rural areas delay care-seeking at public facilities due to high travel costs, long queues, perceived ineffective care and dissatisfaction regarding privacy and cleanliness.

Most facilities have a lack of accessibility and presence, where buildings are unrecognisable as health care facilities, blending in with the surrounding urban landscape of business parks and residential housing. Waiting areas, where most people spend their time in these facilities, seem to be merely leftover spaces within buildings, filled with rows of uniform seating. These spaces rarely face or connect to outdoor areas, mostly fronting reception areas or corridor walls (Master's research group 2018). No architectural manifestation seems to create an overarching identity apart from the red cross icon traditionally displayed on clinic and hospital entrances. Hospitals and clinics are mostly fenced-off with hard barriers, not interacting architecturally or spatially with the surrounding context and activities, creating an exclusion from the public realm. In terms of scale, a lack of appropriate scale is noted with clinics and hospitals functioning as disjointed entities, failing to relate to or connect to the surrounding context (Master's research group 2018).

Figure 1.39: The Phamaneng clinic in Mamelodi East. (Author 2018)

Figure 1.40: Collage depicting the current spatial experience in health care facilities (Author 2018)

RESEARCH OBJECTIVES

1.4.1 Research problem

Factors such as adequate health care, good nutrition, and stimulating environments have an impact on children's health and growth (Statistics South Africa 2018). Although various policies advocate for the reformation of child-centered health, not much attention is given to the spatial settings. The spatial experience of public health care buildings in Mamelodi East have resulted in people having an aversion to such visits, which have become more of an institutional experience, rather than a facilitating experience.

1.4.2 Project statement

The dissertation explores the potential of architecture as instrument in health exchanges, and illustrates the role of the physical environment in health settings on the health and wellbeing of those that these spaces are predicated to anticipate. The project also explores the notion of shared resources within the public sector that can stitch together, encourage exchanges and contribute to a healthier society.

1.4.3 Research question

How can architecture as facilitator connect health and social exchanges through a multi-function public infrastructure within Mamelodi East?

1.4.4 Research intentions

The intention of the dissertation is to re-interpret the architectural environment of primary health care facilities, contribute to possible approaches of preventative health care, and investigate solutions that could address identified shortcomings with early childhood health care and development within Mamelodi East.

1.4.5 Delimitations

The aim of the dissertation will not be focused on creating a new health care or clinic typology, but to explore the role of architecture as facilitator in promoting a multi-functioning public space that connects to existing schools or clinics. The response will investigate architectural interventions that may address identified health, social and child-centered needs in the community of Mamelodi East.

1.4.6 Research method

To address the issues and intentions of the dissertation, the following research methods are proposed to reach an appropriate architectural response:

Context analysis

o be able to reach a well-informed architectural solution, a thorough exploration and critical analysis of the existing context and urban fabric of Mamelodi East is necessary. The exploration will include physical mapping of relevant existing networks, unstructured discussions, as well as site visits and observation to gain a deeper understanding of the layered city that Mamelodi East represents. This will be achieved through observatory fieldwork and desktop studies.

Precedent study

Health care design is nothing new to the field of architecture; therefore an extensive comparative precedent analysis of both international and local case studies will be discussed throughout the dissertation. The case studies will aid in revealing the history of health care facilities, what health care facilities look like in our current society, and the direction that health care design is moving towards in the future. This will be achieved through desktop studies as well as site visits to observe and experience local health care facilities.

Theoretical exploration

The evidence-based theory of salutogenesis and sensory design will be investigated throughout the dissertation to inform the architectural design process. Salutogenesis becomes a valuable design driver as it recognises the physical environment to be a source of meaning and a sphere of influence (Golembiewski 2017:270).

PROPOSED PROGRAMME

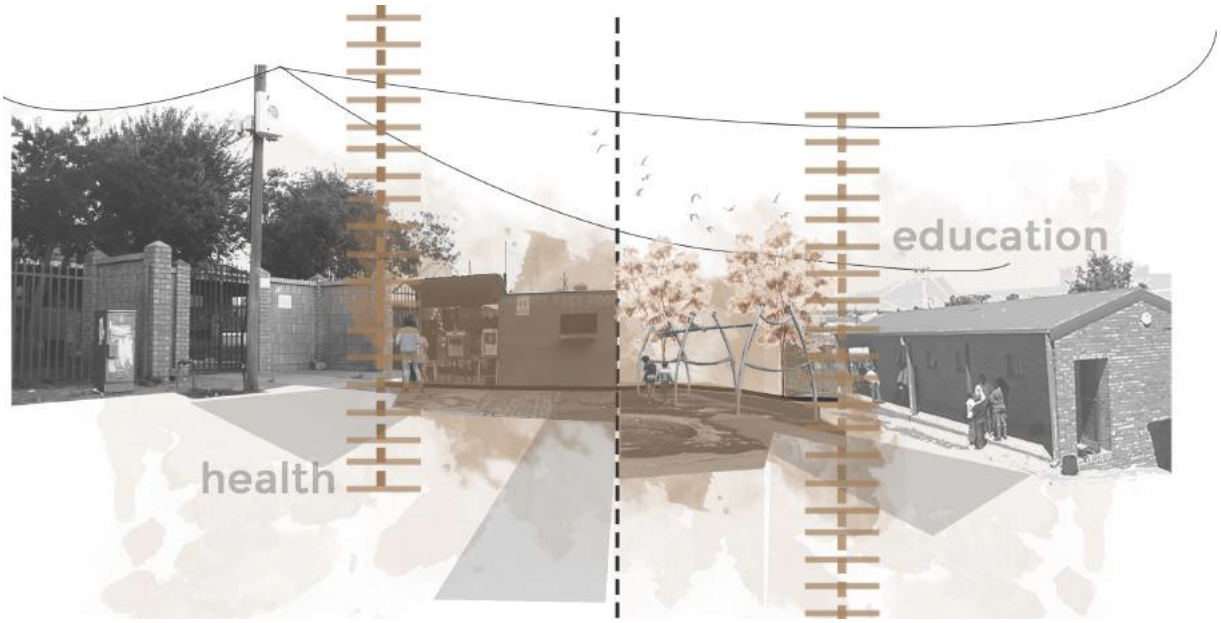


Figure 1.41: Creating an overlap between health and education sectors in Mamelodi East (Author 2018)

5.1 Programmatic intentions

The programmatic intention aims to introduce a new perspective on health care for children by exploring the proposed restructured model of a school-based health care facility that takes a preventative and stimulative approach, rather than curative approach. It aims to stitch together the community by providing a multi-function public platform of shared resources.

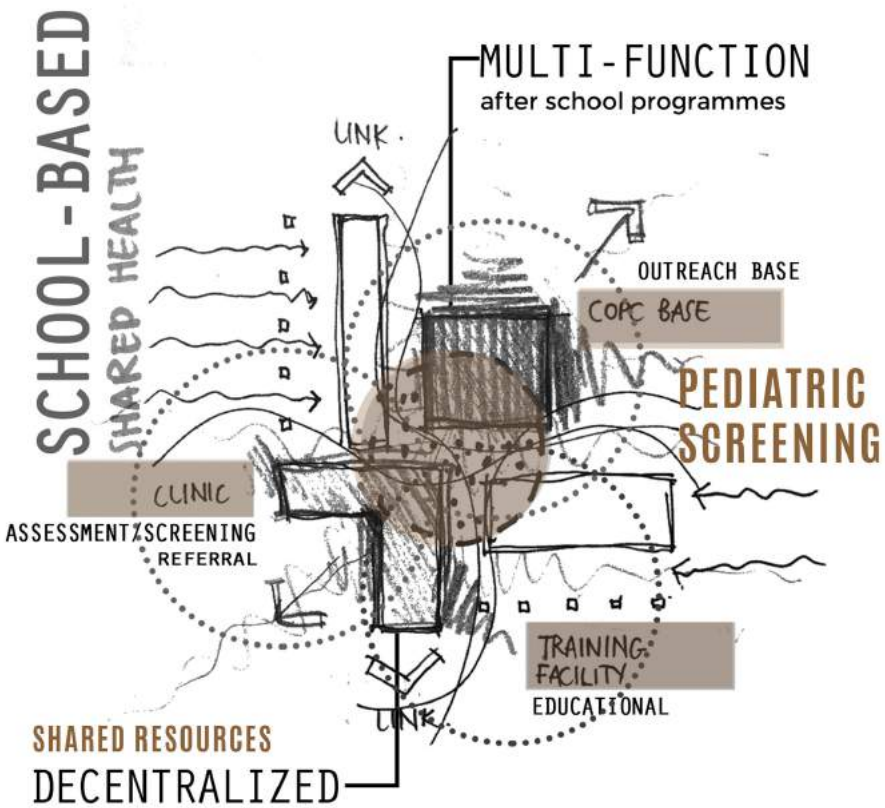


Figure 1.42: Programmatic intentions of the project (Author 2018)

1.5.2 Responding to identified issues

Responding to the issues identified in the previous section, the proposed programme is developed to ensure an intervention that contributes to and supports the community of Mamelodi East.

PUBLIC INFRASTRUCTURE AND HEALTH CARE
As identified in the background and urban analysis, current health care facilities within Mamelodi East do not provide evidence of thoughtful concern for human needs and have become more of an institutional experience for residents. Therefore, the starting point for the program development is to re-imagine the architectural environment of health care facilities in Mamelodi East.

SCHOOL-BASED PRIMARY HEALTH CARE
As identified through the urban mapping within Mamelodi East, only nine health care facilities service the Mamelodi East area (Master's research group 2018). In contrast to the health care network, the education network is almost four times the scale. Therefore, an overlap between these two networks is proposed in alignment with one of the three streams of primary health care provision of the restructured model (Department of Health 2015:39). The core of the programme will explore a school-based primary health care facility in Mamelodi East.

OPPORTUNITY IN CURRENT REFERRAL SYSTEM
As mentioned before, primary health care (PHC) facilities, such as clinics, are the point of care that is closest to the community, and which relies on effective referral relationships between the various tiers of health provision (IUSS 2014:15). In Mamelodi East, the Community Oriented Primary Care (COPC) programme is presenting effective results as a bottom-up health care approach (Bam et al 2013), with clinics and hospitals filling in the top-down approach, but a possible space for a new approach is identified.

The first layer of the programme aims to address the gap in the current structure by proposing a screening facility, which places greater emphasis on the notion of preventative care rather than on curative care. To assist in the promotion of early childhood development, standard screening procedures such as growth monitoring, nutrition and supplementations, as well as ear and eye assessments, will be available for children below the age of 14. This is a crucial age in a child's development (Republic of South Africa 2015:8), and provides the perfect opportunity to identify and treat preventable diseases or shortcomings before it creates permanent consequences in terms of their health and development.

SUPPORTING PROGRAMMES
The proposed sub-programmes aim to support the main programme by creating a stimulative and creative layer as well as educational layer. The stimulative and creative layer include training spaces for the COPC programme, new social spaces such as public plazas, and trading spaces, as well as creative spaces such as reading, music and art rooms.

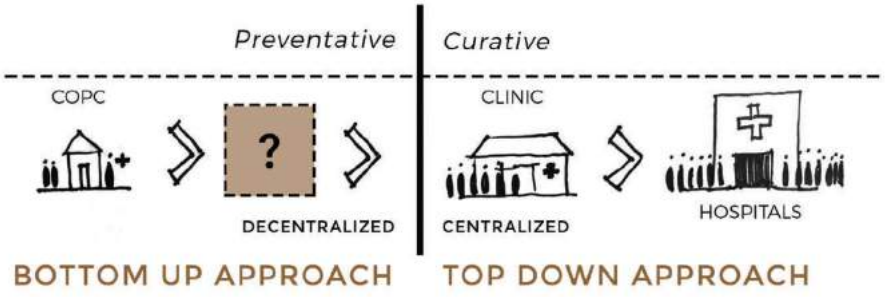
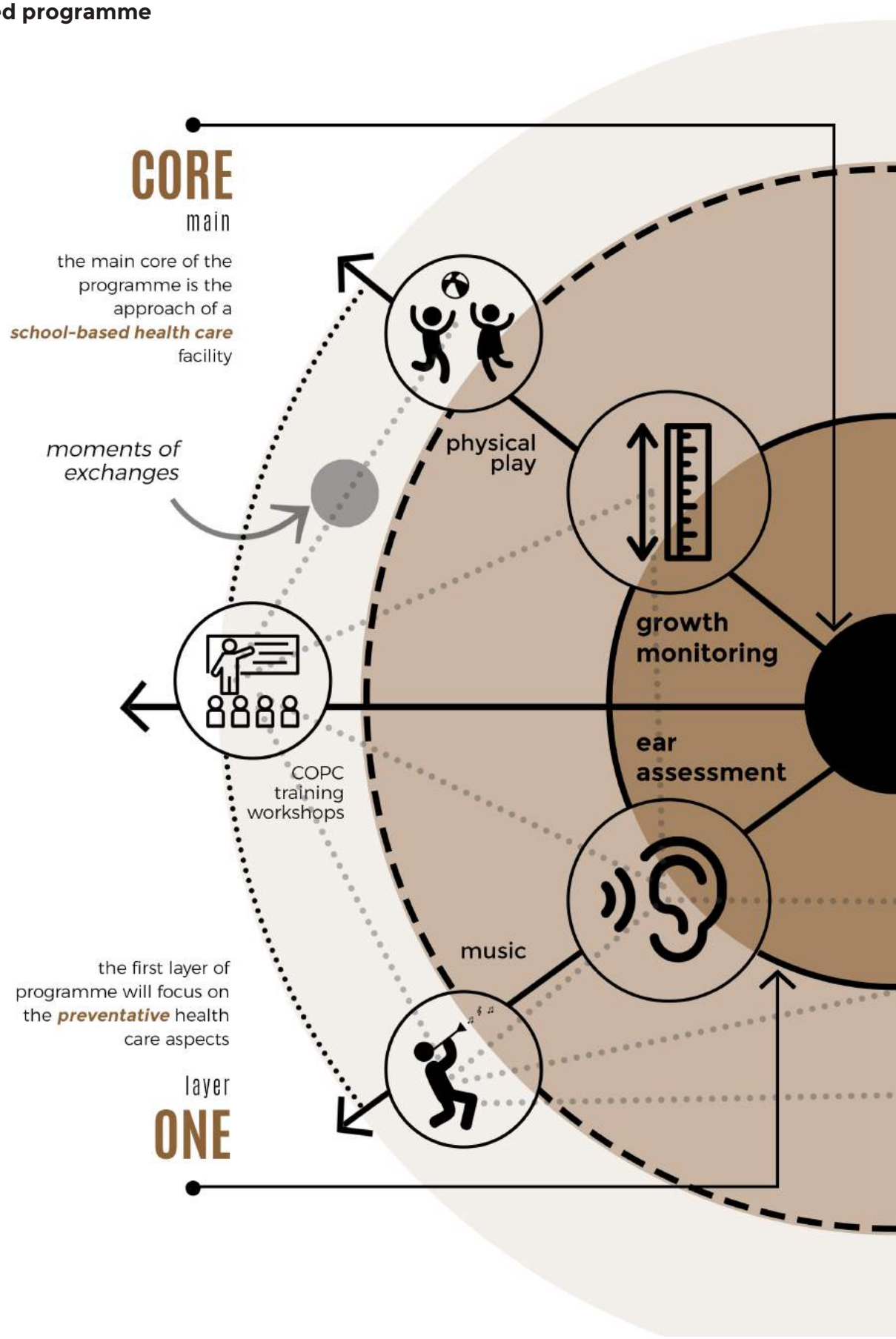


Figure 1.43: Opportunity in the current referral system in Mamelodi East (Author 2018)

1.5.3 Proposed programme



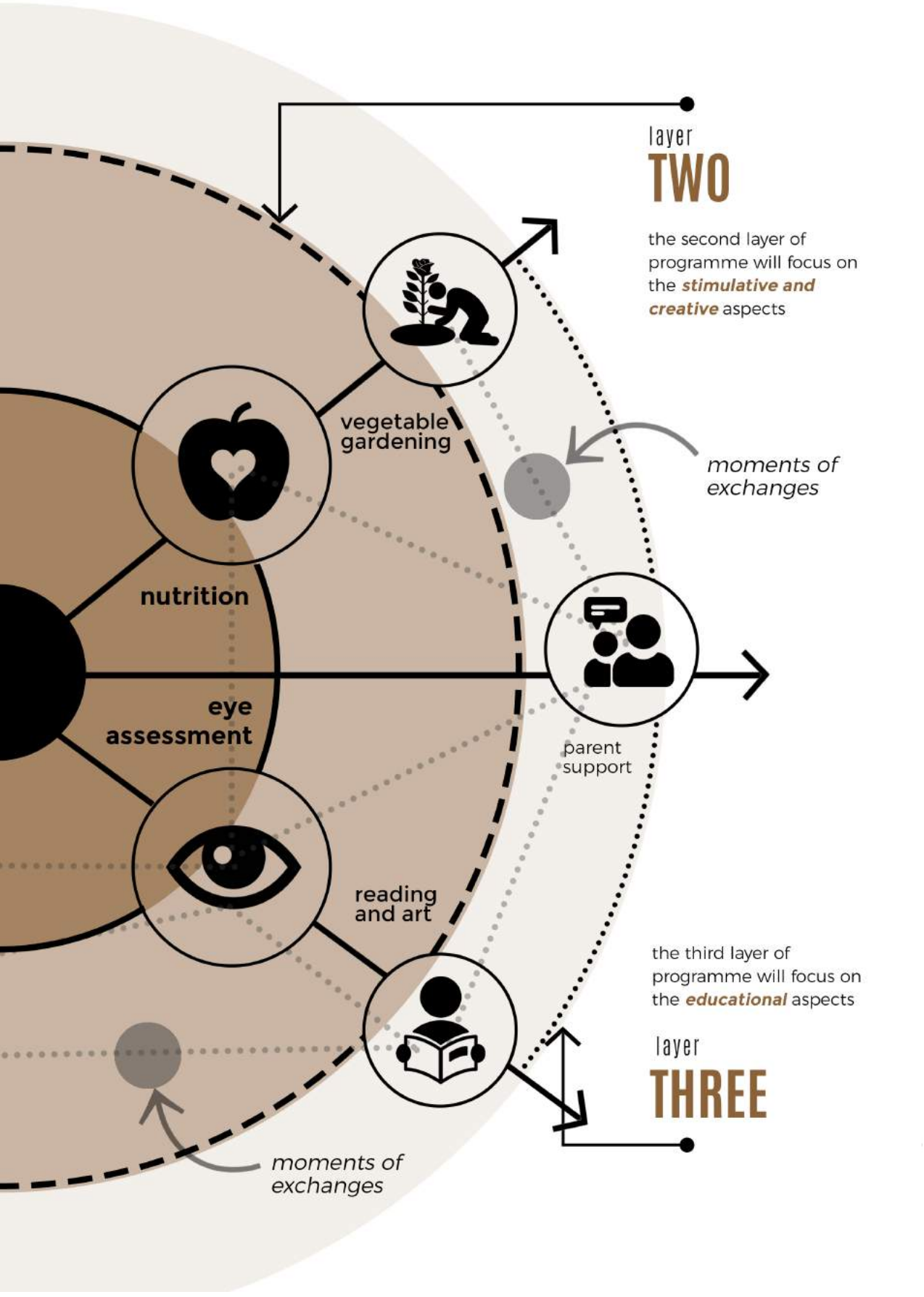


Figure 1.44: Diagram depicting the various layers of programme and how they align with each other (Author 2018)

1.5.4 Stakeholders and client

The following stakeholders as well as clients are identified to provide a new child-centered health care facility within Mamelodi East. The stakeholders involve parties from both the top-down as well as the bottom-up sections of the hierarchy. This involves government bodies, NGOs, as well as the community of Mamelodi East, creating a diverse range of input for the process.

Figure 1.45: Proposed stakeholders and client of the project (Author 2018)

1.5.5 Spatial requirements

With the programme divided into three main layers, the spaces for the programme are also divided into three main categories in terms of hierarchy, viz. primary, secondary, and tertiary spaces. Minimal floor area requirements for each space are based on a combination of the IUSS Health facility guide (2014) and Architects' data (Neufert 2002). The following table indicates the spatial requirements, functional requirements as well as possible users for these spaces.

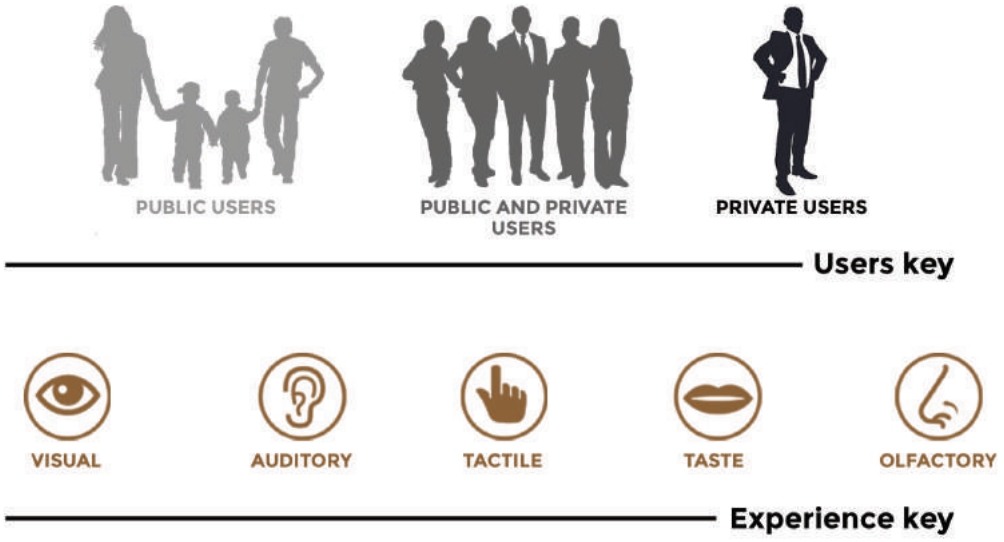


Figure 1.46: Spatial requirements table key (Author 2018)

SPATIAL REQUIREMENT TABLE

Space	Functional	Experience	Users	Area (m²)
PRIMARY SPACES [preventative spaces of exchange]				
CONSULTATION ROOMS (X4)	BASIN		●	13-20
SCREENING ROOMS (X4) THERAPY ROOMS	BASIN; WC; STORAGE		●	> 40
WAITING AREAS	SEATING		●	25
SECONDARY SPACES [stimulative and creative spaces of exchange]				
COPC TRAINING CENTRE Reception Workshop spaces	SEATING		●	40 13-20
Administration offices Conference room			●	35 13-30
CREATIVE SPACES Art space Art garden	BASIN; STORAGE		●	20-30 >10
Music space Music garden	STORAGE		●	20-30 >10
Reading room	STORAGE		●	30
CAFETERIA Vegetable garden Preparation space	COMPOST YARD; BASINS; WATER POINTS; STORAGE		●	150 20-30
Kitchen space Sit-down space	GAS SOURCE; BASINS; SEATING		●	±15 60
TERTIARY SPACES [educational spaces of exchange]				
ADMINISTRATION OFFICES	STORAGE		●	10-20
ABLUTIONS Food hub Creative spaces COPC training centre	*FEMALE* 17 WC'S, 17 WHB'S *3 X UNISEX DISABLED WC'S* *MALE* 8 WC'S, 9 URINALS, 17 WHB'S		●	±2 p/p 9 ± 2 p/p
MULTI-FUNCTION HALL	SEATING		●	60-90
RESTAURANT	KITCHEN; SEATING		●	60

Figure 1.47: Spatial requirements in terms of proposed programme (Author 2018)

1.6.1 Site selection criteria

To fulfill the programmatic intentions mentioned above, a selection criteria is created to find a possible site for an architectural intervention. This narrows down the search within Mamelodi East area and ensures a location that best fit the project intention. To meet the programmatic requirements, the following elements need to be present at potential sites:

Urban vision alignment

The proposed site will need to be in alignment with the proposed interventions of the urban vision for Mamelodi East. The site needs to provide opportunities for infrastructure upgrade, densification and diversification, as well as connectivity. The site ought to link to the proposed block vision.

Connection to existing network

To support the background and argument of the dissertation, it is essential for the selected site to allow for connection or strengthening of existing networks within the community of Mamelodi East. As suggested in the urban vision, the focus is on creating a multi-functioning public platform. The site will need to already have or allow for new networks to form ensuring a mixture of programmes on site.

COPC-based ward

To support the existing COPC programme in Mamelodi East with a new training centre, the site needs to be located in an existing COPC serviced ward.

School-based

To comply with the restructured health care model of the National Health Insurance (Department of South Africa 2015:39), the site needs to be school-based. To support the intended programme of a paediatric screening facility, a primary school is preferred.

Accessiblity

The site needs to be easily accessible to provide services and basic transport facilities, as well as ensure easy access for the community of Mamelodi East.

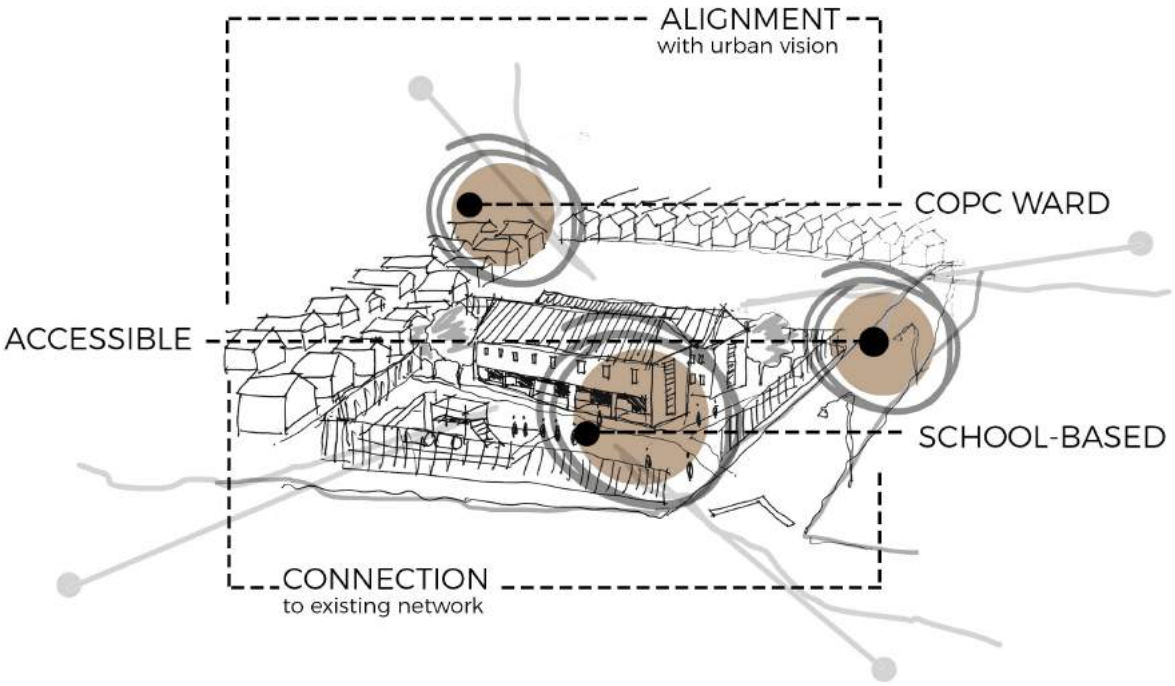


Figure 1.48: Diagram depicting the site selection criteria to identify a suitable site (Author 2018)

1.6.2 Site possibilities

Four possible sites were identified through applying the selection criteria in the Mamelodi East region. This presented four primary schools in the area as indicated in the diagram below:

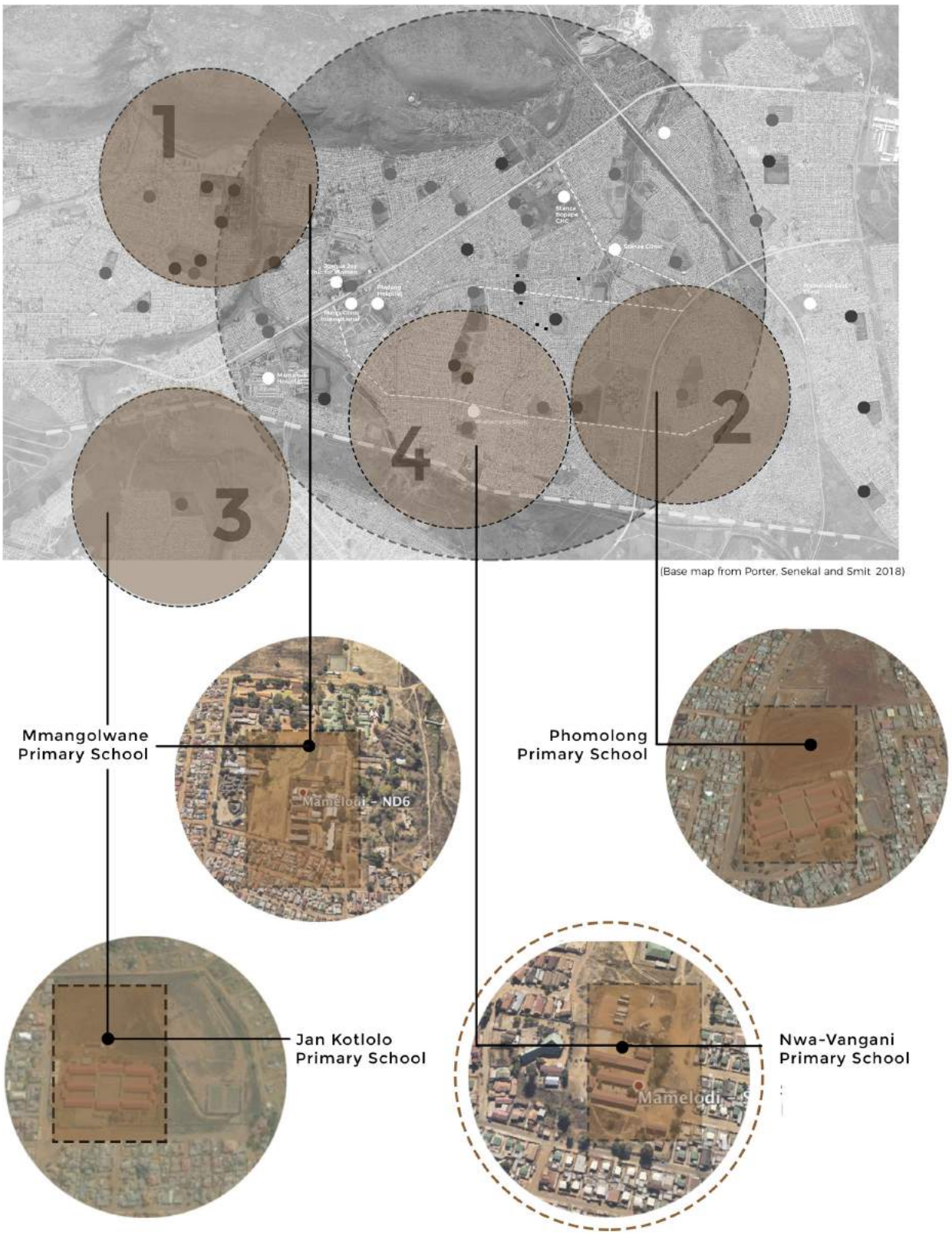


Figure 1.49: The four site possibilities identified in the Mamelodi East area (Author 2018)

1.6.3 Site selection and context

From the four sites, the Nwa-Vangani Primary School is selected as the proposed site for intervention. Not only does it comply with the site selection criteria, it also presents various opportunities in terms of current activities, user energy, topography as well as location.

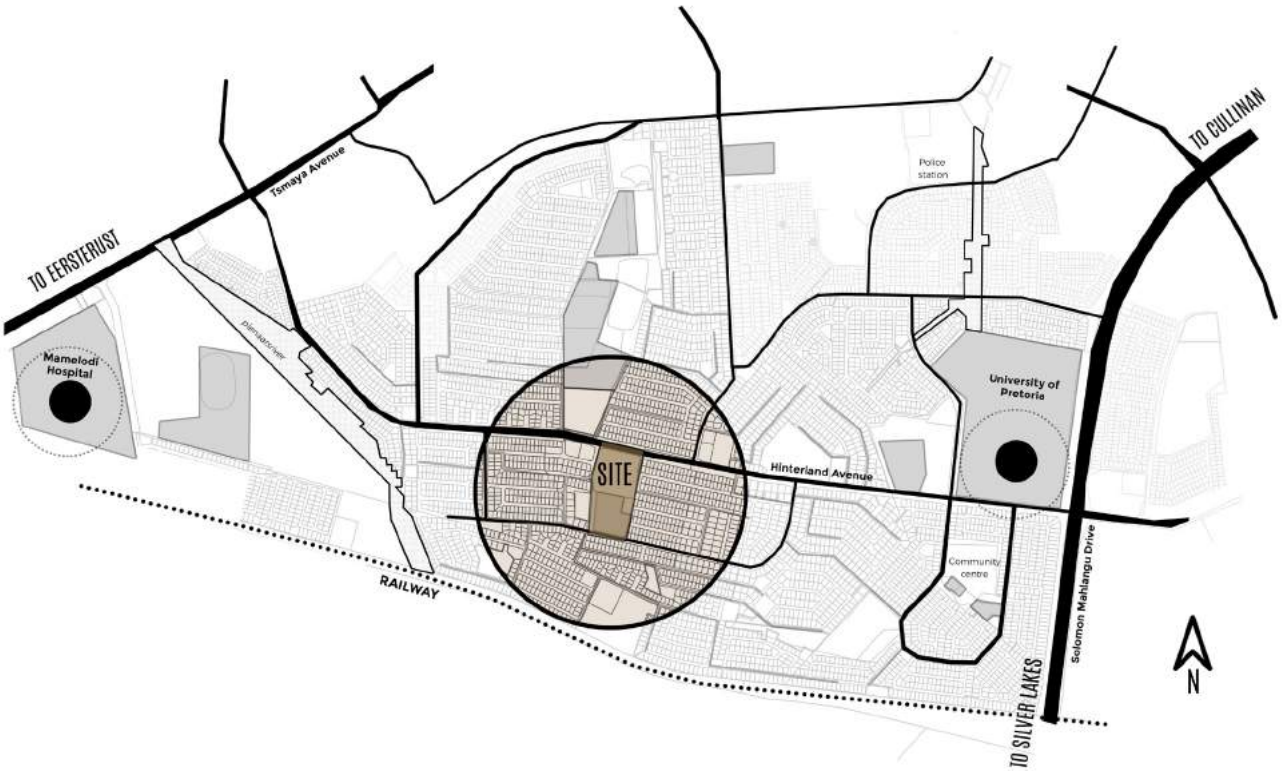


Figure 1.50: Locality map of the selected site in Mamelodi East, positioned in between the University of Pretoria campus and the Mamelodi Hospital (Author 2018)

Figure 1.51: Northern aerial view of the selected site and the surrounding urban context (Author 2018)

The site is located on Hinterland Avenue, one of the main routes in Mamelodi East. It forms a midpoint on the route between the Mamelodi Hospital and the University of Pretoria Mamelodi campus. An in-between open space is identified between the Nwa-Vangani Primary School and the Phamaneng Clinic as a potential site.

In close proximity to the site is the URCSA Mamelodi Church, a shopping centre, a high-school cluster of five schools and residential edges surrounding most of the site. More temporary activities such as informal trading on the Hinterland Avenue edge, various desire lines of pedestrian traffic, as well as an informal transport hub are present on site. The site is located on a hill sloping towards Hinterland Avenue, facing the Magaliesberg mountain range towards the North. Apart from the main access from Hinterland Avenue, the site allows for access from most of the edges as it is surrounded by secondary vehicular routes.

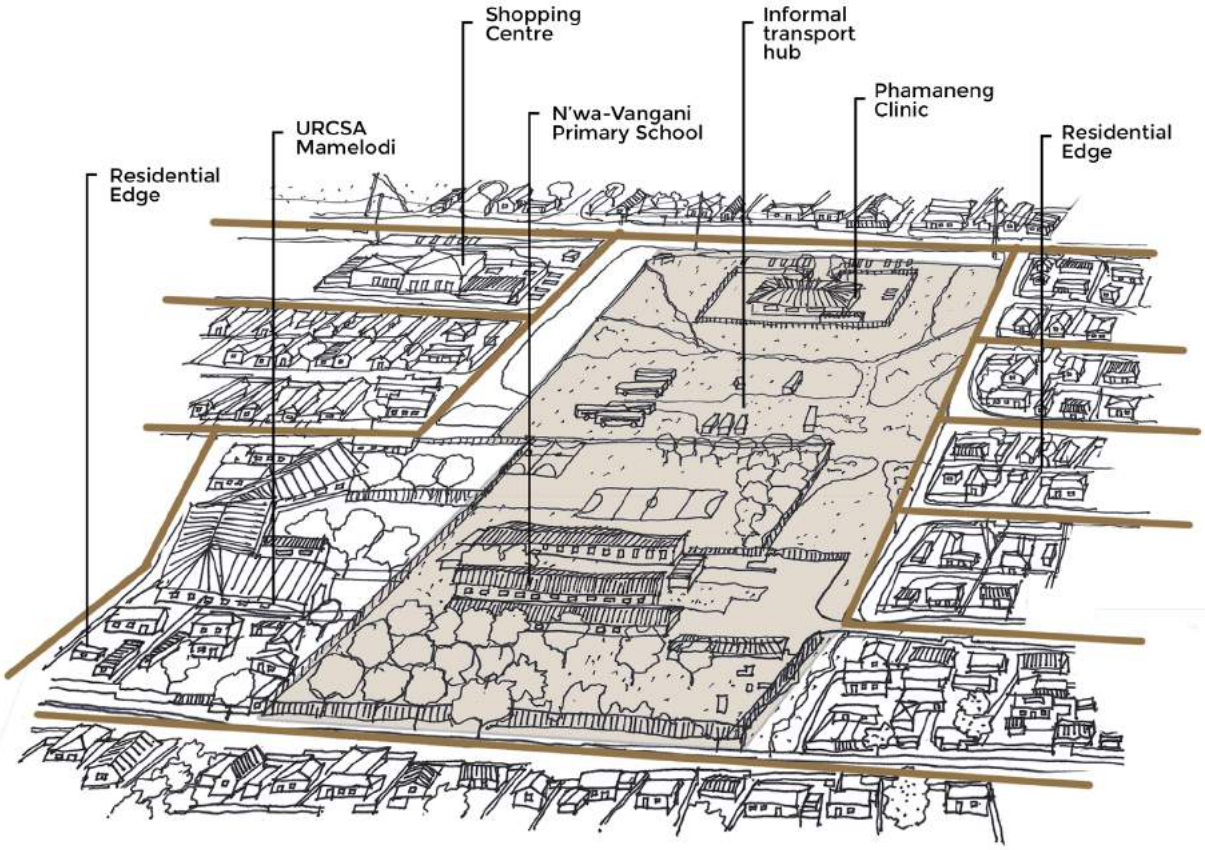


Figure 1.52: Current context on the selected site (Author 2018)

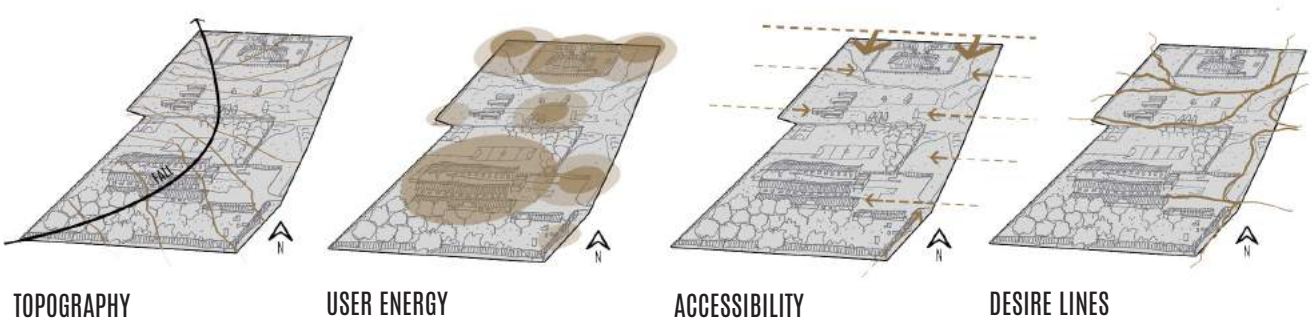


Figure 1.53: Site observations in terms of topography, user energy, access and desire lines (Author 2018)

Figure 1.54: The Nwa-Vangani Primary School (Author 2018)

Figure 1.55: The play courtyard spaces at the primary school (Author 2018)

Figure 1.56: The assembly space at the primary school (Author 2018)

Figure 1.57: The Phamaneng clinic on site (Author 2018)

Figure 1.58: The informal transport hub of busses and taxis on site (Author 2018)

Figure 1.59: The unwelcoming entrance to the existing clinic (Author 2018)

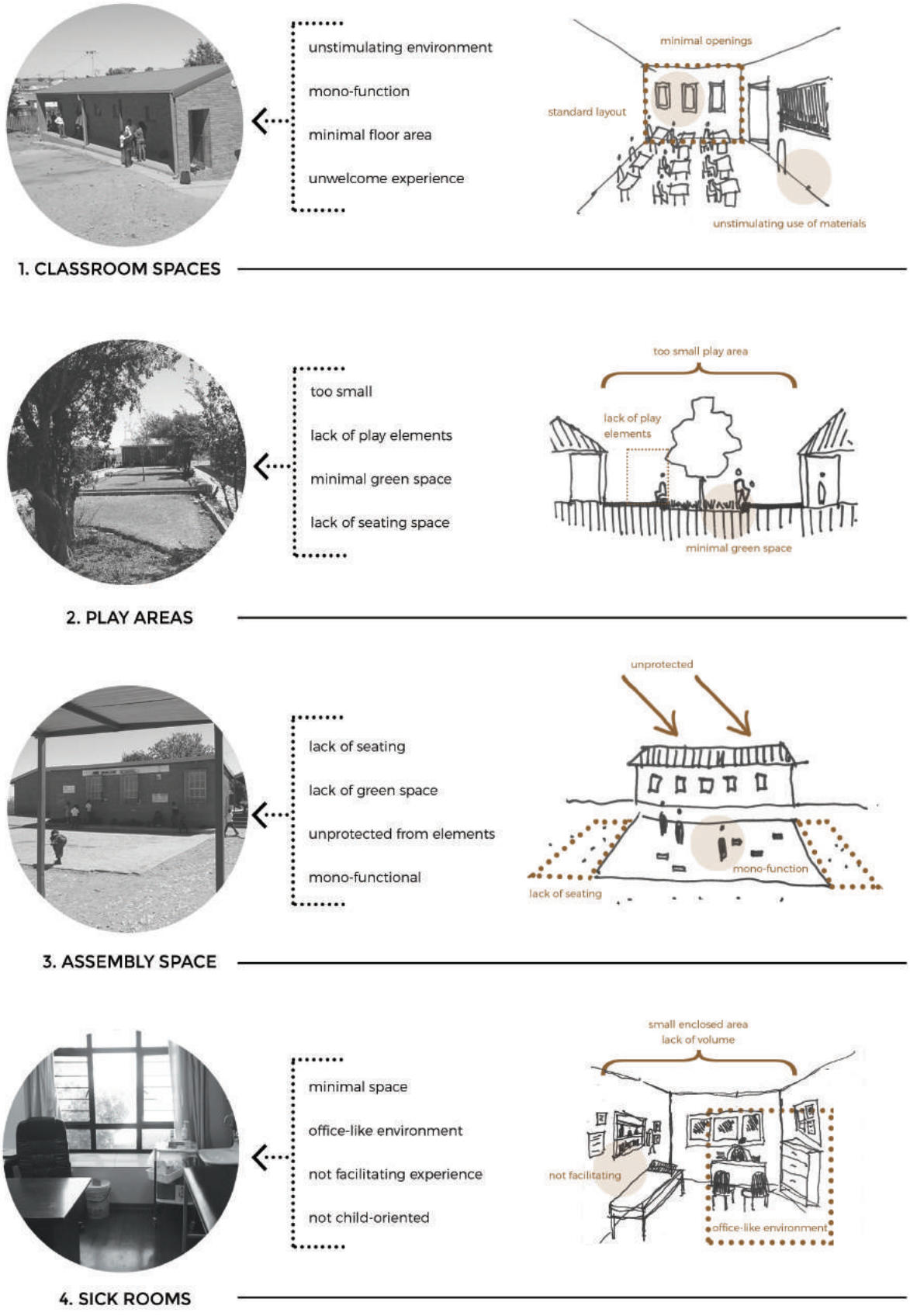


Figure 1.60: Spatial observations at the existing school on site (Author 2018)

CHAPTER TWO

Argument

THEORETICAL PREMISE

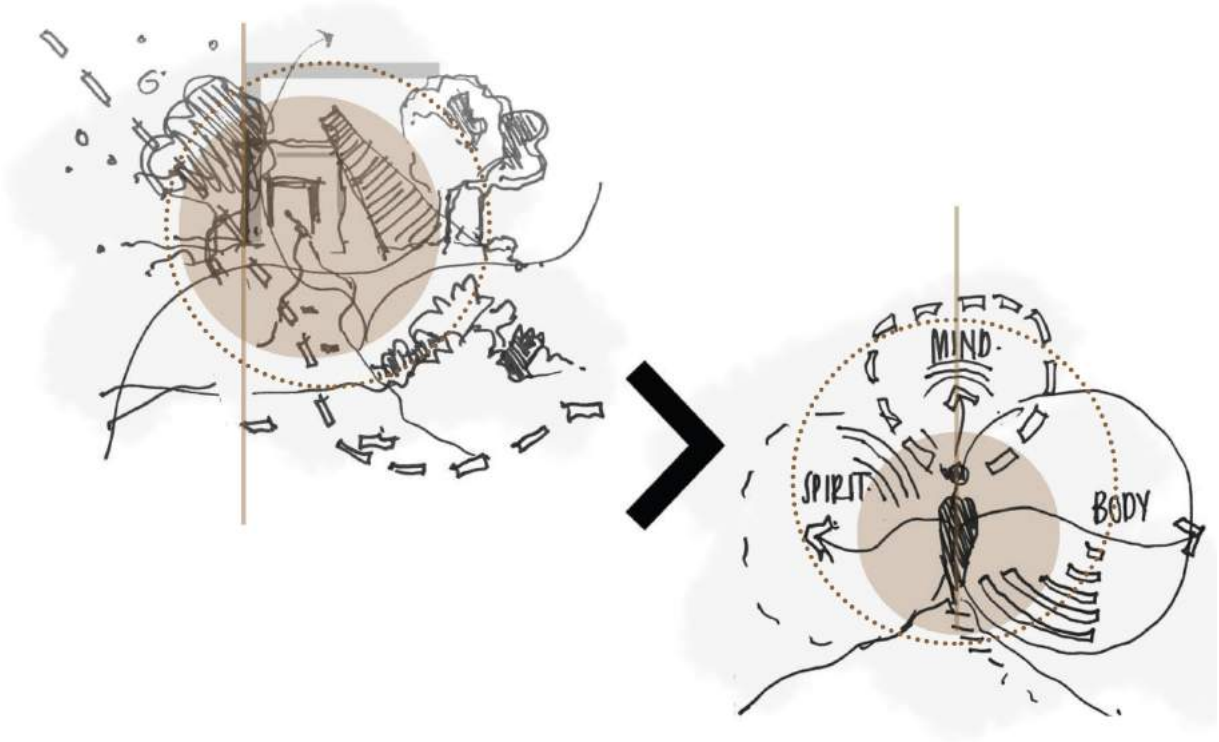


Figure 2.1: Exploring the relationship between the physical environment and health (Author 2018)

2.1 Preface

The reluctance in a given community to attend health or education related settings is due to the fact that this has in terms of spatial experience become more of an institutional experience rather than a facilitating experience. For this reason, it is important to understand the relationship between health and the physical environment. Situated in the theoretical context of salutogenesis and sensory design theory, the relationship between the physical environment and child health care is explored.

The theoretical premise of salutogenesis is discussed, considering the architectural application thereof, and the way in which it relates to the physical environment. A sample set of precedents is investigated to identify common characteristics and features in the physical environment, which represent a salutogenic approach. The findings are unpacked and discussed to illustrate connections to the theoretical premise.

From the findings, a set of design guidelines is derived to apply the proposed salutogenic principles within school-based health environments. These guidelines form a departure point to generate possible architectural interventions, which can improve the wellbeing and development of children in school-based health care settings through their spatial environment.

The chapter concludes that the physical environment's contribution to health is vital within school-based health care settings. Moreover, existing health care design typologies can potentially be improved through salutogenic architectural principles, thereby contributing to child health care.

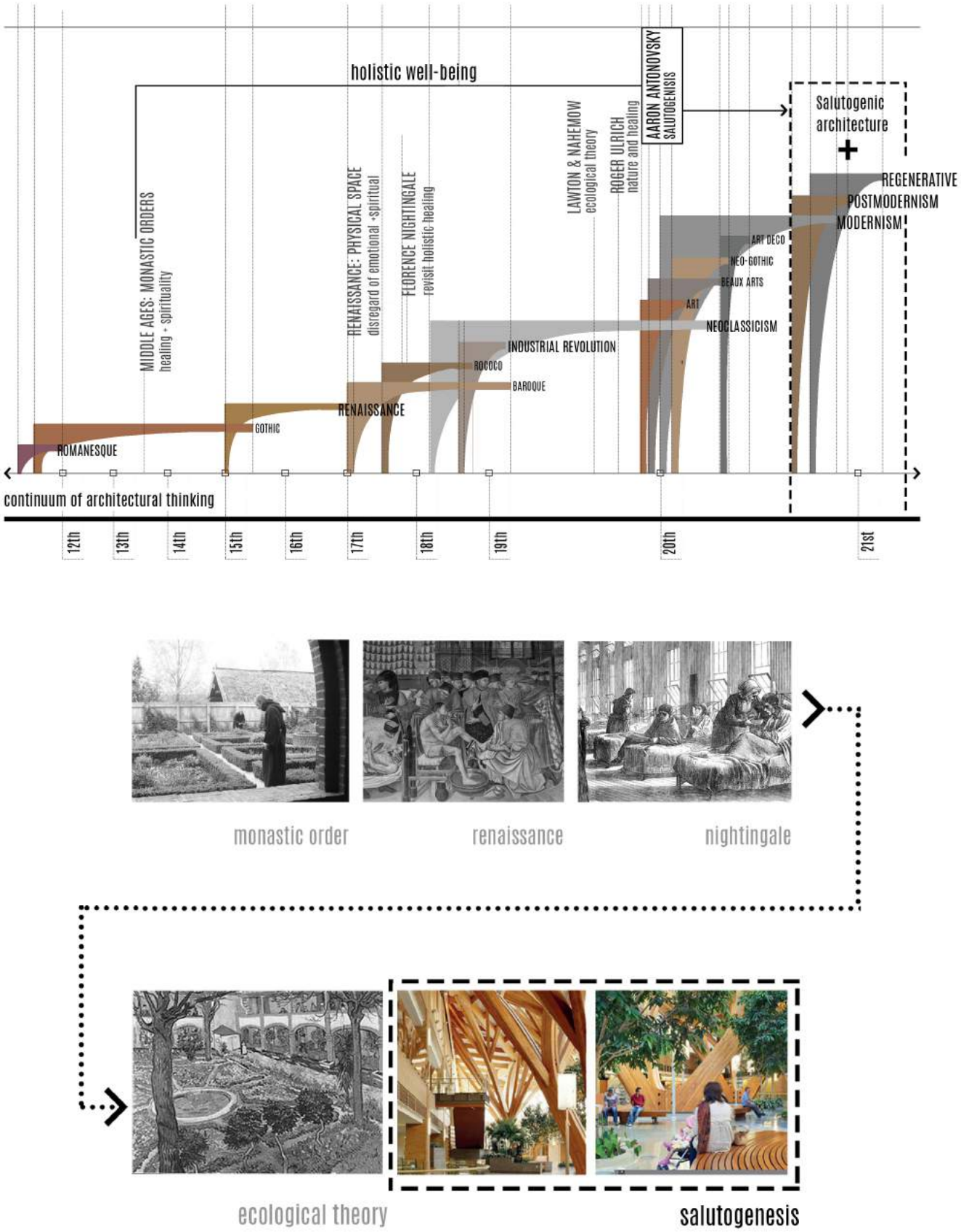


Figure 2.2: Salutogenic architecture in the continuum of architectural thinking (adapted by Author 2018 from Minnaar 2017)

2.2 The relationship between health and the physical environment

Figure 2.3: Spheres of influence of an individual's health and wellbeing. (adapted from Tsekleves and Cooper 2017:6)

Boluijt and Hinkema (2005:38) emphasise the importance of environmental qualities within health care design and the way in which the interaction with the surrounding environment plays an important role in a patient's wellbeing. Substantial evidence indicates that aesthetic design in these settings can influence wellbeing and health outcomes for patients (Ulrich 2006:538). Tsekleves and Cooper (2017:6) argue in this regard that the physical environment impacts an individual's health at a holistic level that in return influence wider health aspects that play a significant role in long term well-being and development.

The impact of the physical environment on the wellbeing of humans date back almost 5000 years to holistic healers in China and India. As early as the 4th century B.C., the father of medicine, Hippocrates, stressed the role of nature in the healing process. This approach placed emphasis on healing that consider the complete body, rather than focusing on specific illnesses or injuries (American Holistic Health Association 2018). This was evident during the middle ages when religion and healing became closely associated, due to the compassion ethos expanding into society. This was continued into monastic orders, where cloister gardens became part of the architectural blueprint to provide comfort and care (Burpee 2008:1). With the scientific revolution in the 19th century that revealed germs to be a disease-causing agent, medicine and healing became more dedicated to intervention (American Holistic Health Association 2018). The focus on disease and the treatment thereof replaced the notion of holistic healing, whilst the outbreak of numerous wars only increased the demand for physical health care and treatment. Florence Nightingale became an influential figure in health care provision, re-establishing the notion of holistic health care after observing the correlation between patient survival and the cleanliness of the hospital wards (Burpee 2008:1). This observation prompted her to write *Notes on Hospitals* in 1863 (Burpee 2008:1), where she stresses the importance of the physical environment in healing environments as well as social welfare of patients. She argued that patients require access to natural light, air, landscape, and hygiene.

Unfortunately, with the high demand for hospitals following World War II, large-scale buildings that prioritised efficiency over comfort and healing replaced Nightingale's concept of holistic hospital design (Burpee 2008:2). Only from the 1970s onwards did a re-examination of these automated hospitals occur. This re-ignited the concept of holistic healing and the role of the physical environment within it. This concept continued to emerge in health related theories, such as Lawton and Nahemow's (1973) ecological theory, which argued for a balance between designing for comfort and mental wellness, as well as Ulrich's (1991) evolutionary hypothesis, to explain influences of natural views on health. Although various theories have developed over time to explain some of these influences, most are restricted to specific stimulus. An overarching logic for the effect of design on health and the promotion of health is the salutogenic theory (Lindström 2018:96).

2.3 Salutogenesis: Health as resource

Salutogenesis provides a way of understanding the complete spectrum of wellness and illness, transcending the differentiation between people, diseases, circumstances and environments (Golembiewski 2017:267). It becomes a useful approach to grapple with overall wellbeing and the complexity of the physical environment's influence on health (Golembiewski 2017:267). The theory of salutogenesis was first created in the 1990s by sociologist Aaron Antonovsky, who argued that it is more important to focus on people's resources and capacity to create health instead of the traditional focus on ill health and disease (Jonas et al 2014:82). Salutogenesis is the opposite approach to that of *pathogenesis*, which is described as the process of disease, illness generation and breakdown of function. The theory suggests that good health is maintained through a dynamic ability to adapt to changing circumstances (Lindström 2018:96). Therefore, salutogenesis argues the shift to a preventative approach, rather than a curative approach. The theory establishes the concept of a "*sense of coherence*" (SOC) as an essential part of the healing process, which is in turn reinforced by three main resources, namely comprehensibility, manageability, and meaningfulness. Golembiewski (2017:268) defines Antonovsky's comprehensibility as a person's ability to make sense of one's life. He continues on to argue that the essence of comprehensibility is the understanding of one's life narrative, context and circumstances. By understanding these aspects well, one is enabled to make the most of them. Manageability refers to a person's ability to manage day-to-day physical activities in order to maintain physical life, such as remaining nourished, rested, and comfortable (Dilani 2008:56). The final principle of meaningfulness forms the foundation of the desire to live and is possibly the most important of the principles. Found in personal connections and aspirations with the outside world, meaningfulness is also the most intangible aspect, as meaning is difficult to define and differs from person to person (Golembiewski 2017:268). People find meaning in different social settings and conditions, and within this differentiation, determine the basis of identity (Dilani 2008:56). If meaningfulness is absent, people find themselves without motivation or desire to act.

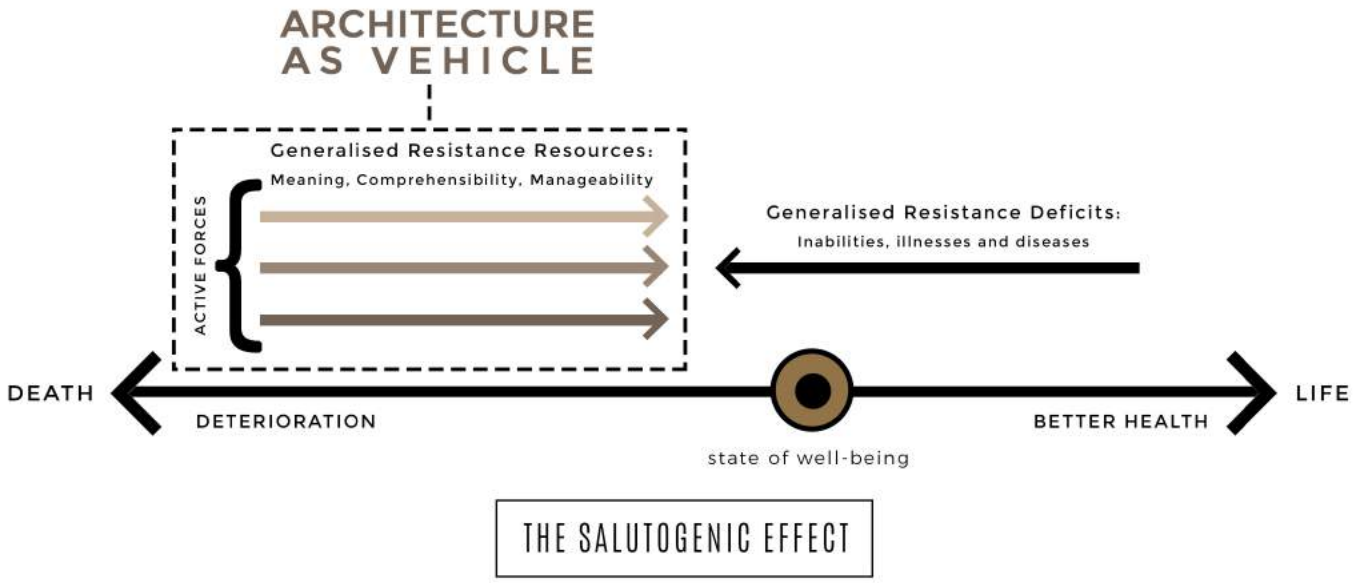


Figure 2.4: The salutogenic effect and how it relates to the physical environment (adapted by Author from Golembiewski 2017:4)

Figure 2.5: Salutogenic resources and sensory design elements visible in the built environment (Author 2018)

2.4 Salutogenic architecture

Sir Winston Churchill (1944) stated "*we shape our buildings; thereafter, they shape us.*" This illustrates the essence of the salutogenic theory applied in the built environment. All of the above-mentioned principles can be influenced by architectural design (Golembiewski 2017:269). Therefore, the salutogenic framework is a valuable design driver for primary health care settings, as it recognises the physical environment to be a source of meaning and sphere of influence (Golembiewski 2017:270). Salutogenic architecture takes its rightful place within the built environment by promoting preventative care strategies that have the potential to shape not only buildings, but also the wellbeing of its users. The main focus of the approach is to create a healthier society by addressing societal sectors, such as where human beings live, work and play. The focus thereby shifts "*from risk factors and treatment of disease to a more holistic understanding and evolution towards a healthier society*" (Dilani 2017). This approach also provides a different perspective to consider the role of architecture in health and wellbeing. South African guidelines such as the IUSS Health Facility Guide document for primary health care facilities (IUSS 2014:34) encourage the implementation of salutogenic design to improve user outcomes in public health care buildings. An architectural extrapolation of the salutogenic theory by Golembiewski (2017:269) provides an architectural translation of the three salutogenic resources to achieve a sense of coherence:

1. COMPREHENSIBILITY
Ensuring perceptual cues to assist perceptual processes. This includes the use of texture, materiality, environmental features and sizing of spaces.

2. MANAGEABILITY
Allowing users to exercise control of the environment. This can be achieved by details such as opening windows, temporary elements and provision of recreational facilities.

3. MEANINGFULNESS
Enriching the environment with complexity, order, familiarity, and aesthetic elements. This includes meaningful space for waiting areas and interaction with the natural environment.

From the architectural translation, it is apparent that interaction with the physical environment plays an important role in achieving a sense of coherence. The way humans experience built environments is to a great extent guided by their sensory experiences (Malnar 2004:129). For this reason, it is essential to understand the notion of sensory design and how it is interwoven with salutogenic architecture.

2.5 Sensory design: Sense-sensitive environments

Mostafa (2014:143) defines architecture as the science of environment creation that deals with the manipulation of space to serve certain programmes and users, invoke particular behaviours, or create specific experiences. The built environment is the setting in which people spend most of their time, are near to, or influenced by. Few besides the architect themselves think consciously about architecture and the built environment, but many feel it (Day 2017). The sensory environment – auditory (sense of sound), visual (sense of sight), tactile (sense of touch), olfactory (sense of smell) and gustatory (sense of taste) – plays an important role in the perception of and influence of the built environment. This is due to the fact that our sensory system forms part of our nervous system, which is responsible for information processing to generate responses or reactions. Our sensory system is complex, and includes various components that collect information (Abraham et al 2015:3):

1. *the auditory system*: the sense of hearing;
2. *the olfactory system*: the sense of smell;
3. *oral sensory processing*: the sense of taste;
4. *the tactile system*: the sense of touch;
5. *the visual system*: the sense of sight;
6. *the vestibular system*: to sense where our bodies are in space;
7. *hapticity*: to experience through the contact with our skin;
8. *proprioception*: to sense the way our bodies move;
9. *kinaesthesia*: to experience through the movement of our bodies;
10. *the interoceptive system*: responsible for sense of our body's physical condition, such as hunger, thirst and internal discomfort; and
11. *synaesthesia*: the phenomenon of sensory information transferred from one sense to another.

The Sensory Design Theory is based on the concept that the sensory environment influences the process of perception and development (Mostafa 2014:145). It argues that sensory experiences are key elements in creating beneficial environments, and ought to be considered equally significant as form and function during the design process. The theory proposes that tangible input may encourage intangible output. Commonly in health care settings, the sensory environment is manipulated through design to form certain meanings and experiences to users. It becomes crucial to ensure that environments do not become overstimulating, especially for children, as it can result in confusion, unresponsiveness, and negative behaviour (Abraham et al 2015:3). Rather, the sensory environment ought to be considered with great care, so as to ensure sensory information can be easily processed to generate appropriate responses.

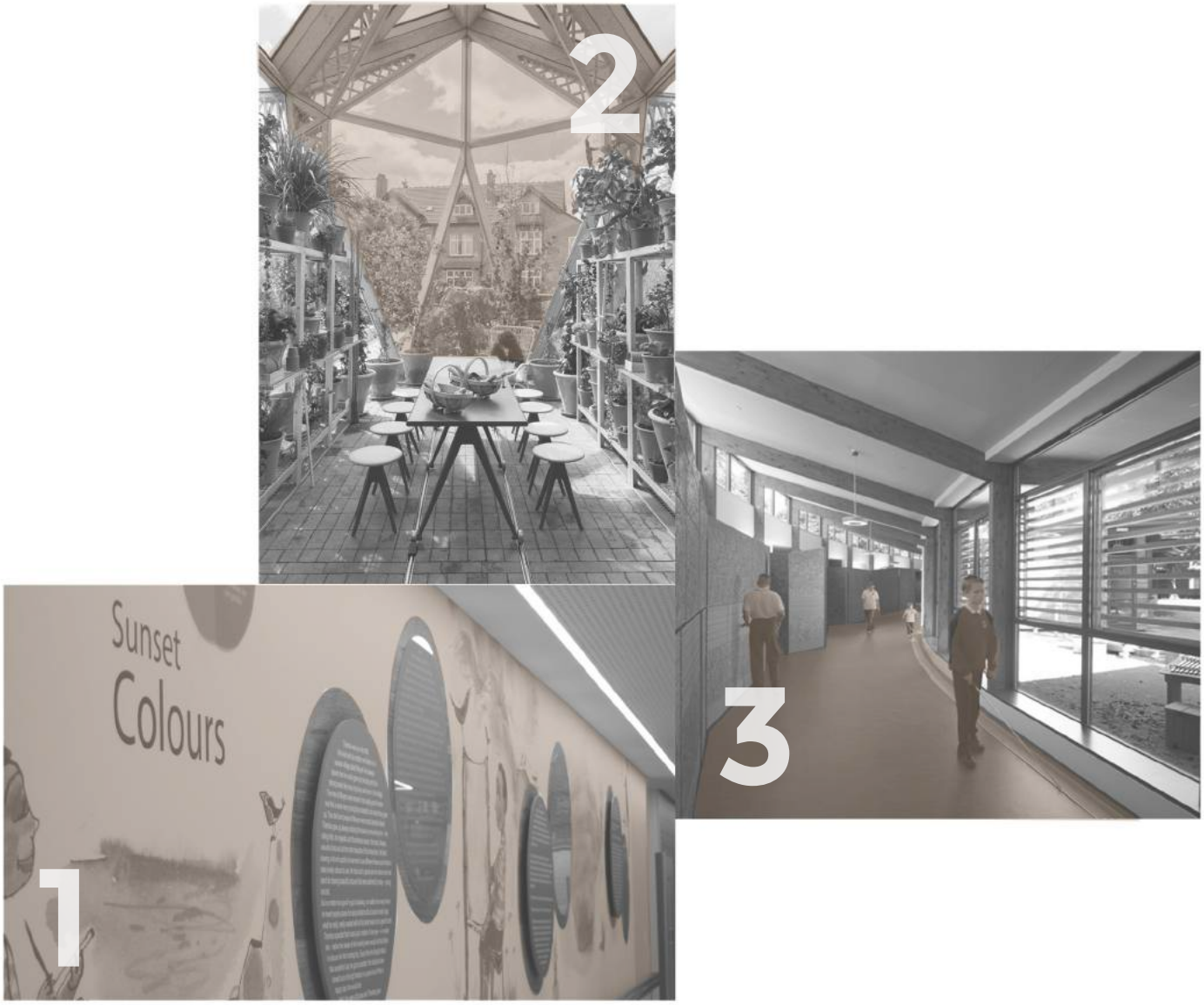


Figure 2.6: Collage of selected precedents for thematic analysis (Author 2018)

2.6 Revealing salutogenic themes through precedents

Concluding from the thematic analysis, selected precedents are discussed to illustrate salutogenic and sensory design themes in the built environment:

Figure 2.7: Bright coloured, storytelling passages in the Children's Hospital (Author 2018)

Figure 2.8: Play garden spaces located in central courtyards (Author 2018)

Figure 2.9: Water as stimulation and play element in the sensory garden (Author 2018)

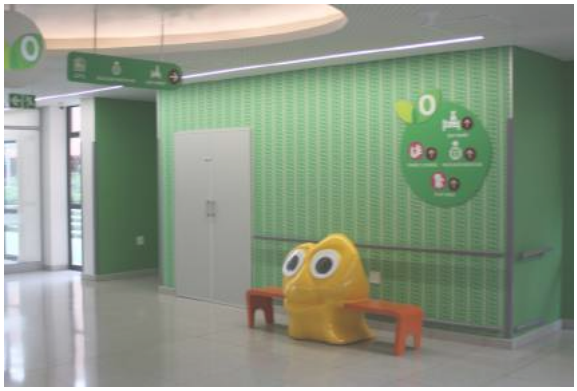


Figure 2.10: Colour schemes implemented to identify different wings within the hospital (Author 2018)

Figure 2.11: Movable play elements celebrate the child as main user (Author 2018)

2.6.1 NELSON MANDELA CHILDREN'S HOSPITAL

LOCATION: Johannesburg
COMPLETION: 2016
ARCHITECTS: Ruben Reddy Architects, GAPP Architects & Urban Designers, Sheppard Robson International, John Cooper Architecture

The newly built Nelson Mandela's Children's Hospital located in Parktown, Johannesburg aims to create a state of the art health care facility that allows a playful, family-oriented space within a natural environment for its patients as well as staff (Leonard & Schnaid 2017:66). Moving away from a single block massing building, artificially lit corridors and excessive white walls typical of many health care designs, an extended courtyard typology with six wings is implemented to allow maximum connection to the natural environment. A central 'street' functions as connection between the individual wings. Colour schemes are creatively implemented in each wing to create distinction between different functions and specialities. The idea is extended to the exterior of the building on the horizontal shading screens (Leonard & Schnaid 2017:67). Bright signage and infographics assist with easy way-finding in the building, creating a fun and playful experience, which purposefully alleviates the heaviness of the programme. The use of texture, light and interactive elements does not detract from the importance of the child as main user within spaces. Indeed, many features in and around the building are included as result of child participation workshops involving prospective users such as children, parents and staff (Leonard & Schnaid 2017:67). Clay-inspired seating, story-telling wall art, and screening elements designed from children drawings speaks of a welcoming family-centered environment. A series of different garden spaces, ranging from play gardens to healing gardens, echo the interior spatial intentions through continuing the child-centered experience. A balance is achieved to ensure a welcoming and hopeful environment for patients without compromising clinical functionality (Leonard and Schnaid 2017:67). The design team succeeds in moving beyond the functional requirements of a health care building to create an inclusive place of healing that accommodates both users and staff. It innovatively guides and engages the user through space that is comprehensible, welcoming and functional.

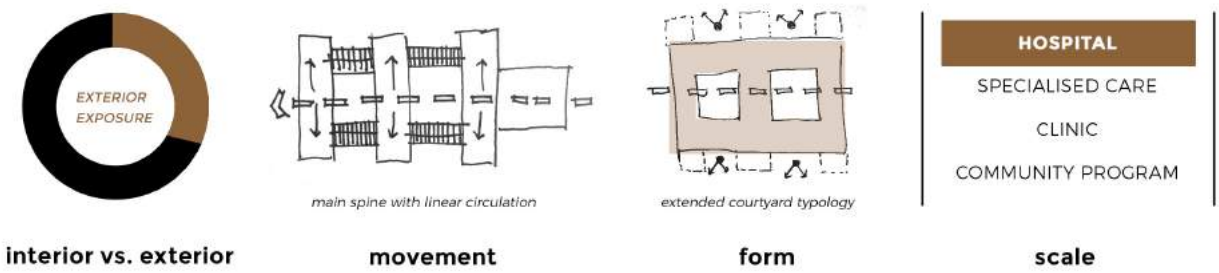


Figure 2.12: Sketch analysis of Nelson Mandela Children's Hospital (Author 2018)

Figure 2.13: A fusion between the interior and exterior spaces at Maggie's Centre with no institutional references (Foster+Partners 2018)

Figure 2.14: A tranquil gathering space with garden as backdrop (Foster+Partners 2018)

Figure 2.15: Home-like spaces with natural materials as sanctuary (Foster+Partners 2018)

2.6.2 MAGGIE'S MANCHESTER

LOCATION: Manchester, England
COMPLETION: 2016
ARCHITECTS: Foster + Partners

Forming part of the collection of Maggie's Centres across the globe, the Maggie's Manchester Centre designed by Foster and Partners creates a unique sanctuary for cancer patients. The project illustrates the concept of "a home away from home" (Foster and Partners 2018). The power of architecture is to create comforting spaces that move away from institutional references. The light-filled building with a timber structure echoes a strong domestic atmosphere. Located on a sunny site, on a single-storey scale, the building reflects the residential scale of the surrounding streets. The structural beams are innovatively incorporated to act as natural partitions within the interior spaces and gradually dissolve into the surrounding gardens (Foster and Partners 2018). A central spine acts as connection between a variety of spaces. Spaces such as intimate library niches, exercise rooms, and a large communal kitchen create a sense of distance from the traditional evocations of other institutional environments. A warm material palette with natural wood and tactile fabrics compliment the sanctuary nestled within its green setting. Natural light and views of nature constitute the heart of the centre, with most of the areas opening up towards garden spaces. The southern end of the building merges with a greenhouse in celebration of light and nature (Foster and Partners 2018). It serves as gathering space, a quiet retreat or a therapeutic workspace for green fingers that want to embrace the outdoors. The garden filled with flowers and other produce does not only provide a natural backdrop for the building, but also provides patients a sense of ease during vulnerable times (Foster and Partners 2018).

Within the heaviness of the programme, a sense of meaning is established through the use of architecture, by providing an intimate sanctuary of comfort, in harmony with nature.

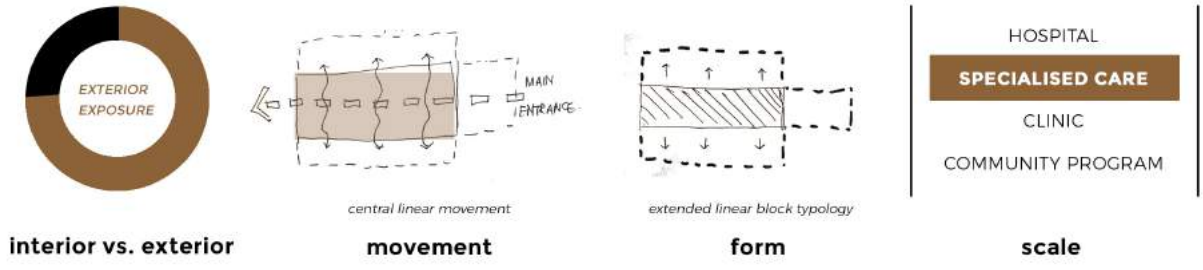


Figure 2.16: Sketch analysis of Maggie's Centre (Author 2018)

Figure 2.17: The distinctive curving interior spine as navigation device in the building (Institute for Human Centered Design 2009)

Figure 2.18: Cork-texture interior walls and natural lighting for easy wayfinding (Institute for Human Centered Design 2009)

Figure 2.19: An intimate scale in fusion with the natural environment (Institute for Human Centered Design 2009)

Figure 2.20: Uncluttered and colourful walls to minimise over stimulation (Institute for Human Centered Design 2009)

2.6.3 HAZELWOOD SCHOOL

LOCATION: Glasglow, Scotland
COMPLETION: 2007
ARCHITECTS: Gordon Murray + Alan Dunlop Architects

The award-winning project located in Glasglow, Scotland set out to create a facilitating learning environment for children with disabilities to be independent and safe. The building consists of a single story with a series of garden spaces that encourage outdoor learning opportunities and more intimate experiences. The distinctive curving interior spine allows for easy navigation throughout the building (Institute for Human Centered Design 2009). Cladded in cork material, the corridor creates a warm atmosphere and provides tactile cues to assist users in the way finding process. The curved form also reduces the visual scale of the circulation route, and aids in creating a more facilitating experience, moving away from long single corridor spaces. The school accommodates children with limited abilities with physical limitations such as with their hearing or vision. The tactile sensory system is predominantly depended on to create user-friendly legibility in the design through the use of patterns, texture and natural materials. Signage throughout the school is presented in a simplified form such as pictures and braille, which enables an effective and familiar form of communication. Subtle colours, along with contrast, as well as adaptable lighting elements, are used to accommodate users with residual vision. A calming atmosphere is promoted in classroom spaces through uncluttered walls, and minimal furniture, by means of which to ensure children are not overwhelmed by visual stimulation. Distinctive finishes, ranging from gravel to recycled rubber, define each pathway and circulation route, with a unique tactile and auditory experience. Common architectural elements, such as floor finishes and window sills, innovatively double as navigation devices. Acoustic-specific ceilings are incorporated to control reverberation (Institute for Human Centered Design 2009). Orientation of the building takes advantage of northern light exposure and opens up into quiet garden spaces to minimise visual distractions for children. The implementation of innovative solutions to accommodate the specialised user-group is evident and results in a nurturing and stimulating environment for children.

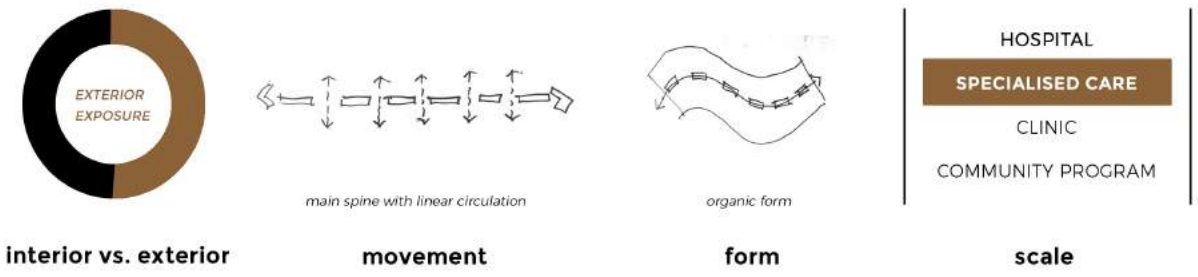


Figure 2.21: Sketch analysis of Hazelwood School (Author 2018)

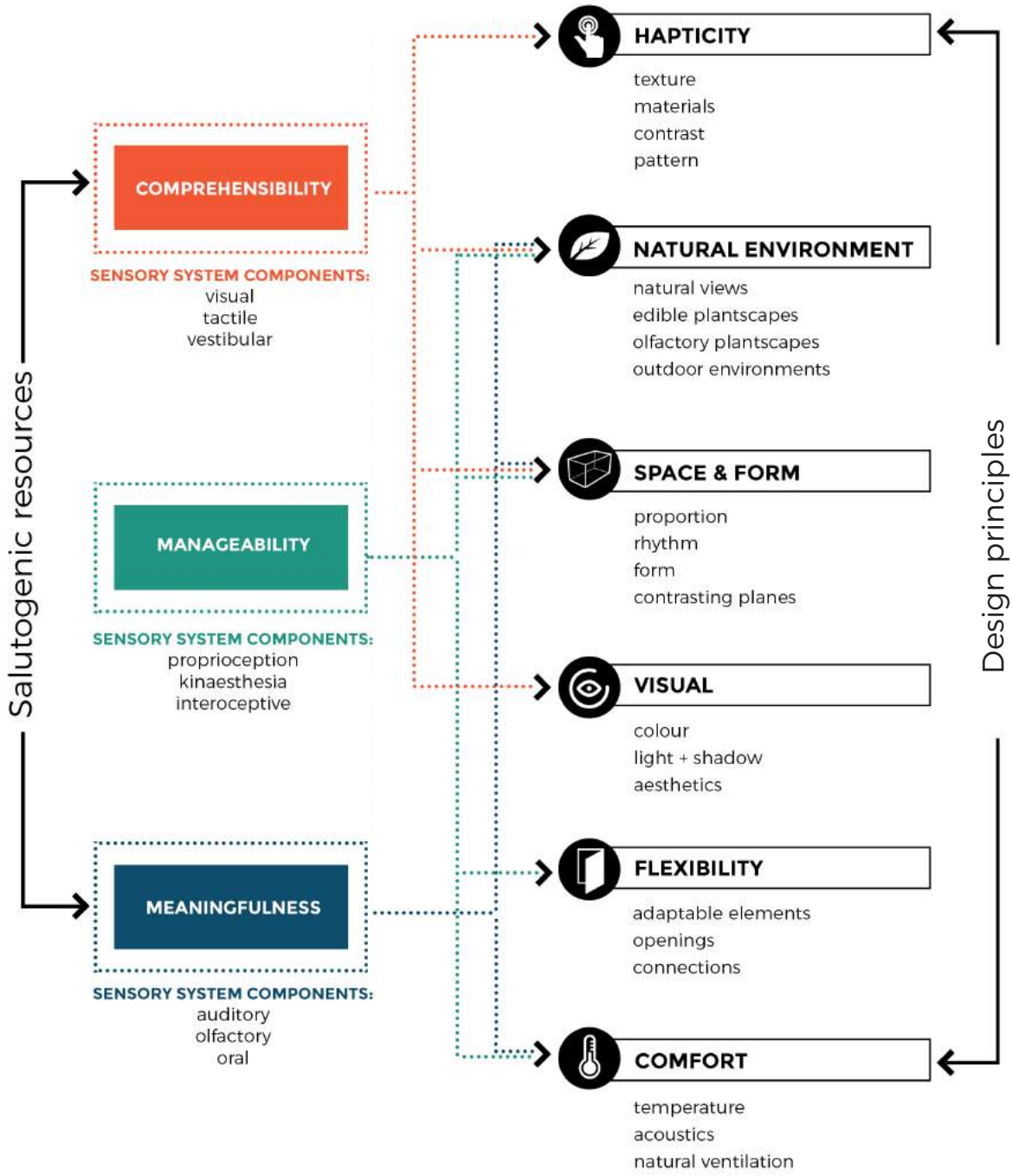


Figure 2.22: Design principles developed from the salutogenic theory through precedent analysis (Author 2018)

2.7 Translating themes into principles

Common themes that illustrate a salutogenic approach in the selected precedents are identified. The identified themes reflect the way in which architecture can contribute to health and development and illustrate the physical environment as valuable tool and sphere of influence, which can be optimised in health settings. The themes are developed into a set of design principles categorised under the three salutogenic resources namely comprehensibility, manageability and meaningfulness. These guidelines offer a design tool for applying salutogenic architecture, especially in health care settings.

2.8 Connecting architecture, health and the child

In order to connect architecture and child-centered health, the critical question should be asked as to how the physical environment, through salutogenic architecture, can support school-based health provision. This question provides the lens through which the findings from the precedent analysis are critically evaluated. The guidelines are categorised according to six principles: *hapticity, natural environment, space and form, visual, flexibility, and comfort*.

HAPTICITY

Discussed in the theory of sensory design, the sensory system is responsible for the way in which users experience their environments. The role of the tactile sensory system in architectural design is explored by examining hapticity. Papale (2016:866) defines hapticity as "*the sensory integration of bodily percepts*". In agreement with Mostafa (2014:145), tactile based perception and imagery play a pivotal role in the architectural experience.

For this reason, through understanding haptic qualities and the associated experiences they create, designers can deliver optimal healing health care settings for children. This principle contributes to the salutogenic resource of comprehensibility, where it assists in the perceptual process. As seen in the Hazelwood school case study, contrast in textures and materials can serve a greater purpose than aesthetics. It can assist in wayfinding through buildings, and provide tactile stimulation through unique experiences. Ultimately, designers can enhance the child's experience of space through incorporating relevant haptic qualities to contribute to a more comprehensible and stimulating environment.

NATURAL ENVIRONMENT

A growing body of evidence indicates that natural views and spaces within the built environment can contribute to healing, learning, and productivity (Ulrich 2006:S39, Bowler et al 2010:457, Shishegar & Boubekri 2016:18). The natural environment contributes to all three of the salutogenic resources on various levels. The Nelson Mandela's children's hospital incorporates the use of sensory gardens to create meaningful and healing spaces for children, parents as well as staff. Maggie's Manchester implements the idea of edible and olfactory gardens, which gives patients the opportunity to take care of the garden to offer a sense of meaning and purpose in their lives. The Hazelwood School extends the notion of classroom into the exterior garden spaces it has created, to minimise visual distractions and engage children directly within nature. For this reason, it is clear that the natural environment principle can be implemented as constitutive elements in the built environment, offering a powerful tool that provides healing and stimulation for children.

SPACE AND FORM

A salutogenic approach to design has the potential to shape not only our buildings, but also the wellbeing and development of its users. Mazuch (2017:42) agrees that the very form and massing of health care environment has the ability to influence health outcomes. The principle of space and form stretches across all three salutogenic resources and encourages the creation of as many spatial conditions as possible. The use of scale and form can organise spaces in logical hierarchy, and assist users in orientating themselves.

The curved circulation core at the Hazelwood School illustrates the use of scale and form as spatial organiser and promotes easy navigation throughout the building. Contextual familiarity in space and form also becomes important as it creates recognisable environments resulting in users feeling a sense of comfort and safety. The Nelson Mandela Children's Hospital makes use of seating elements in passages that resemble children clay-models. As a result, children can associate with the environment through familiarity.

VISUAL

From all the sensory systems, the visual system is mostly relied upon to perceive our surrounding environment. When ensuring that environments are accessible and easy to understand, users experience a sense of comfort, which lowers stress levels that are usually associated with health care settings (Ulrich 2006:S39). Colourful signage and infographics in the Nelson Mandela Children's Hospital present a good example of accessible way finding in complex built environments. This encourages a fun, accessible and learning experience for children. The Hazelwood School implements neutral colours and uncluttered wall to provide a calming atmosphere in classroom spaces, so as to minimise overstimulation. Maggie's Manchester celebrates the use of light and nature, providing maximum connection and visual links to the surrounding plantscapes, and moving away from institutional references. Thus, visual elements such as colour, light, art and natural views become useful tools in creating more comprehensible and stimulating environments for children.

FLEXIBILITY

Supporting the salutogenic principle of manageability defined by Golembiewski (2017:15), flexibility in the built environment provides users the opportunity to interact and alter their surrounding environment. This includes different types of flexibility, such as adaptability, movability and transformability, situated in-between the scale of permanence and temporality of the built environment. The garden spaces at the Nelson Mandela Children's Hospital emphasise the importance of the child as main user, providing movable and interactive play elements. Flexibility in the built environment, such as window openings, play areas, multi-purpose elements and adaptable spaces, create interactive spaces where users can exert an impact on their surrounding environment, even if only temporary.

COMFORT

Focused more on the technical and functional qualities of a building, comfort of internal environments can influence a user's experience (Mazuch 2017:46). Considering internal environment qualities such as temperature, acoustics, background noise, and ventilation offers numerous benefits especially in health care settings. Ulrich (2006:S38) argues that quiet health care settings are mainly determined through the appropriate design of the physical environment, not by modifying users' behaviour. Acoustic control ought to be considered according to the type of activity taking place within spaces. As seen in the Hazelwood School case study, acoustic considerations become vital to ensuring reverberations and background noise are minimised, so as to avoid overwhelming children within internal spaces.

From the findings and discussion, it is evident that the salutogenic framework can be a valuable design driver for primary health care settings. The guidelines are further refined to architectural principles, so as to allow for adaptation and various implementation levels. For this reason, the guidelines can be altered to suit any contextual setting. It gives designers the opportunity to envision and experiment with the way in which the physical environment can contribute to improved health care. Ultimately, the guidelines aim to assist designers during the design process to generate built environments that not only provide efficient health care settings but also healing and stimulating environments.

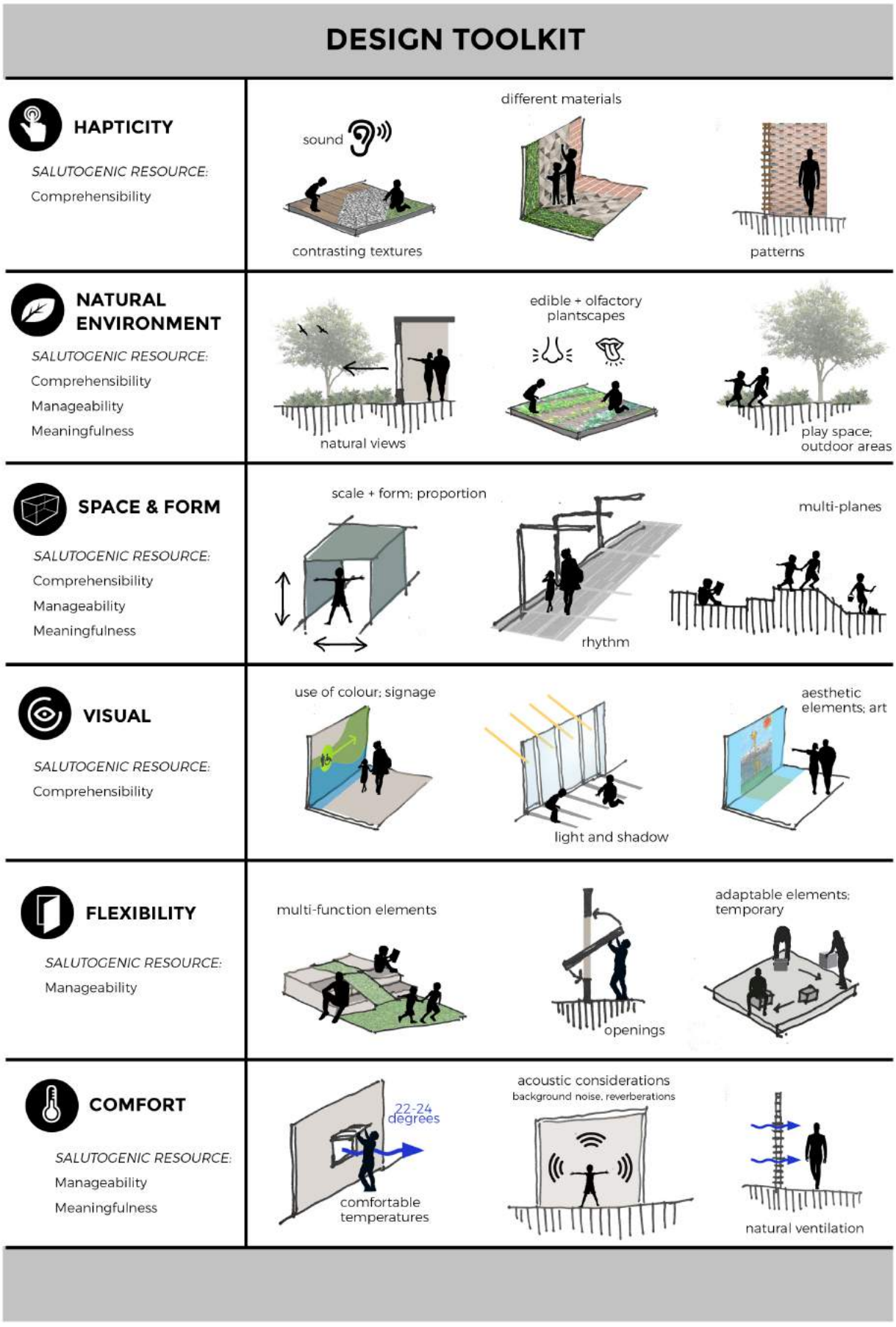


Figure 2.23: Design principles translated into a design toolkit for implementing a salutogenic approach (Author 2018)

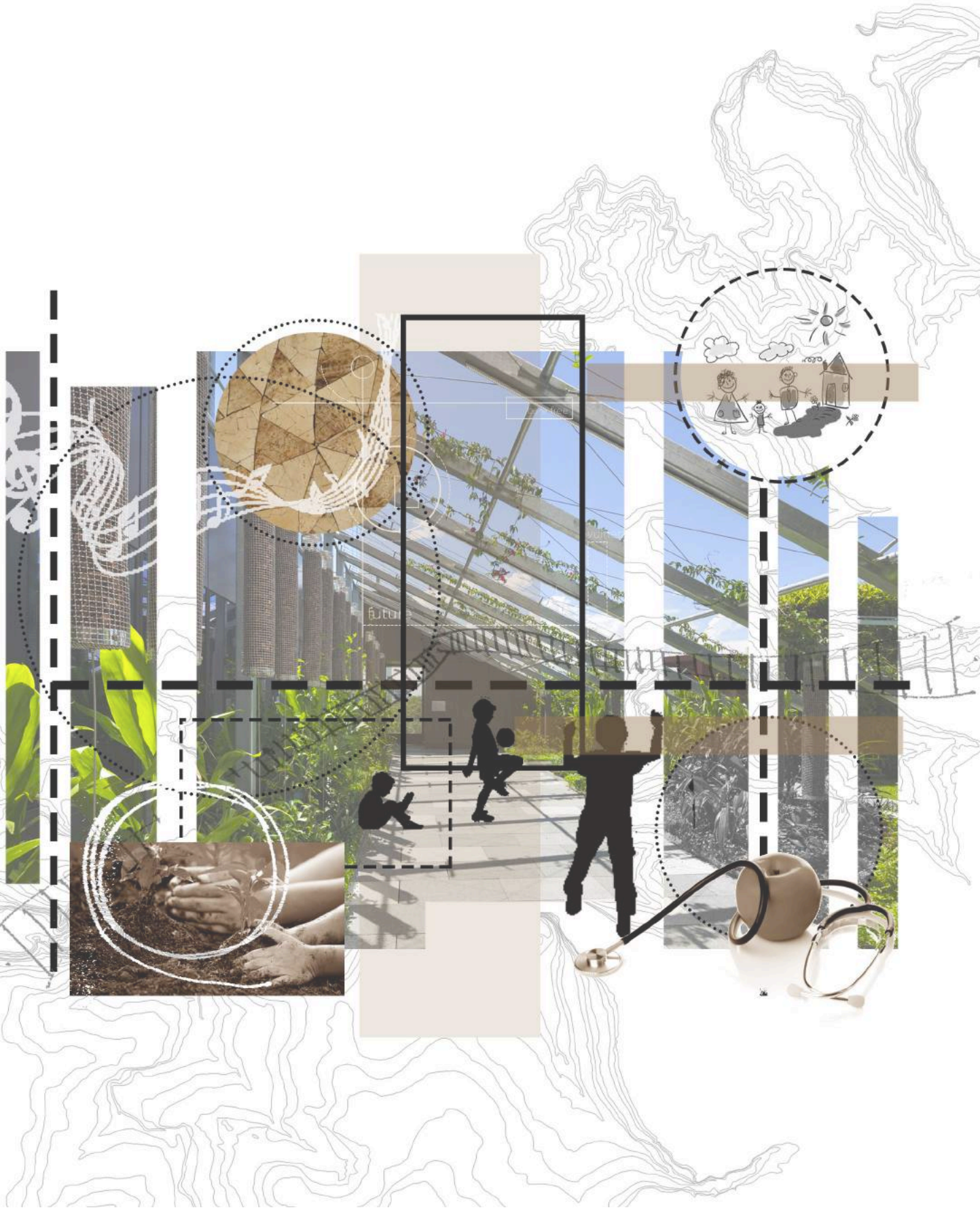


Figure 2.24: The reciprocal relationship possible between architecture, health and the child (Author 2018)

2.9 Contribution to health care architecture

As seen in this chapter, evidence-based research and new design tools such as salutogenic architecture and sensory design can assist designers in the process of designing health care facilities. Through implementing these approaches to design, the built environment, from the tactile detail to the very form, can positively impact health outcomes (Mazuch 2017:47). There is a global shift in expectations, moving towards care that not only offers efficient and affordable health care facilities, but also sustainable people-oriented healing environments (Boluijt & Hinkema 2005:4). Therefore, making use of the physical environment as tool in school-based health care settings can prove beneficial. This chapter highlights the possibilities for a beneficial relationship between the physical environment and child health care. The theoretical premise of salutogenesis offers evidence that the impact of physical environments on people offers a valuable tool when designing for health settings. An alternative approach for the design of school-based health care is suggested through the lens of salutogenic architectural principles.

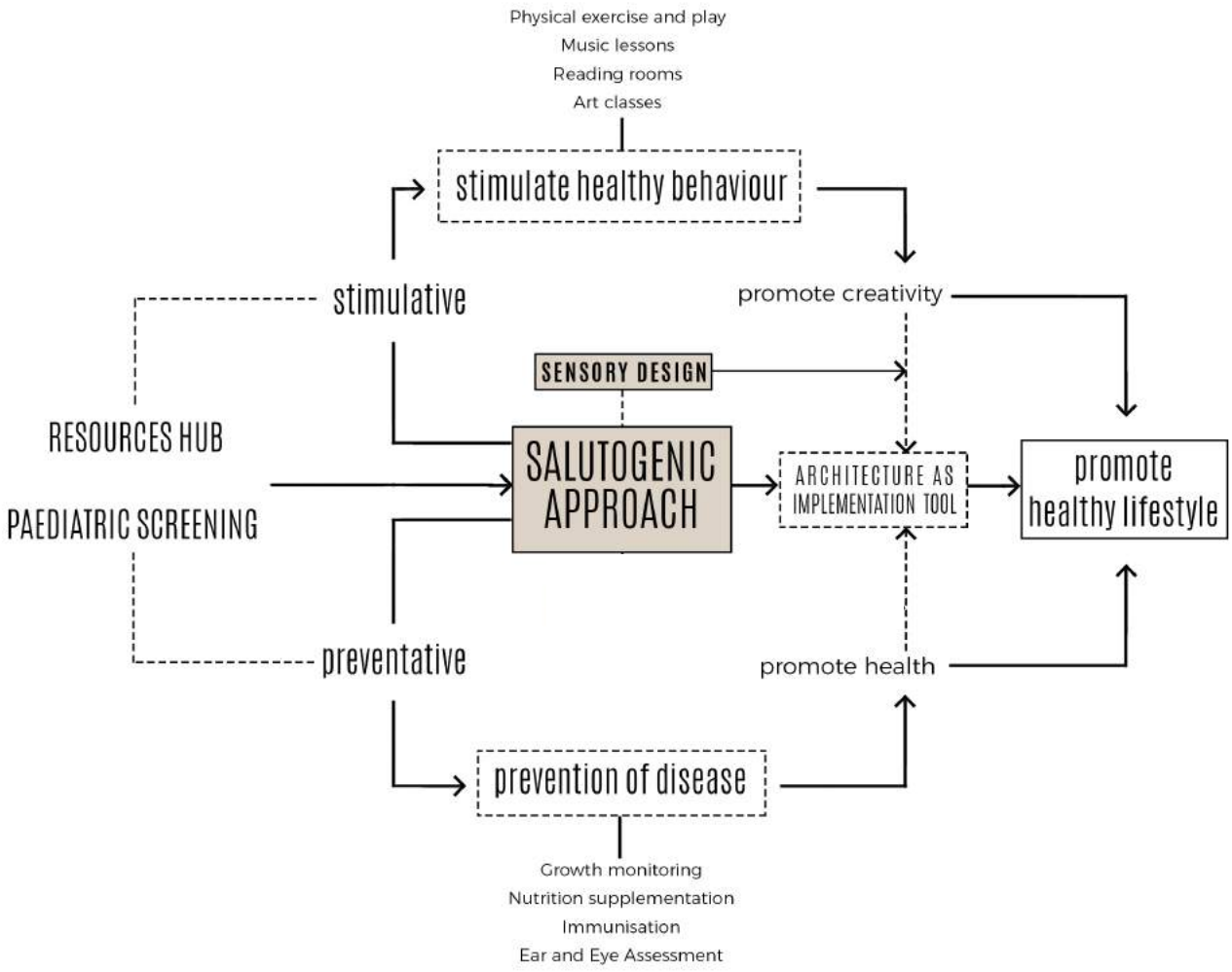


Figure 2.25: The relationship between programme and theory to create alternative approach to health care settings (Author 2018)

CHAPTER THREE

Expression

PREFACE

Figure 3.1: Exploring the architectural possibilities of stitching together the existing (Author 2018)

3.1 Preface

Drawing from the previously discussed chapters, the contextual and programmatic informants are translated into an architectural expression, which is embedded in the theoretical premise.

Firstly, the conceptual intention of architecture as prosthetic device in Mamelodi East is introduced in relation to the overall analogy of the dissertation. Selected design precedents relating to the architectural intentions are discussed. An architectural response is explored, developed and refined through an iterative design process, which is influenced by the discussed design drivers. The iterative process influences the development of the design in terms of overall massing, plan, section, and various scales of detail, in order to achieve a final design synthesis that represents a holistic resolution.

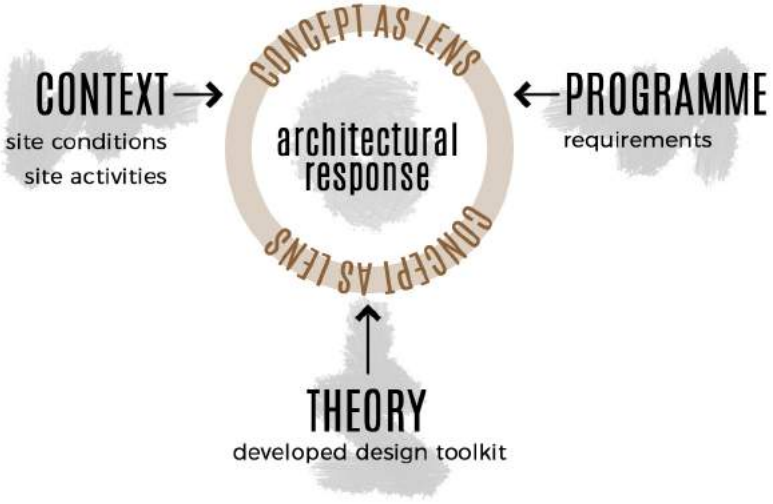


Figure 3.2: Diagram depicting the design drivers to produce architectural response (Author 2018)

CONCEPT

3.2.1 Conceptual intention

[Architecture as prosthetic device]

The Oxford dictionary defines a prosthetic device as an "*artificial substitute or replacement of a part of the body designed for functional or cosmetic reasons*". For the most part, a prosthetic device or artificial limb is observed to be a functional replacement or object to fill a gap of a missing body part. The poem Prosthetic illustrates this common perspective:

"A replacement,
An ornament,
Something essential,
But artificial."
(Unknown May 2017)

Health care architecture in our informal settlements and vulnerable communities has, in a sense, become a manner of 'prosthetic' devices within the urban landscape. That is to say, although essential or necessary, it merely becomes an ornament, artificial and is, in some cases, rejected. To ensure that the architecture created does not become an ornament in the urban landscape of Mamelodi East, the complex process of making a prosthetic device is used as analogy for an appropriate method to create architecture. By making a prosthetic, the process involves a patient-specific approach to ensuring a device that is perfect in its fit. To become unique, it undergoes a process of dialogue, planning, several adjustments, and refinement. As result, the carefully crafted prosthetic device connects perfectly to that which is existing, allows for adjustment and supplements the whole.

The following poem illustrates the proposed perspective of a prosthetic device and in parallel what the architecture created in Mamelodi East needs to be:

"A supplement,
A cornerstone,
Something essential,
But authentic."
(Author 2018)

The key qualities of a prosthetic that inform this architectural intervention are that it serves as a supplement and a cornerstone, while being at once essential and authentic. This analogy will be used as inspiration at various stages of the conceptual development and architectural process.

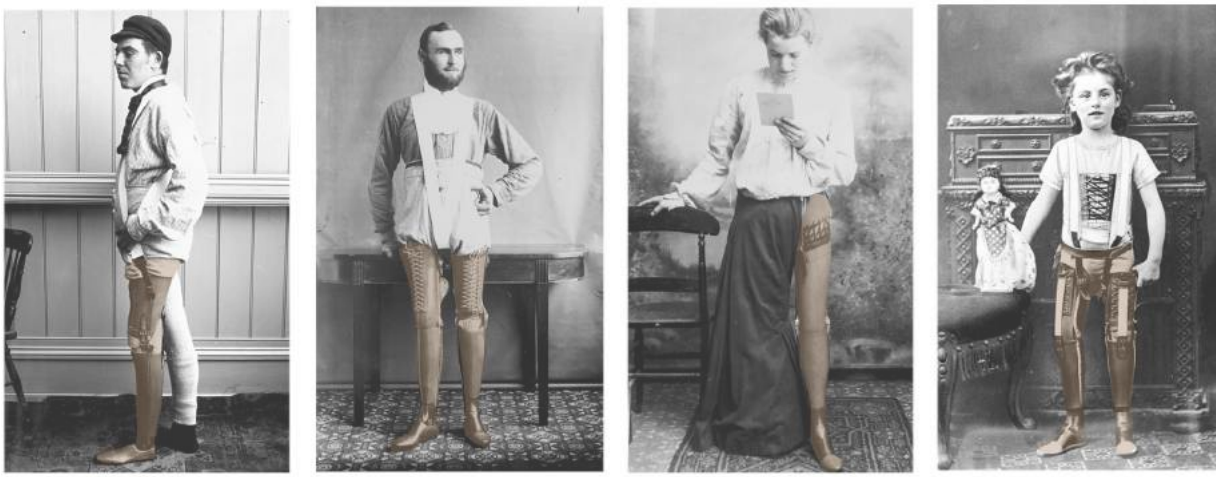


Figure 3.3: The unique leather artificial limbs created by James Gillingham (Arbuckle 2018)

Figure 3.4: Architecture as prosthetic device in Mamelodi East (Author 2018)

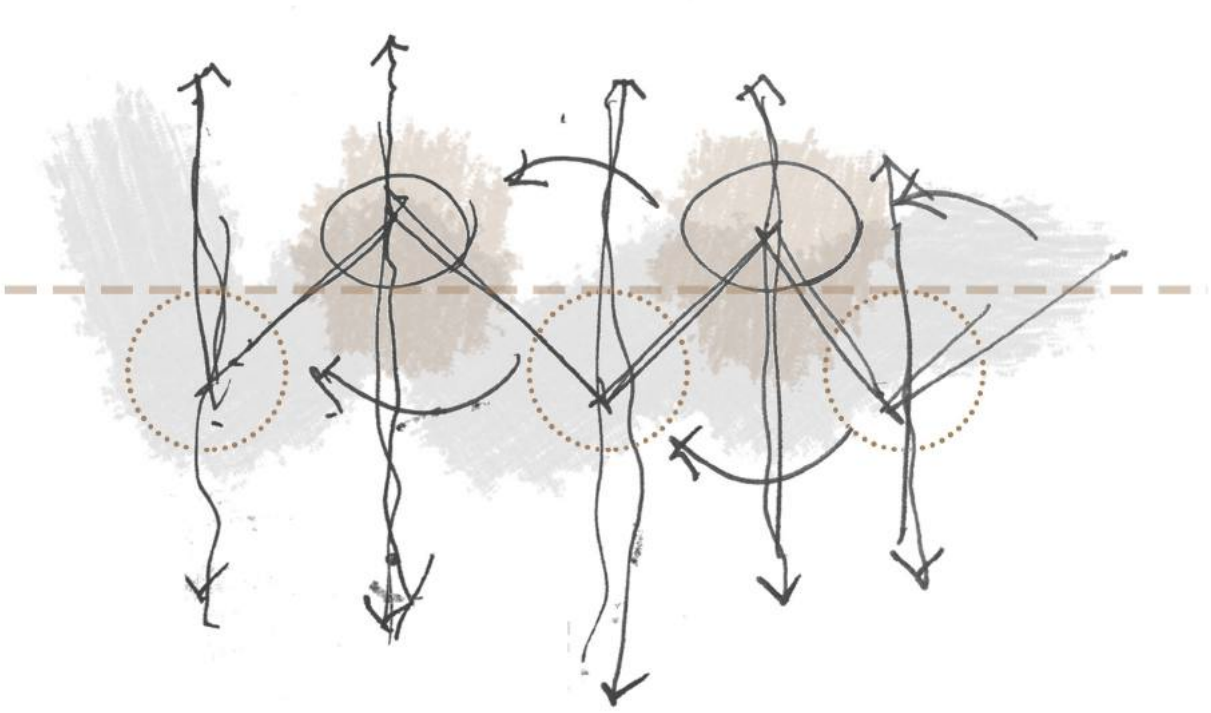


Figure 3.5: Exploring the notion of continuation, threshold and connection (Author 2018)

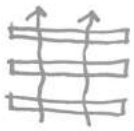
3.2.2 Conceptual expression

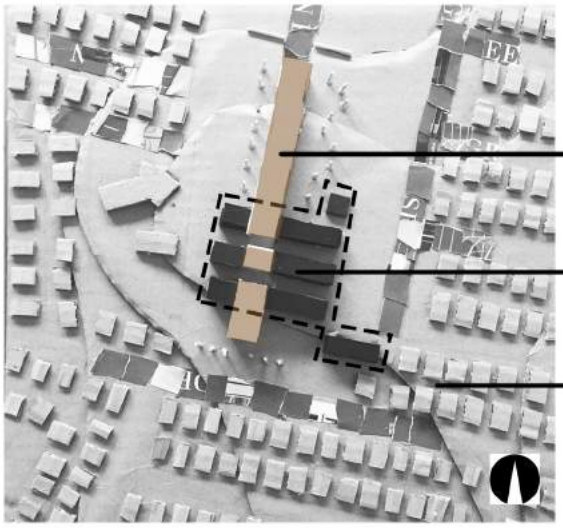
Similar to the function of a prosthetic device to fill in a missing limb, the architecture explored in this dissertation is seen as a device to fill in a missing gap within Mamelodi East. This mentioned gap references the general, urban and architectural issues in terms of health care settings as identified in this study.

Similarly, the architectural response is a unique and holistic approach to address the identified issues within the context through the lense of salutogenesis. The response aims to connect to the existing, allow for adjustment and strengthen the whole. This aligns with the theoretical premise explored and concurs with Fottler's (2000:95) statement which calls for health settings to be responsive to human needs and provide meaningful environments.

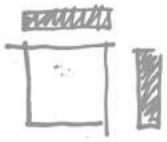
The conceptual intention is illustrated through an architectural exploration of continuation, threshold, and connection, with the starting point of the intervention at the existing school on site. A synthesis of all three approaches is created as the combination of these themes, providing the opportunity to address the identified issues.

THRESHOLDS



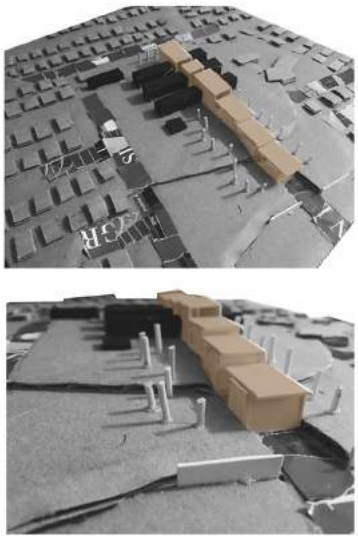


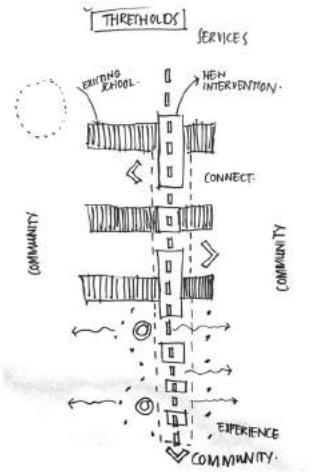
CONTINUATION



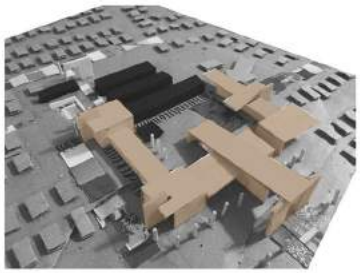
CONNECTION

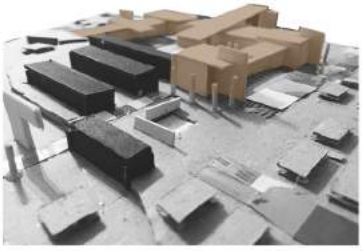
MODEL + SKETCH EXPLORATION

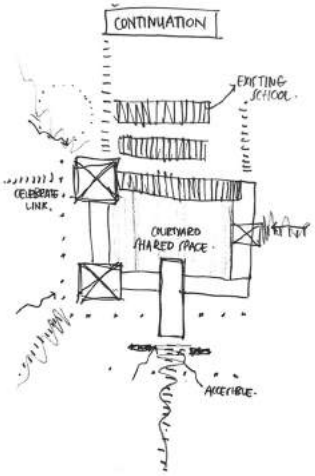




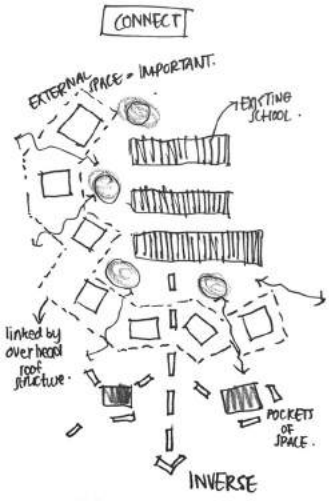
MODEL + SKETCH EXPLORATION



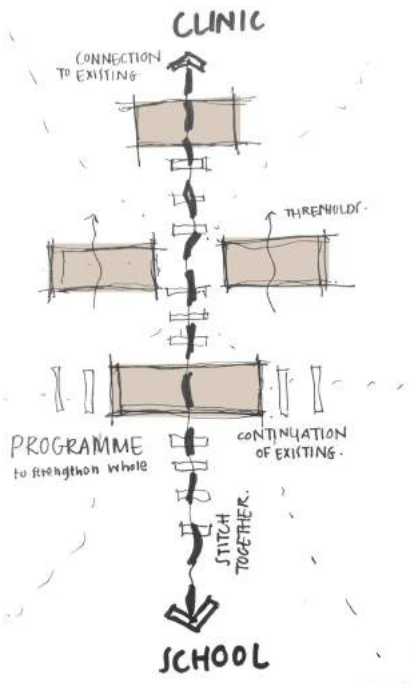




MODEL + SKETCH EXPLORATION



THRESHOLDS +
CONTINUATION +
CONNECTION =
HOLISTIC APPROACH

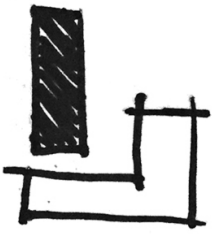


Synthesis of
conceptual intentions

Figure 3.6: Initial explorations of three conceptual approaches (Author 2018)

3.2.3 Architectural intention

The architectural intention of the dissertation is to integrate the fragmented urban landscape, define and celebrate meaningful public space, as well as consider the powerful tool of experience and possible exchanges. Furthermore, the architectural intent is to facilitate a public service that promotes a stimulating and nurturing environment within the community of Mamelodi East. Informed by the issues identified, proposed urban vision, concept, theory, programme and site, the following architectural intentions are proposed:

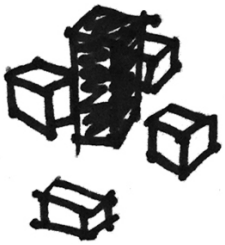


- **Block Vision | Infill**

Due to a lack of health care infrastructure in the inherited landscape of Mamelodi East (Master's research group 2018), it is necessary to fill the gap within the health referral system, in order to support and strengthen extant infrastructure.

- **Programme | Re-interpretation**

Re-imagining the current health care facilities within South Africa and Mamelodi East by challenging the traditional singular function, and centralised and curative approach through the lens of salutogenesis (Lindström 2018:98).

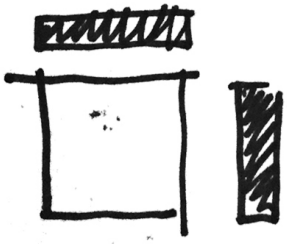


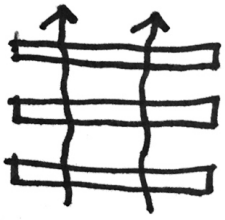
- **Site | Appropriation**

It is essential for the proposed architectural intervention to respect and respond to the context of Mamelodi East so as to ensure a holistic approach.

- **Concept | Continuation**

Similar to the function of a prosthetic device, the existing landscape and urban fabric will be celebrated and represented through an architectural intervention which connects to and strengthens the existing in Mamelodi East.





- **Theory | Experience**

To propose a public facility with multi-functionality that is responsive to human needs and provides a stimulating and nurturing environment (Fottler et al 2000:95) through sensory experience.

PRECEDENTS

3.3 Design precedents

Following the precedent studies discussed in the theoretical chapter, four selected projects are studied, which influenced the design development process and architectural thinking. The precedents illustrate how current health care facilities appear, as well as their future direction. Valuable architectural principles are appropriated from each precedent, and incorporated into the design development process.

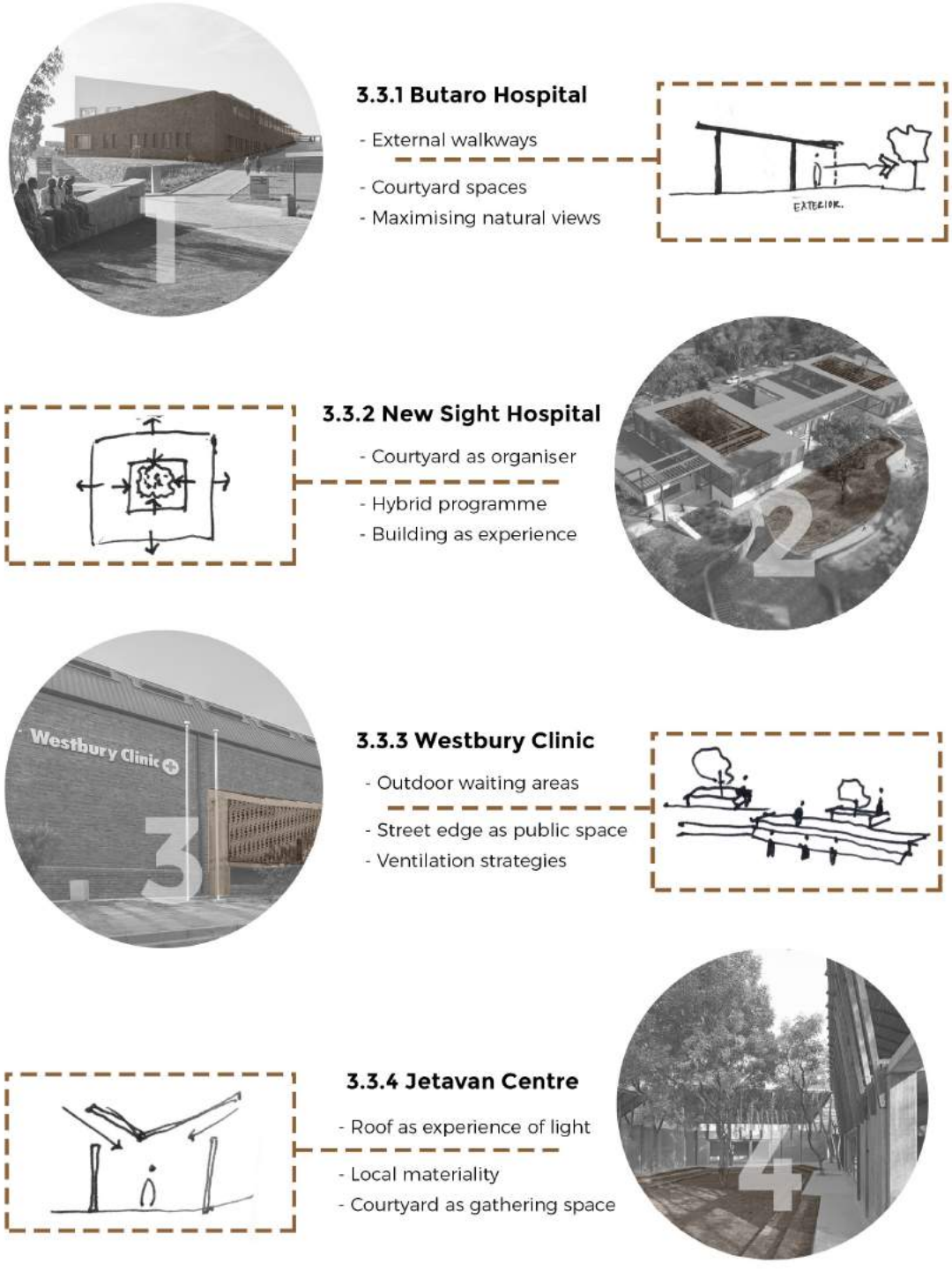
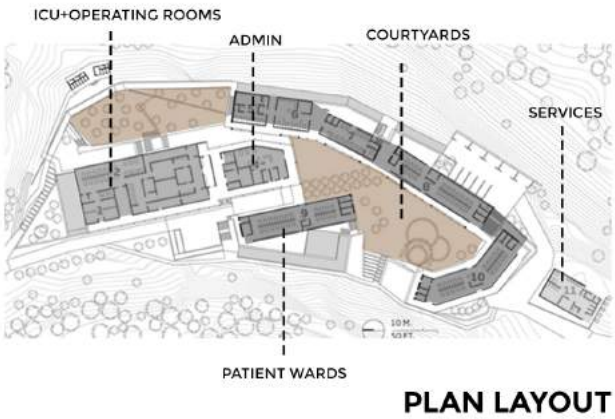


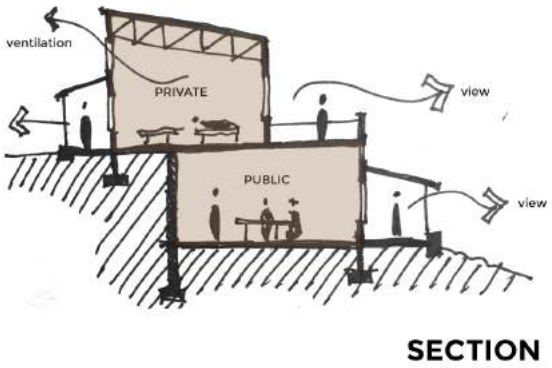
Figure 3.7: Summary of precedents investigated and architectural principles learnt from each project (Author 2018)

3.3.1 Butaro Hospital

LOCATION: Burera, Rwanda
COMPLETION: 2011
ARCHITECT: Mass Design Group

The notion of connecting man and landscape as main conceptual driver at the Butaro Hospital illustrates the importance of the natural environment in health settings (Bowler et al 2010:457). By implementing courtyard spaces, patients are encouraged to spend more time outdoors, where the chances of airborne disease transmission are reduced. These areas also create sanctuary getaways for both patients and staff. The building form is influenced by the topography and provides most spaces with direct views of plantscapes. External walkways and circulation spaces allow for optimal connection to natural views. Building and landscape become intertwined to reduce stress of users and provide nurturing spaces during their health care experience (MASS Design Group 2017).





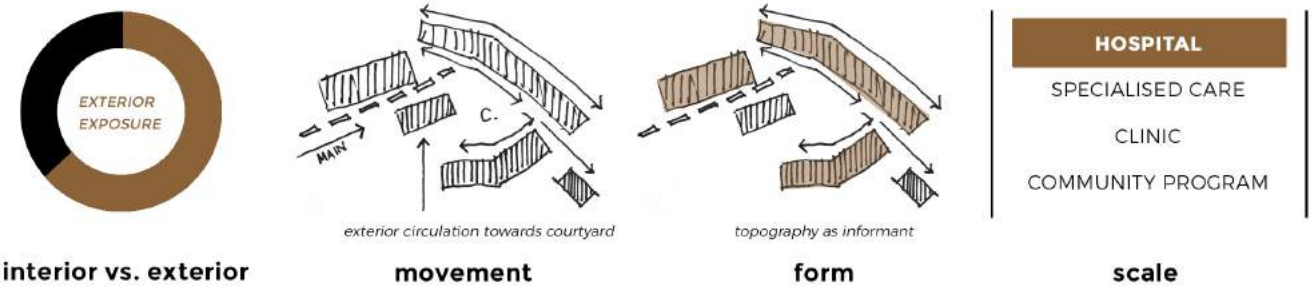
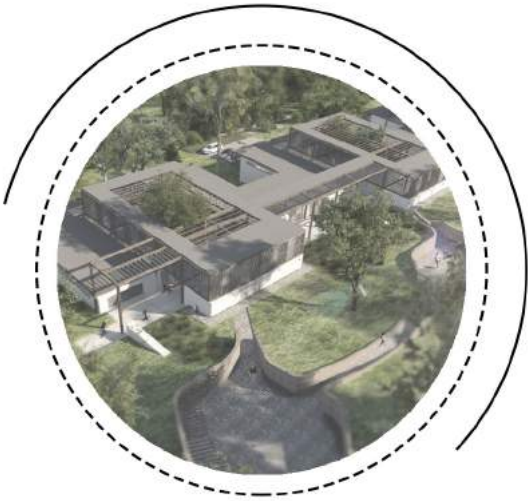


Figure 3.8: Precedent analysis of Butaro Hospital (Author 2018, photographs from MASS Design Group 2017)

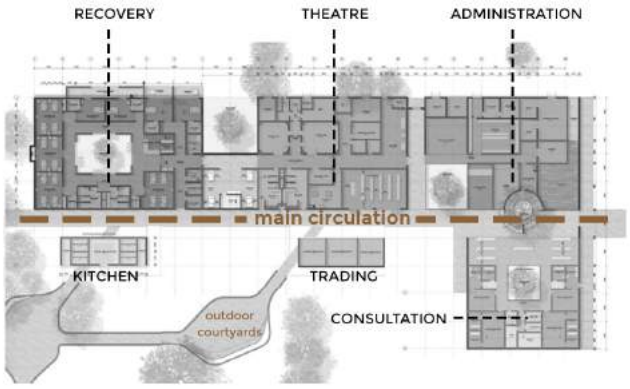


3.3.2 New Sight Hospital

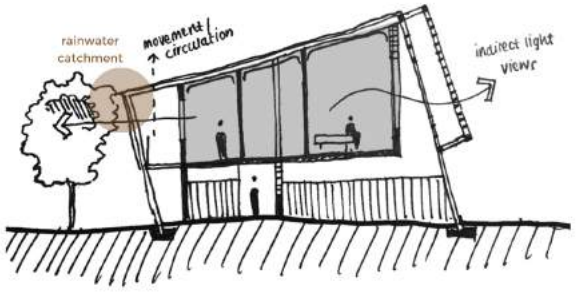
LOCATION: Impfondo, Republic of Congo
COMPLETION: 2017
ARCHITECT: Geyser Hahn Architects and Boogertman + Partners

The theory of sensory design (Malnar 2004:129) is illustrated in the New Sight Hospital through creating sensory experiences through the building for visually impaired users. The use of light, texture and local materiality moves away from institutional references through creating contextual familiarity and a sense of comfort.

Cultural aspects are also incorporated with informal kitchen spaces for families to prepare food together and encourage social interactions and exchanges as part of the healing journey. The experiential quality of place encourages a place of healing, but also a space that celebrates the wonderful gift of sight (Africa Architecture Awards 2017).

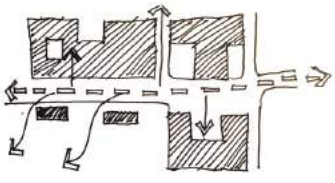


PLAN LAYOUT



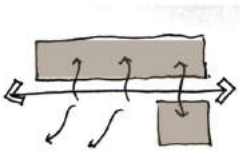
SECTION

interior vs. exterior



main spine with secondary circulation

movement



dissected L-shape typology

form

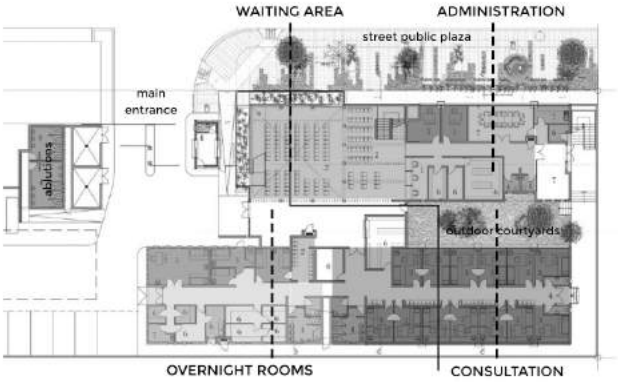
scale

Figure 3.9: Precedent analysis of New Sight Hospital (Author 2018, photographs from Africa Architecture Awards 2017)

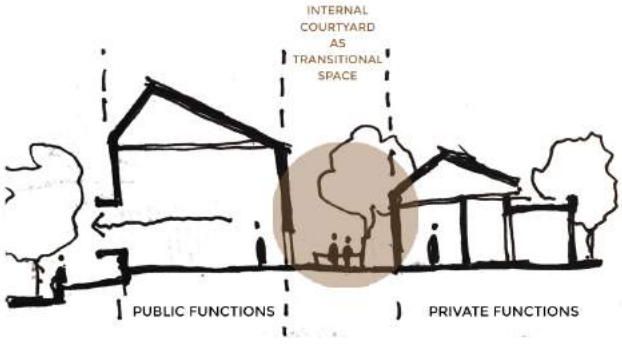
3.3.3 Westbury Clinic

LOCATION: Westbury, Johannesburg
COMPLETION: 2016
ARCHITECT: Ntsika Architects

The design of the Westbury Clinic is inspired to mitigate and reduce the transmission of airborne diseases through innovative design elements and systems. Making use of a courtyard space with ample seating and shading as exterior waiting area, the clinic illustrates the use of outdoor environments as tool for optimal healing spaces. The clinic encourages patients to wait in the outdoor space to reduce risk of transmission with patients waiting indoors. Not only does it assist with effective ventilation but also provides users with a direct connection to the natural environment (Ulrich 2006:S39), contrasting from typical indoor waiting spaces located in passages and reception areas. As a result, the overall function of the clinic attempts to eliminate stigmas linked to health care and the ill by creating a welcoming and nurturing environment (Africa Architecture Awards 2017).

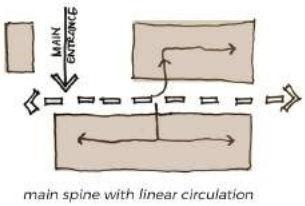


PLAN LAYOUT

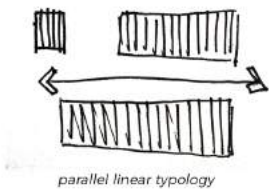


SECTION

interior vs. exterior



movement



form

scale

Figure 3.10: Precedent analysis of Westbury Clinic (Author 2018, photographs from Africa Architecture Awards 2017)

3.3.4 Jetavan Centre

LOCATION: Maharashtra, India
COMPLETION: 2016
ARCHITECT: Sameep Padora & Associates

With a focus on the symbolic representation of the Buddhist tradition and belief, the architecture represents a place of welcoming for monks after their walking pilgrimages. The use of local materials aims to establish familiarity and support local craftsmanship. Furthermore, to contrast the heaviness of the programme, the roof profile allows for natural light to filter down in spaces to create lightness through the architecture.

The openness and simplicity of the spaces allows for adaptability and various courtyards serve as spatial organiser for the different functions of buildings Therefore, it is evident that the centre illustrates the use of space and form (Mazuch 2017:42) to create welcoming and familiar environments. (The Architectural Review 2016).

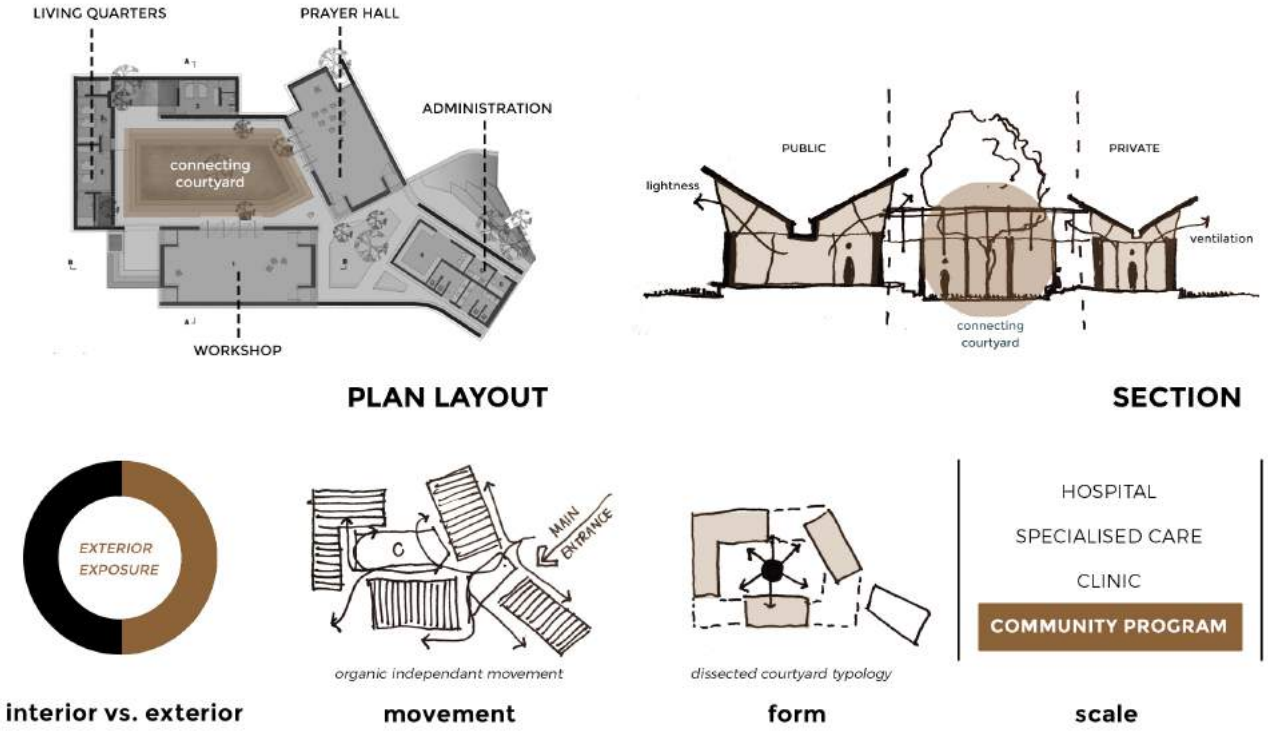


Figure 3.11: Precedent analysis of Jetavan Centre (Author 2018, photographs from The Architectural Review 2016)

DESIGN DEVELOPMENT

3.4.1 Design drivers

Emanated from a synthesis of the preceding discussed chapters, three main design drivers are identified to inform a first design attempt. A brief overview is given for each design driver to indicate their contribution at the initial stages of the iterative design process:

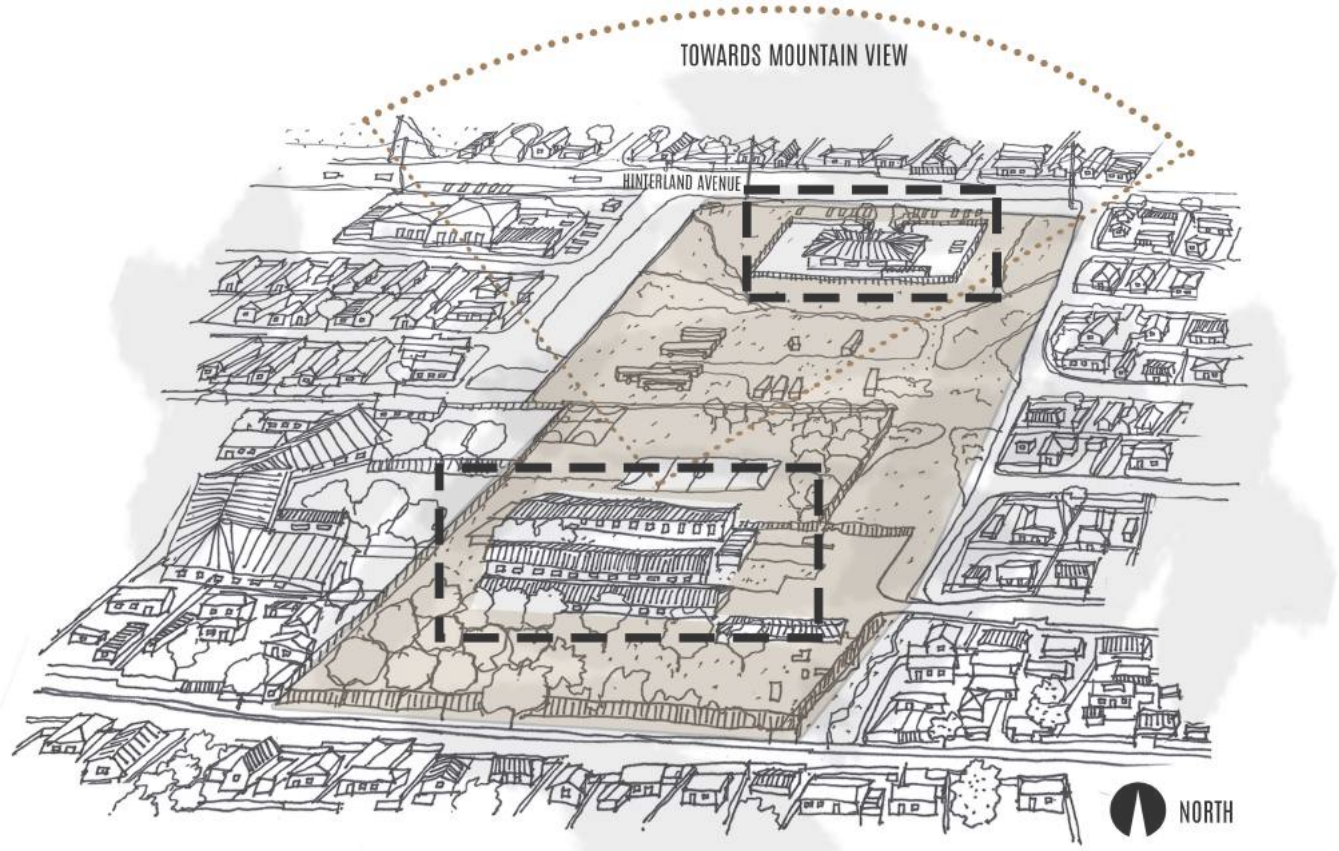


Figure 3.12: Proposed site sketch and context (Author 2018)

Site and context as design driver

Derived from the identified site conditions and context in chapter one, constraints and opportunities are identified on the proposed site and informed the basic layout and orientation of the building. The proposed site is located between the existing Phamaneng Clinic on the northern boundary, adjacent to Hinterland Avenue, and the existing Nwa-Vangani Primary School located on the Southern boundary, with residential edges on the Eastern and Western boundaries. As an intuitive response to begin to create a connection between the existing clinic and school, a strong main axis is established to link both existing buildings and the new screening facility. Influenced by the large area of space available between the two existing buildings and the topography of the site, the proposed intervention is a series of buildings connected by walkways and courtyards. This ensures minimal excavations, and enables the building to form part of the natural fall on site. It also provides the opportunity to orientate most of the buildings towards the North, which can contribute to passive design strategies and optimal natural lighting within spaces (Institute for Human Centered Design 2009).

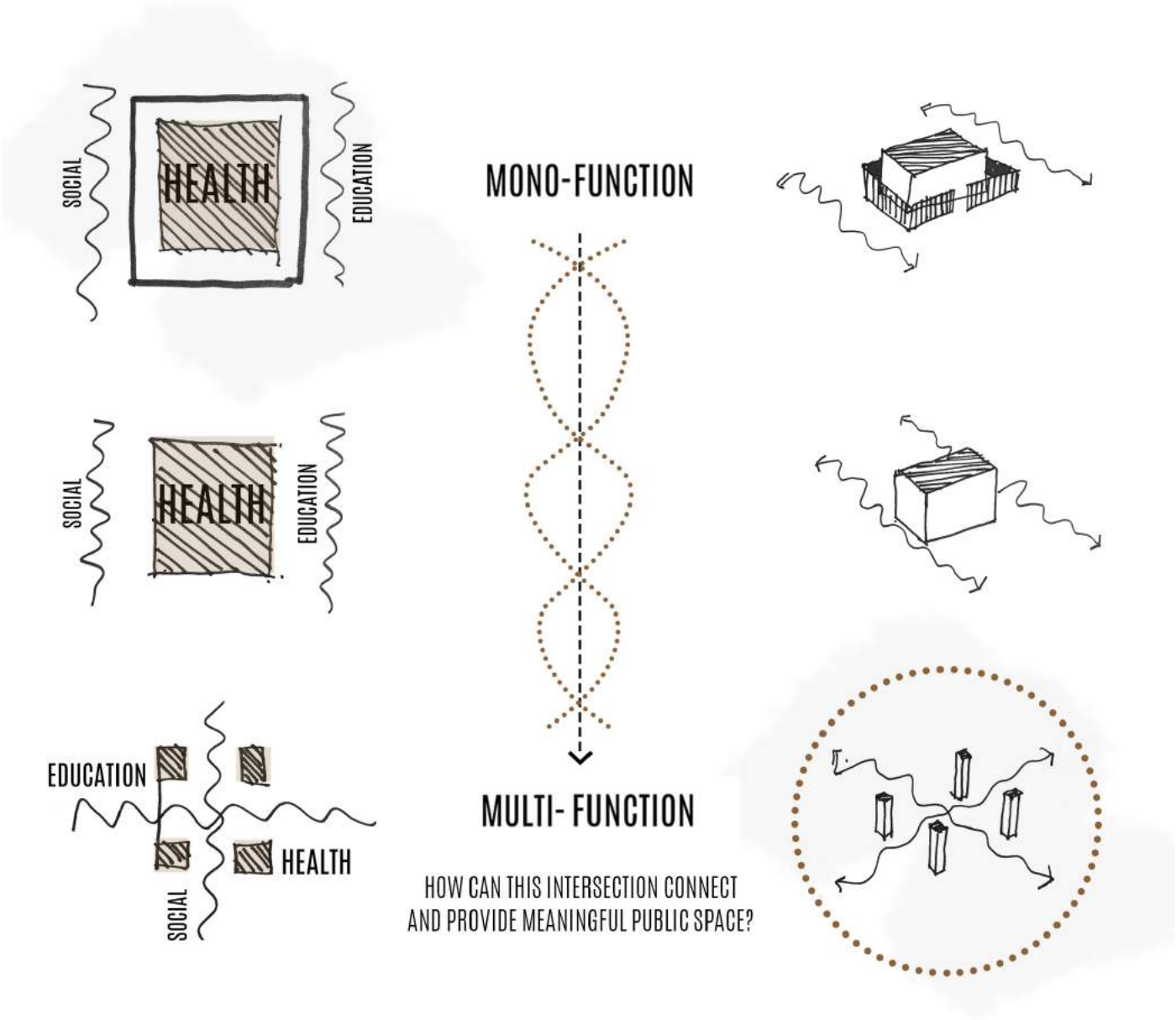


Figure 3.13: Diagram indicating the overlap of public sectors as design driver (Author 2018)

Programme as design driver

As discussed in the introductory chapter, the project explores the hybridisation of health and education sectors in Mamelodi East, to illustrate how the intersection can create meaningful public spaces and exchanges. This informed the basic zoning of the functions, locating functions that support the existing clinic towards the Northern edge, and functions that support the existing school towards the Southern edge, while placing the new screening facility at the core interstice between the two.

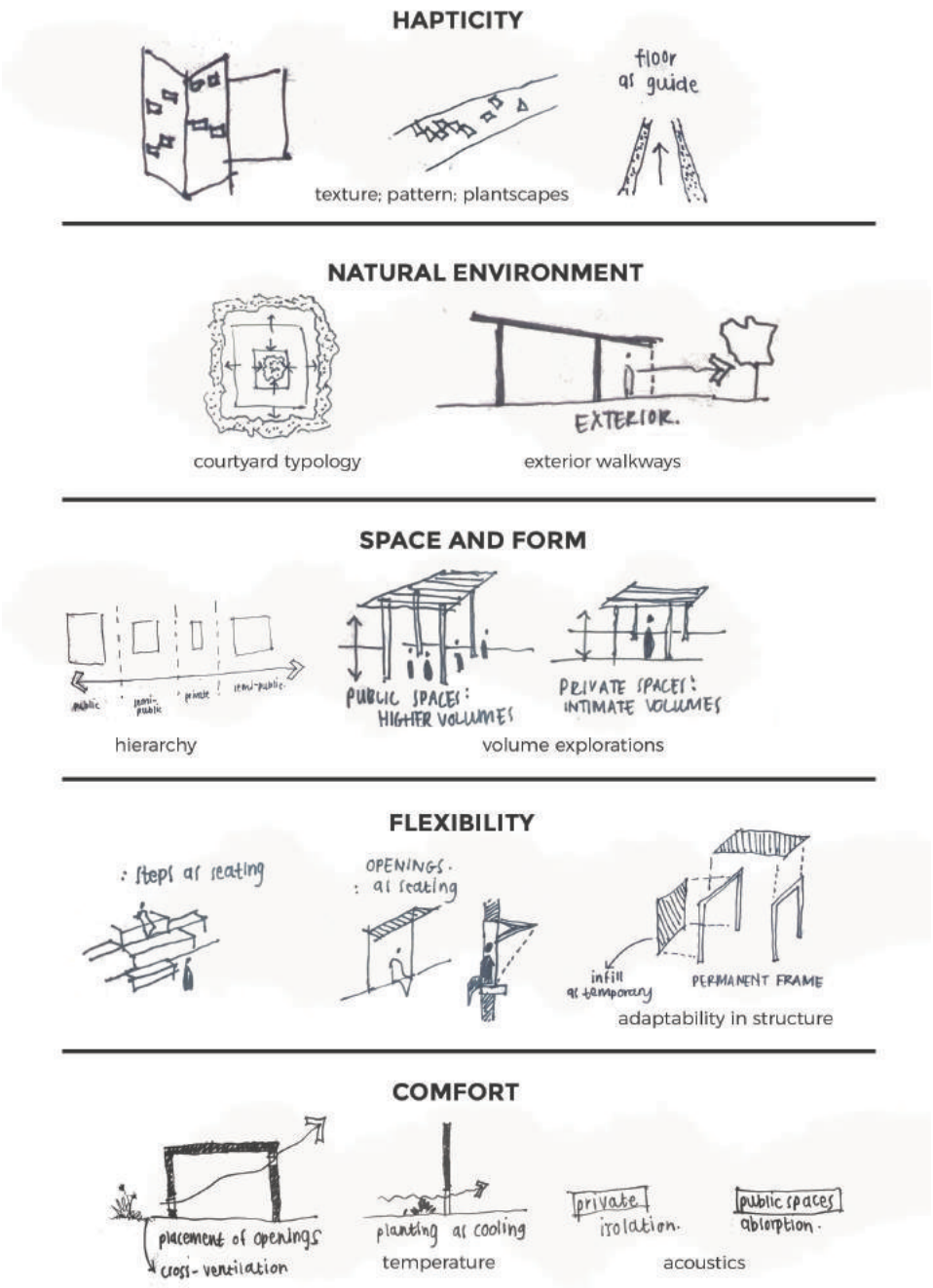


Figure 3.14: Sketch explorations of theory as main design driver (Author 2018)

Theory as design driver

Together with site and programme, the design is predominantly guided by the the principles derived from the theoretical premise, namely hapticity, natural environment, space and form, visual, flexibility, and comfort. These principles influence the architecture on numerous levels from space and form, to technical details such as texture and finishes. The design showcases salutogenic and sensory architecture through incorporating the above-mentioned principles in support of the programmatic and spatial requirements. As result, efficient health care settings, which is also nurturing and stimulating for users, are proposed in agreement with Fottler's statement (Fottler et al 2000:95). Developed in the design guidelines for each principle, the identified architectural elements are incorporated and further explained in the forthcoming design iterations.

3.4.2 Design iterations

Drawing from the discussed architectural intentions, precedent studies as well as the identified design drivers, a series of design iterations are explored to not only provide an appropriate architectural response within Mamelodi East but also ensure a healing and stimulating health environment which illustrates the theoretical argument.

"Iteration is the conversation you have with your ideas."

(adapted from Tom Wujec in Dam & Siang 2018)

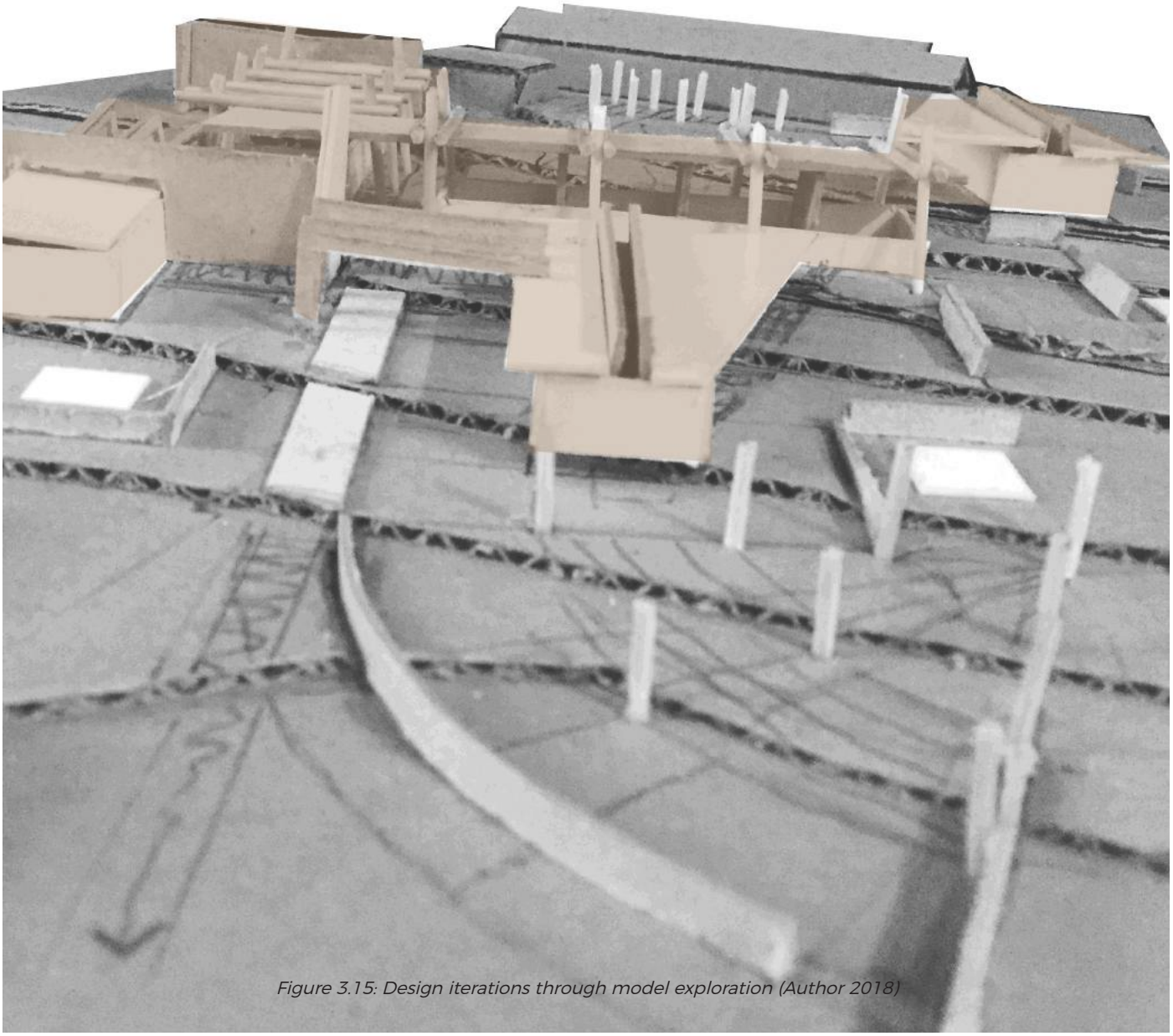


Figure 3.15: Design iterations through model exploration (Author 2018)

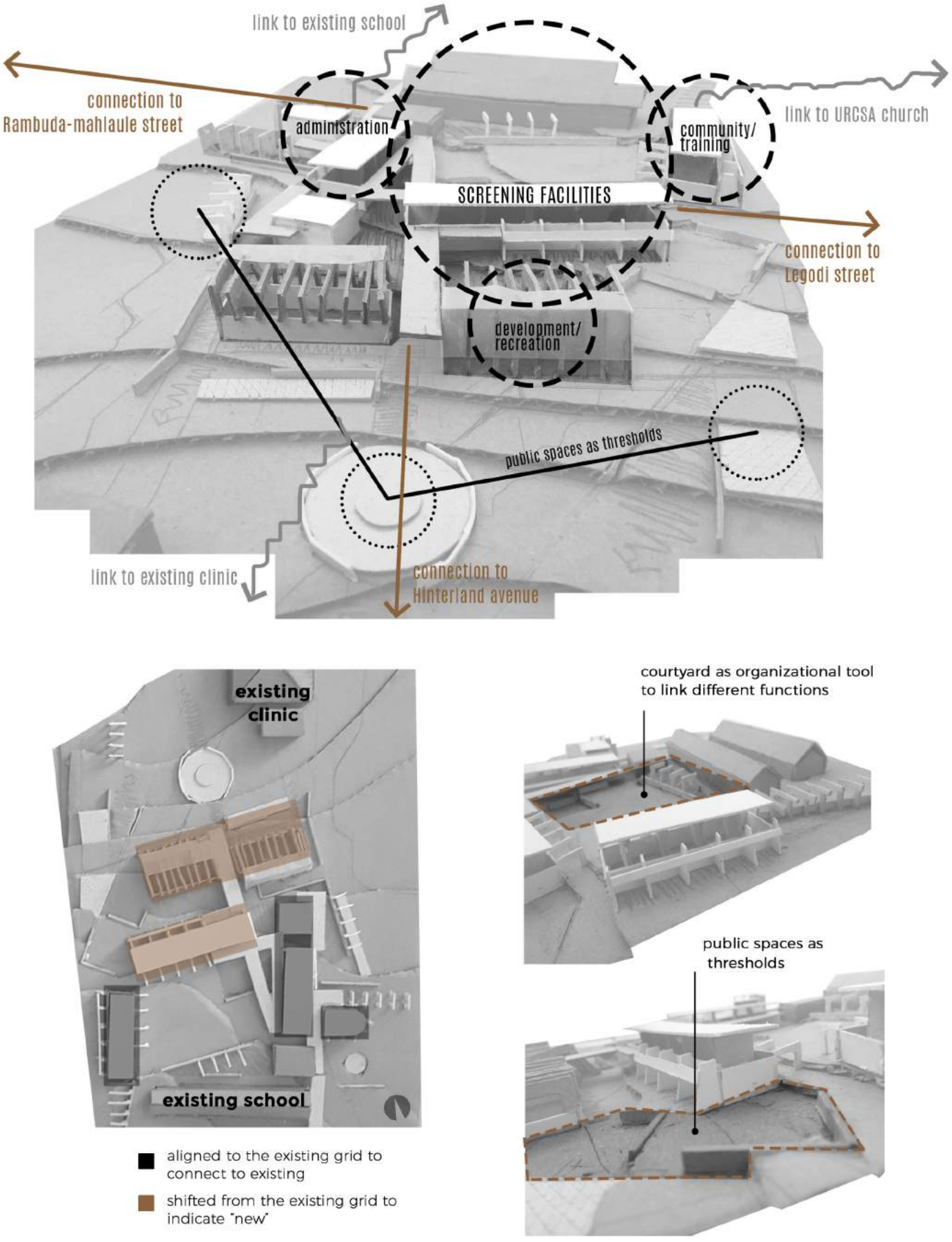


Figure 3.16: Iteration One model explorations (Author 2018)

Iteration One

Following from the conceptual explorations, the first iteration explores the site, programmatic functions, potential form and massing, as well as the relationship between new and existing buildings. Placing focus on the screening function, the secondary spaces, such as the recreational and community functions, surround the primary screening spaces through a central courtyard space as organisational tool. The courtyard also serves as new play area for the existing primary school and main waiting area. To support the salutogenic principle of comprehensibility through providing perceptual cues to assist in perceptual processes (Golembiewski 2017:270), the first iteration aims to create an accessible environment. A central axis is created as spine for circulation and way finding. Possible connections are suggested to the surrounding context of residential edges, with public spaces as thresholds. The linking spaces between new and existing are aligned to the existing grid to connect. The orientation of the building is then shifted off the existing grid to represent the new as well as ensure optimal Northern orientation (Institute for Human Centered Design 2009). The administration spaces of the new building are connected to the existing school building's administration office to serve as link. The hierarchy in spaces follows the approach to introduce, treat and release. Main entrance, administration and waiting spaces introduce the user into the building. The screening rooms located in the core of the building form the layer where children undergo screening consultations. Afterwards, recreational spaces within the building such as art, music, reading and garden spaces form part of the means of release of the user into a stimulating and nurturing environment after the screening process.

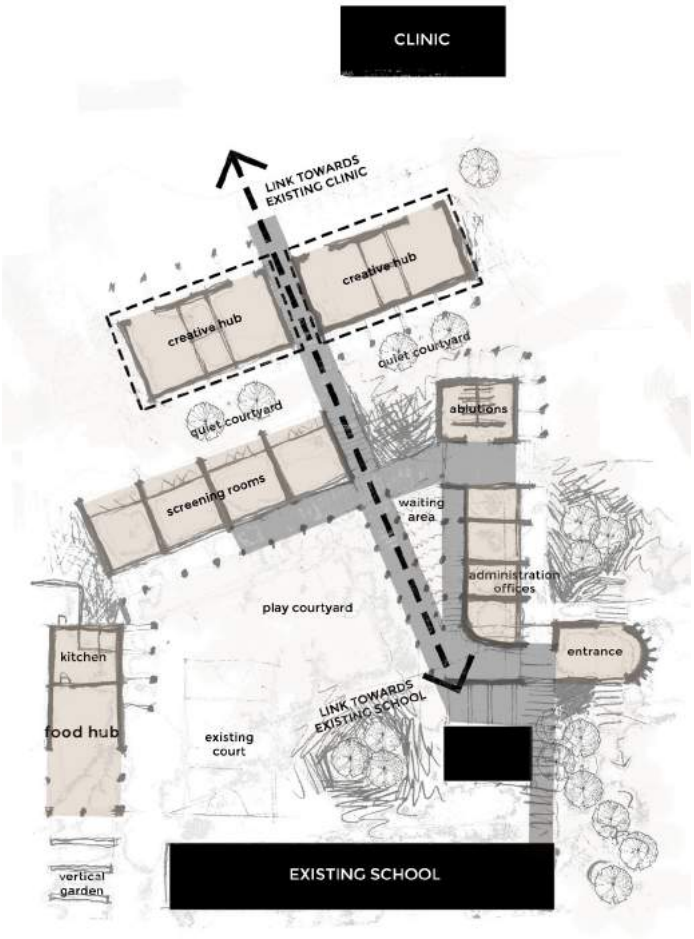


Figure 3.17: Iteration One sketch plan explorations (Author 2018)

Reflection

The initial approach connects the existing primary school and the existing clinic to the new intervention which illustrates the architectural intentions of infill as well as continuation. The site requires further exploration beyond the scope in terms of edges, possible connection to the existing clinic and the way in which public spaces can be activated to encourage meaningful exchanges. Although the shift in alignment with the existing is beneficial in terms of Northern orientation as seen in the precedent study of the Hazelwood School (Institute for Human Centered Design 2009), the connection between the aligned buildings and shifted buildings creates uncomfortable spaces. Accessibility of the building ought to be considered to allow for approaches from both clinic and school. With the large area of courtyards and open space available, the connection between building and landscape should be explored to contribute towards healing learning, and productivity of users (Shishegar & Boubekri 2016:18).

Iteration Two

From the reflection of the first iteration, the site, potential form and massing as well as the relationship between new and existing buildings are reconsidered. The second iteration follows a similar approach in programmatic organisation, placing the screening function central within the building. This ensures a hierarchy in space (Institute for Human Centered Design 2009), placing public functions, such as administration and recreation on the edges, and private functions, such as screening, at the core. The building is shifted from the existing grid to indicate the new intervention. Connection spaces to the existing primary school are created through tectonic and landscaping elements, which lightly stitch together the new and the extant. The recreational functions of the building are rotated in an East-West orientation, to respond to the street on the Western edge. The approach to the building is modified by creating entrances from the existing clinic, existing primary school, and new screening facility. This allows for each function to be accessed and operate independently, but lessens the conceptual approach to introduce, treat, and release users. Similar to the Westbury Clinic (Africa Architecture Awards 2017), a public plaza and landscaping elements are implemented on the Northern edge to provide meaningful waiting space which provides optimal connection to the natural environment (Foster and Partners 2018).

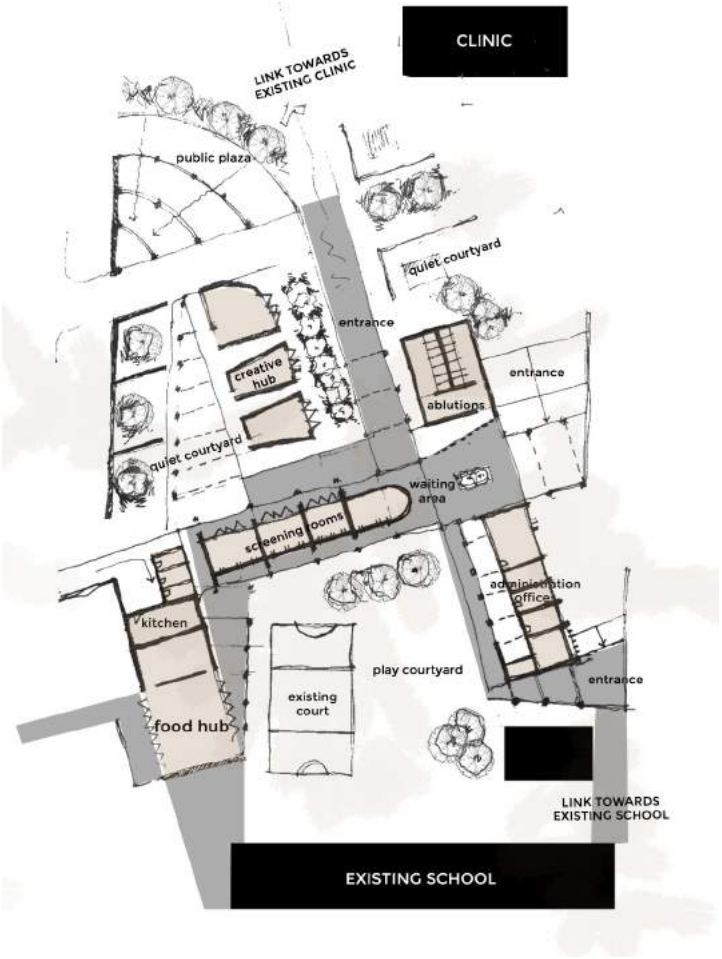
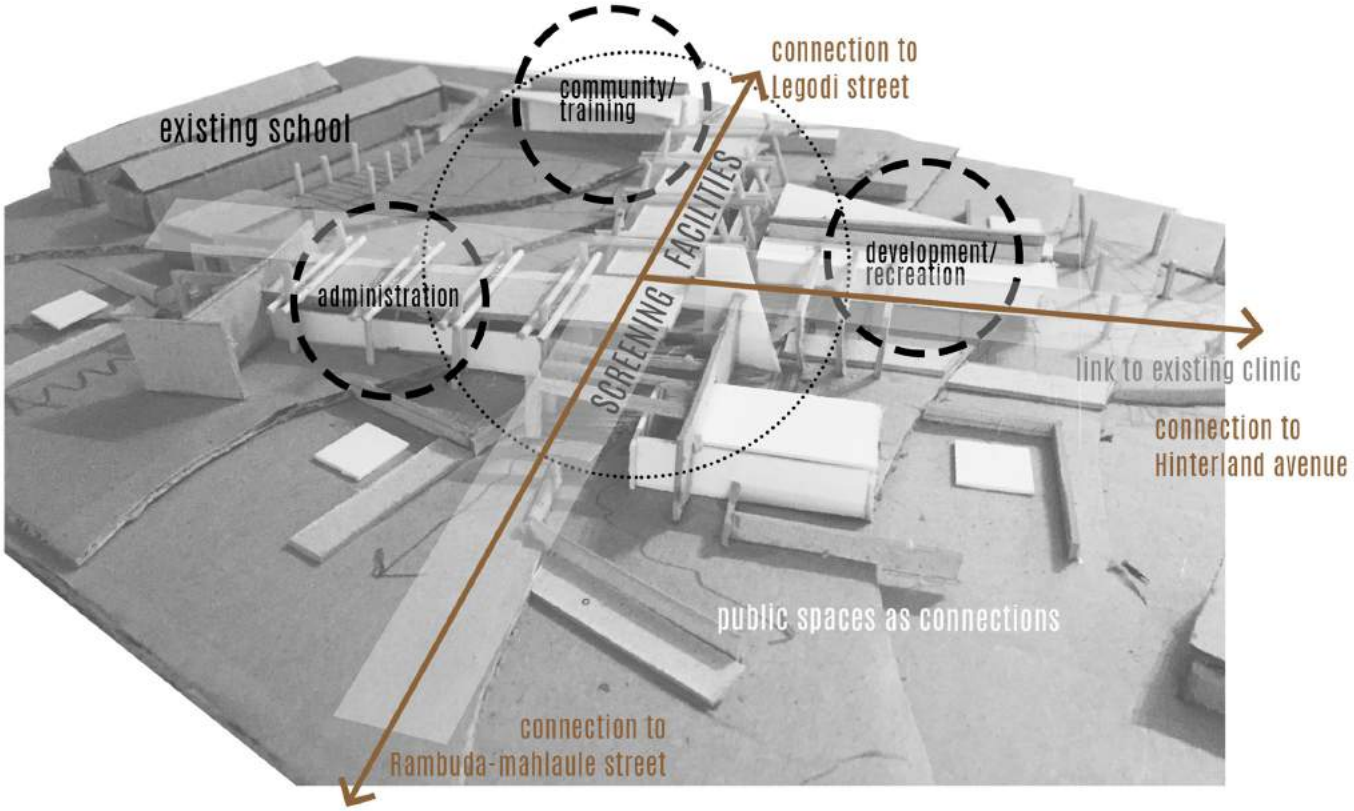
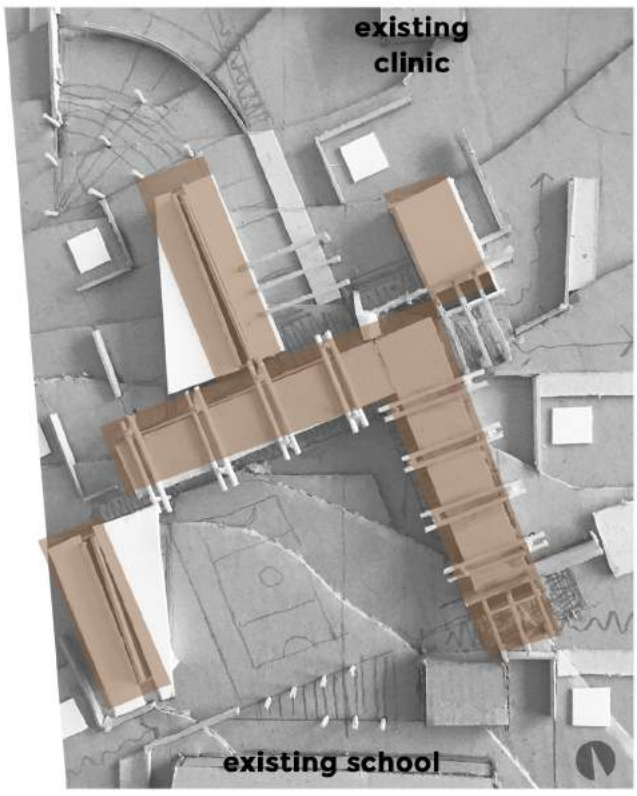


Figure 3.18: Iteration Two sketch plan explorations (Author 2018)

Reflection

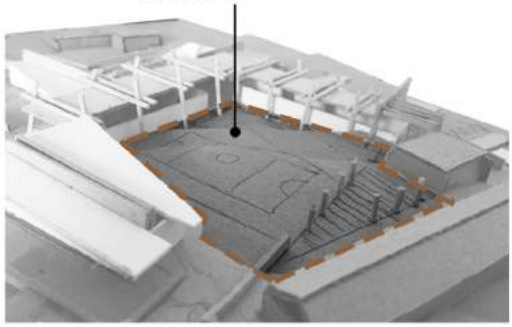
Although the second iteration addresses some of the shortcomings in the initial iteration, the opportunity to connect to the existing clinic is limited and still does not satisfy the architectural intention of continuation. The possibility of three entrances to the building creates a safety concern in terms of access, and ought to be re-evaluated by creating threshold spaces allowing constant passive surveillance. The community food hub and COPC training functions only create shared resources for the existing primary school, and can possibly be separated to support both existing clinic and primary school to introduce a multi-function facility that creates a people-oriented environment (Boljuit & Hinkema 2005:4). The recreational spaces are located on the North Western edge of the site, so as to ensure the release of the user into meaningful public space, but an opportunity is overlooked to link the recreational functions to the existing school as supporting programme for the children during school hours in support of the principle of flexibility.





shifted from the existing grid to indicate "new"

courtyard as as meaningful space providing interaction with nature



public plazas as activation for exchanges

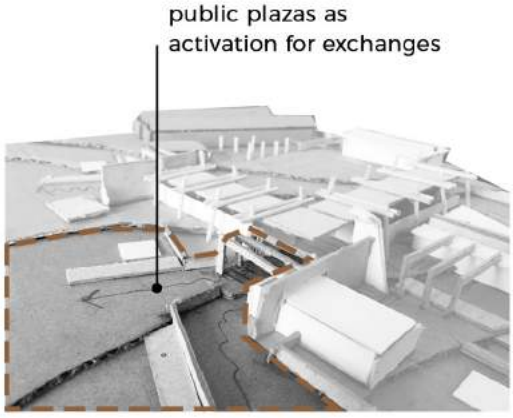
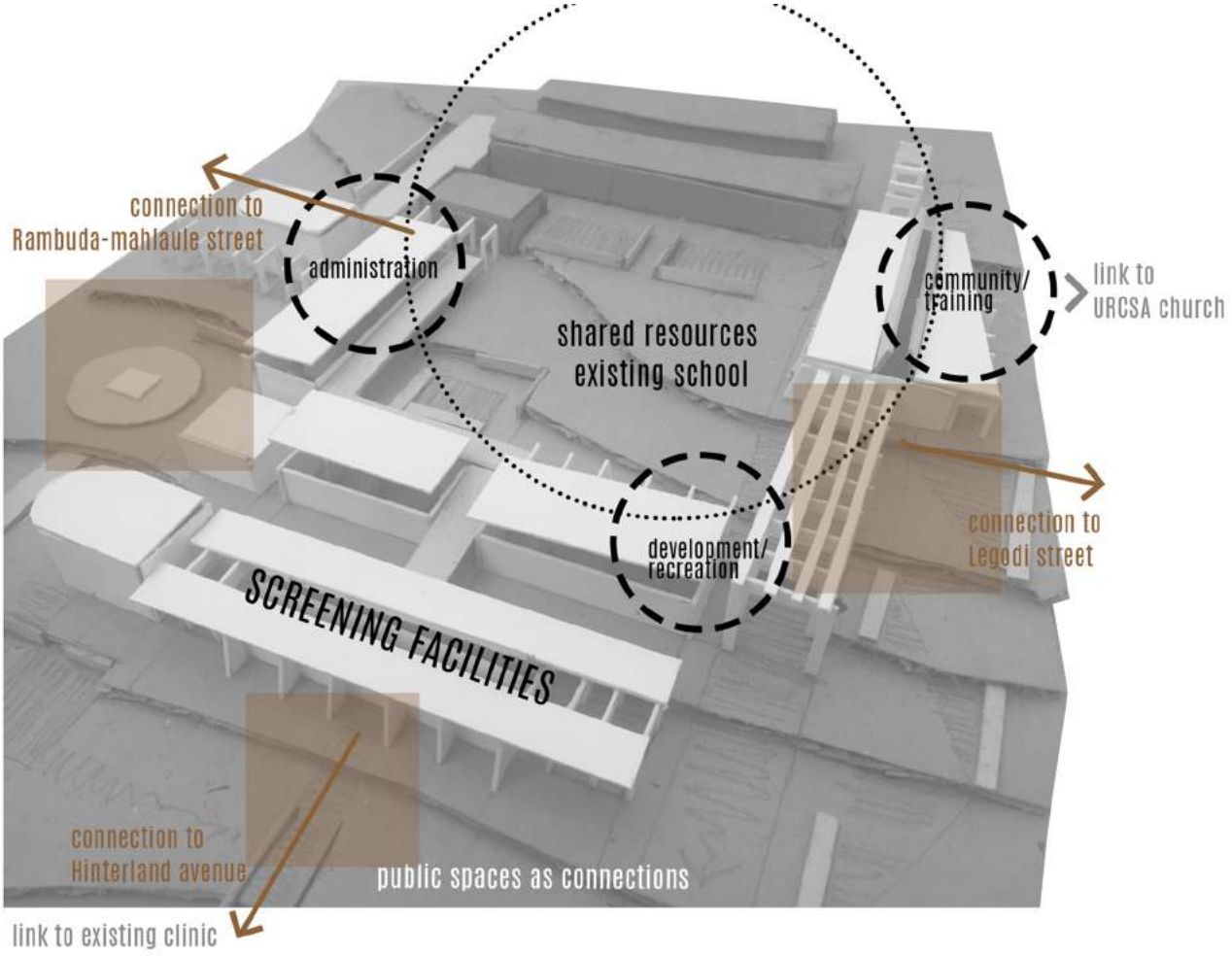


Figure 3.19: Iteration Two model explorations (Author 2018)



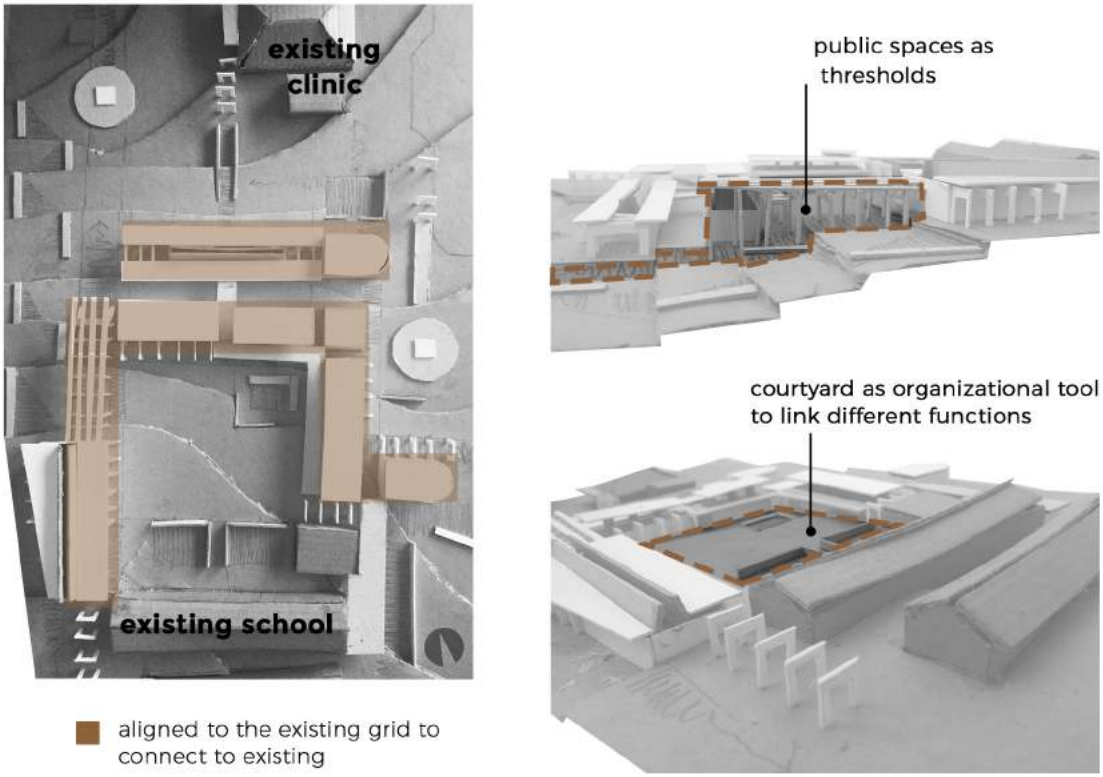


Figure 3.20: Iteration Three model explorations (Author 2018)

Iteration Three

A third iteration is explored to address the reflection mentioned above. The orientation, potential form and massing, as well as the relationship between new and existing buildings, are re-considered. In contrast to the second iteration, the third approach shuffles the programmatic organisation, removing the screening function as central core within the building to address the notion of shared resources towards the school and the clinic. The administration, community and COPC training, as well as the recreational spaces, frame the courtyard space towards the existing primary school with the screening function located towards the Northern edge, linking to the existing clinic. To ensure easy wayfinding and guidance (Institute for Human Centered Design 2009) through the building, the connection between the buildings is created with a prominent walkway to create a comprehensible environment, which influences the process of perception and development (Mostafa 2014:145).

The third iteration explores the possibility of orientating the new building within the existing grid to create a continuation of the surrounding context to contribute to contextual familiarity as mentioned in the salutogenic principle of comprehensibility and meaningfulness (Golembiewski 2017:270) as well as the architectural intention of continuation. As a result, the existing court and new play area for the primary school is framed similar to the New Sight Hospital's (Africa Architecture Awards 2017) design which uses courtyard spaces as organiser. Therefore, the building serves as threshold and creates a semi-public space that is safe for children. Entrance to the building is limited to a secondary entrance from the existing clinic and a primary entrance from the existing primary school. This allows for the existing clinic to make use of the new screening function.

Reflection

After evaluation, the third iteration revealed

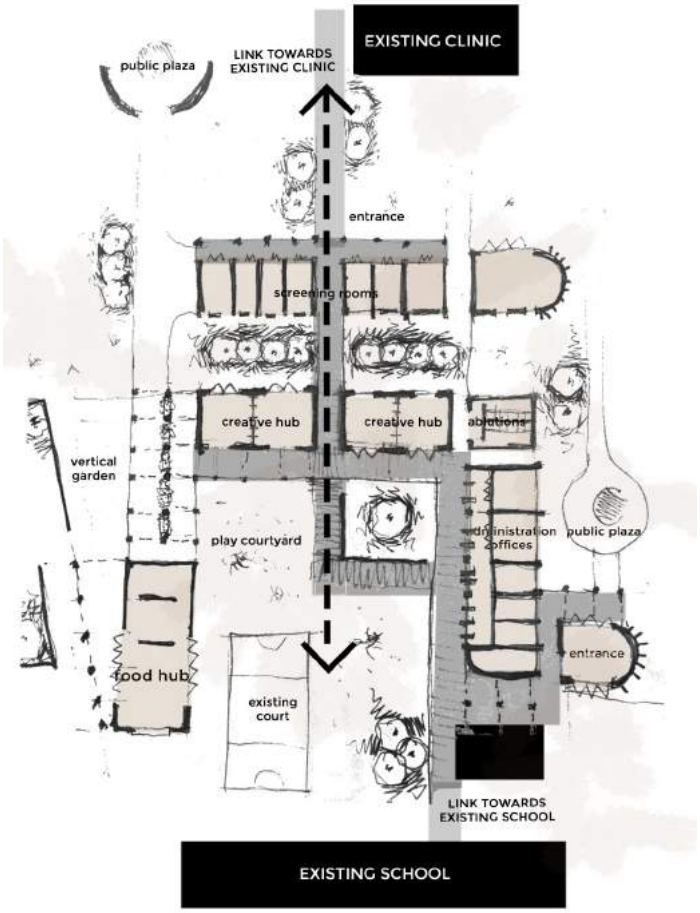


Figure 3.21: Iteration Three sketch plan explorations (Author 2018)

possible opportunities to further develop programmes to link to the existing clinic to create shared resources. Similar to the Westbury clinic (Africa Architecture Awards 2017), the open areas and edges towards the existing clinic can be further explored in terms of creating activated public spaces for exchanges. The vegetable garden to produce food for the cafeteria can be expanded to allow for community participation, encourage urban farming in the area and also support the principle of natural environment (Ulrich 2006:S39) and the sensory experience (Day 2017) it can provide for users. The idea of courtyard spaces can be revisited to provide different outdoor spaces for users as waiting space similar to the Butaro Hospital (MASS Design Group 2017).

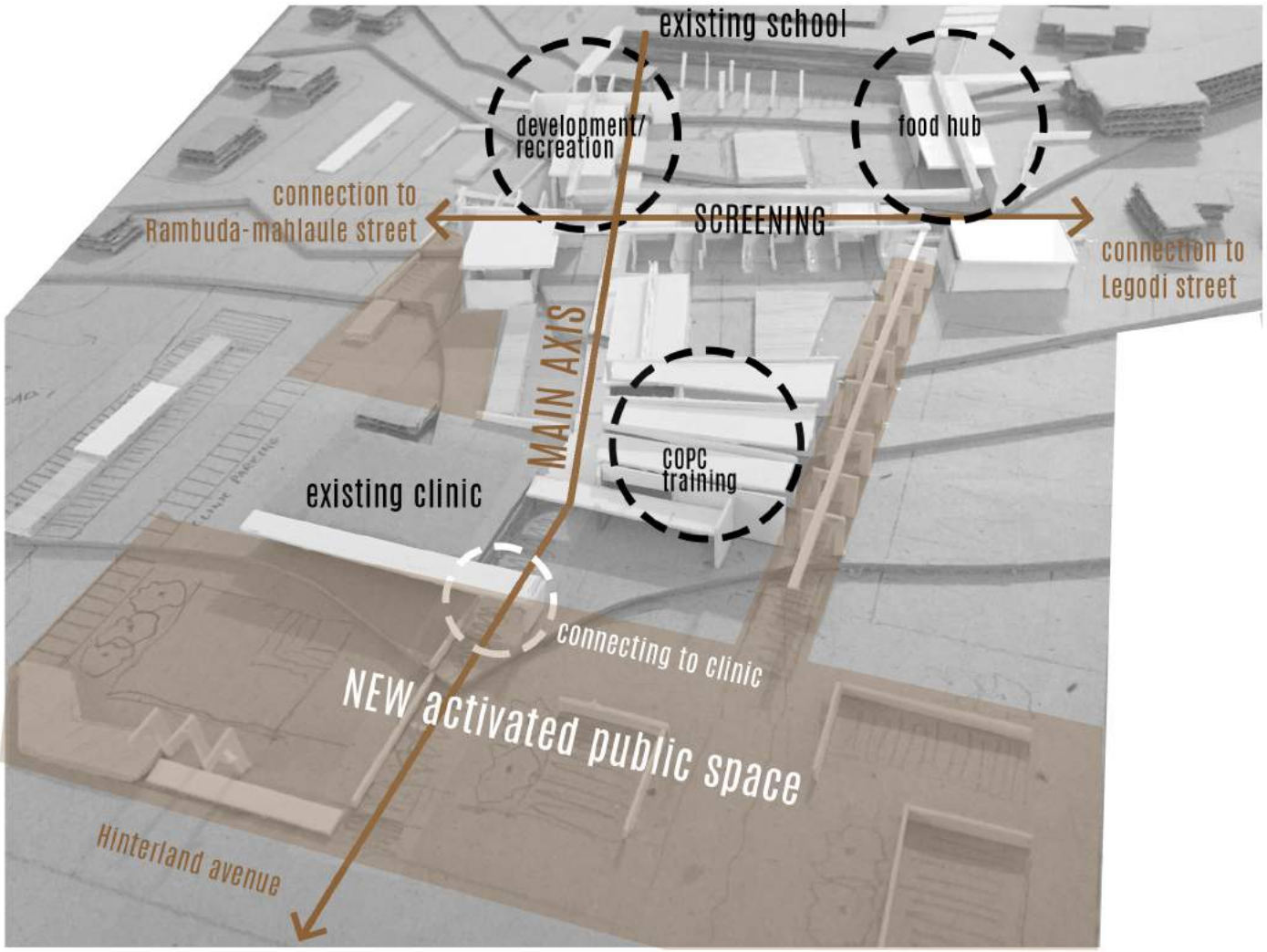
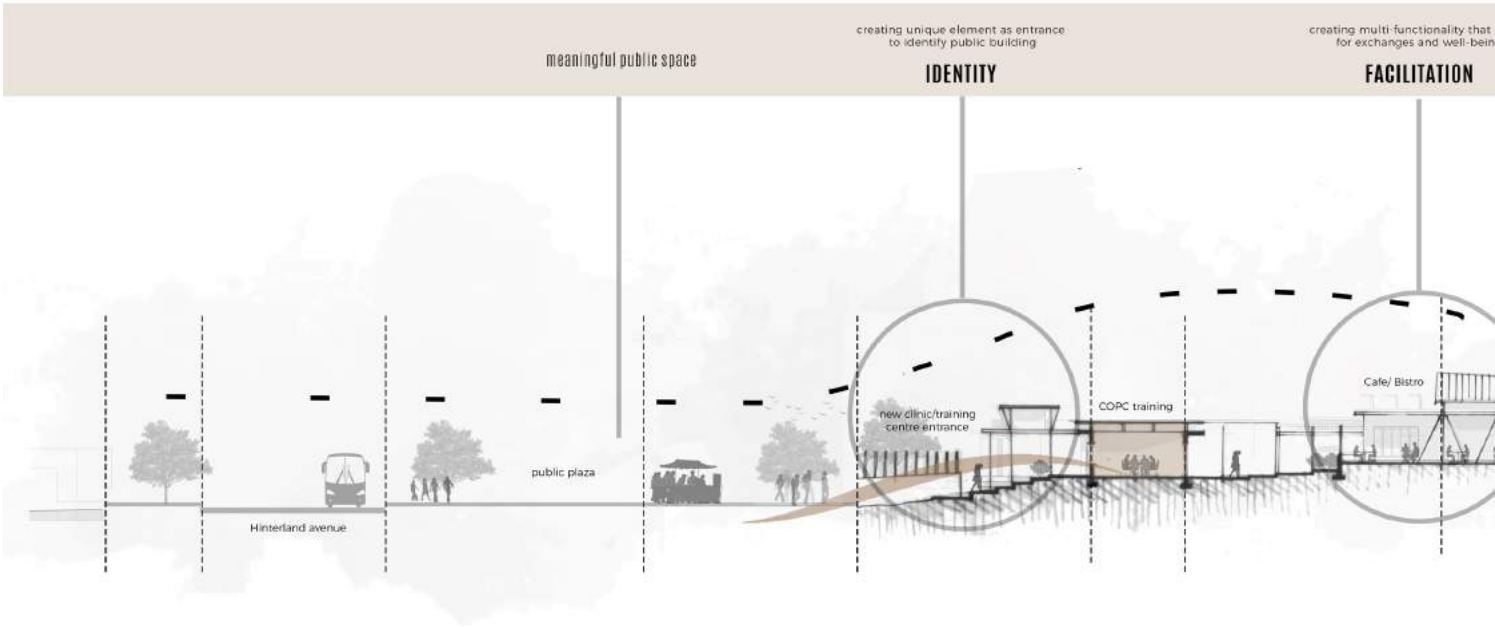


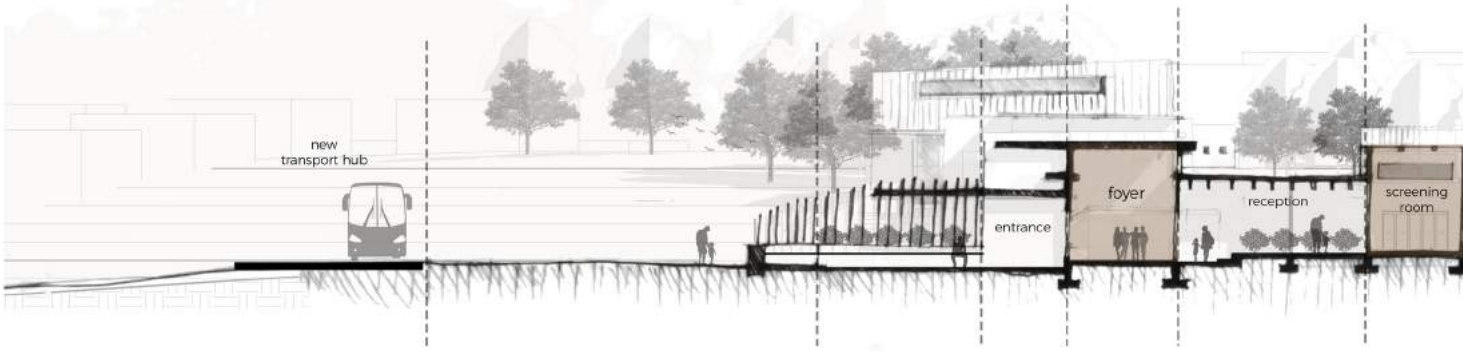
Figure 3.22: Iteration Four first model exploration (Author 2018)

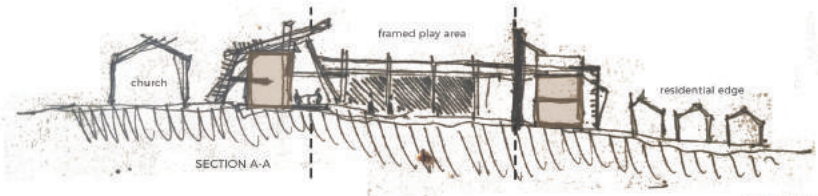
Iteration Four

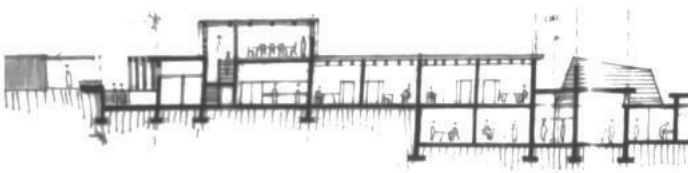
From the three initial iterations, explored through sketch plans and models, a more detailed iteration was developed. This is explored through plans, perspectives, elevations and sections. The iteration revisits iteration two's orientation strategy, by shifting the building from the existing grid to suggest the new within the existing, but the axis is re-aligned at the existing structures of the school and the clinic. Making use of space and form to create as many spatial conditions as possible (Mazuch 2017:42), the main axis leads the users through different experiences of volumes and textures in the transition from existing clinic, through the new screening facility and to the existing school. Similar to the Butaro Hospital (MASS Design Group 2017) making use of topography as informant, the topography of the site also provides the opportunity to create different experiences, such as views of the mountain range, and various volumes. The screening facility is located at the centre of the new facility, branching off in the secondary and tertiary programmes. For each function, an allocated natural space is designed to create optimal connection to natural views. The principle of visual to create a legible and accessible environment (Ulrich 2006:S39) is created through architecture as a user guide through the building by implementing repetition of elements and a series of visual links between buildings. Continuation between the existing and the new is established to reinforce the architectural intention through responding to the existing scale and ensuring the new building does not overpower in scale.

Figure 3.23: Iteration Four sketch plan exploration (Author 2018)









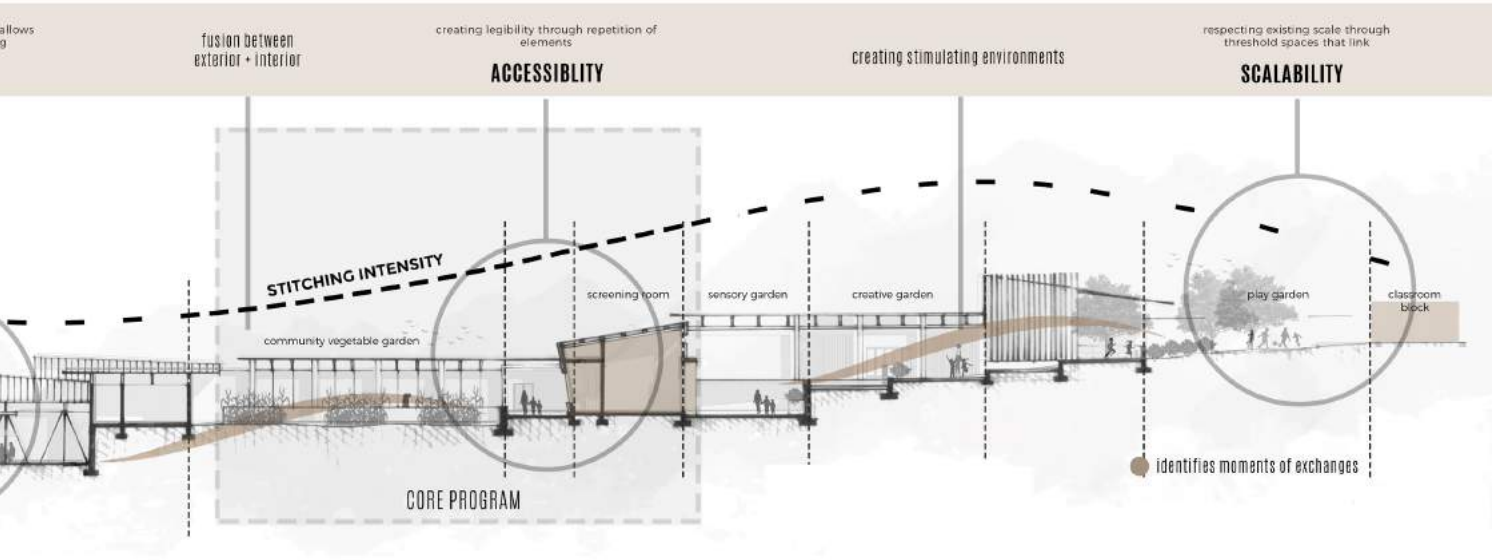


Figure 3.24: Iteration four section exploration showing connection between existing clinic to school with the new facility as linking element (Author 2018)

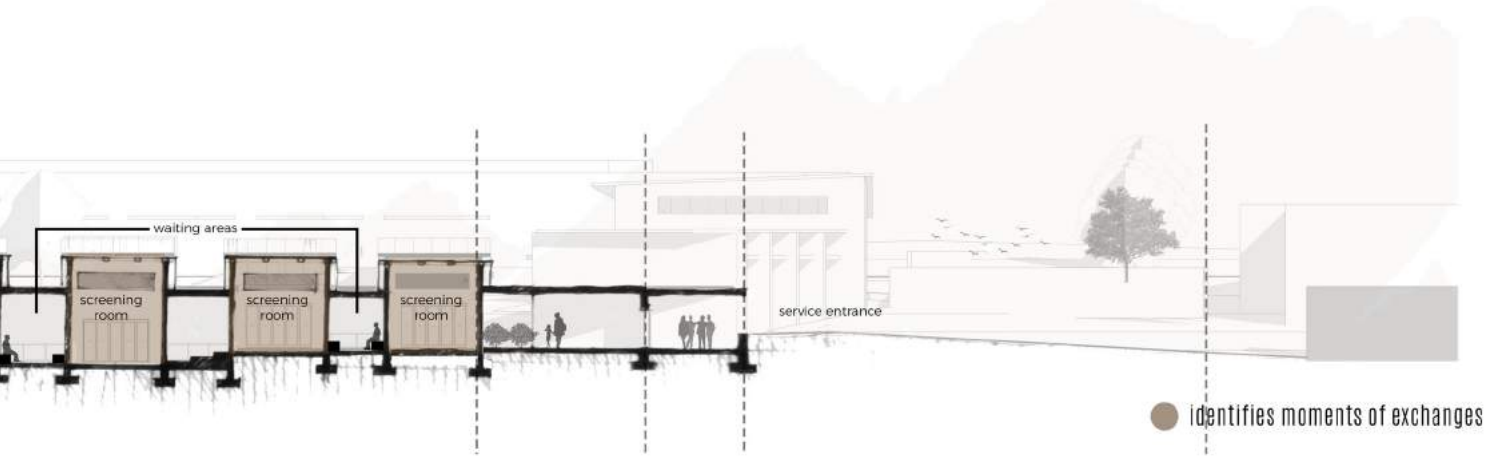


Figure 3.25: Iteration four section exploration indicating hierarchy in volume between private & public spaces (Author 2018)

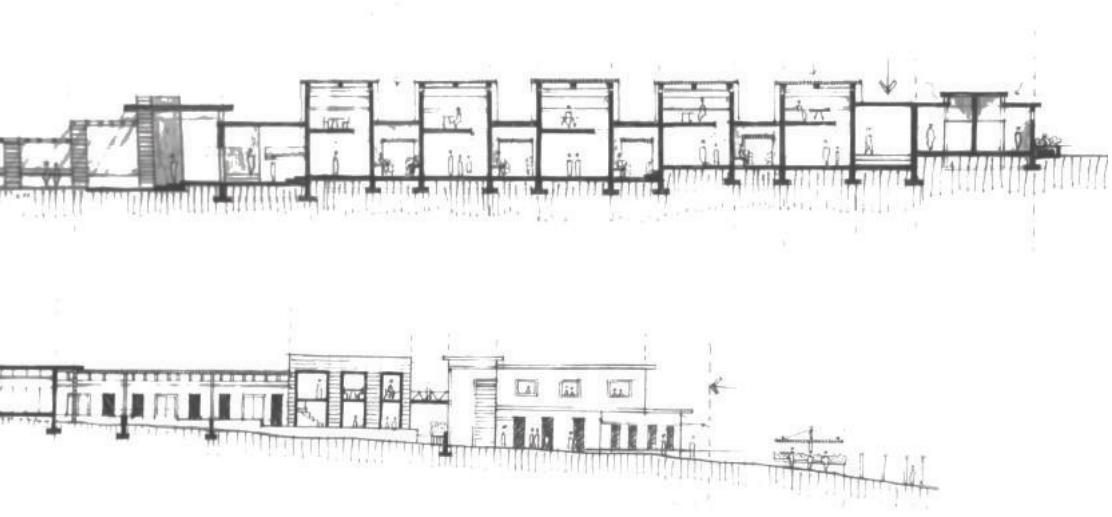
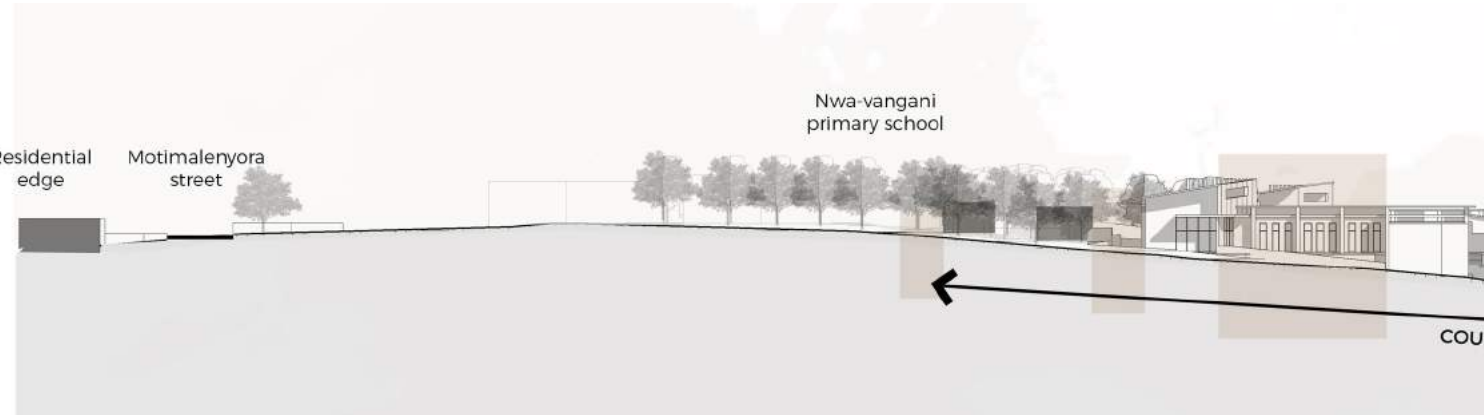
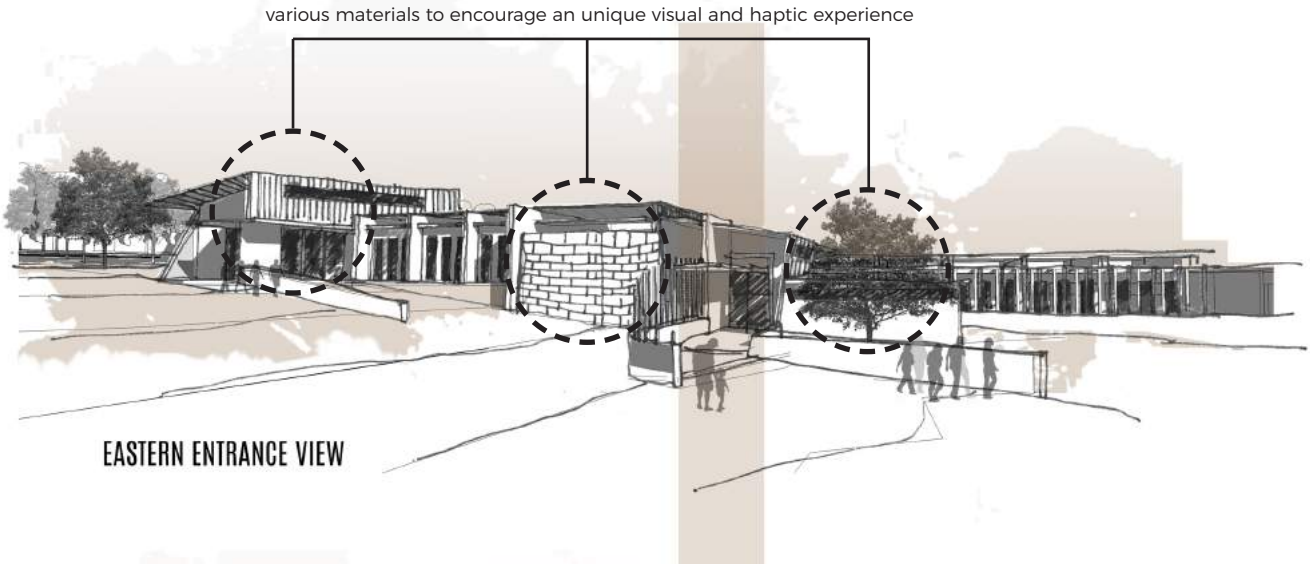
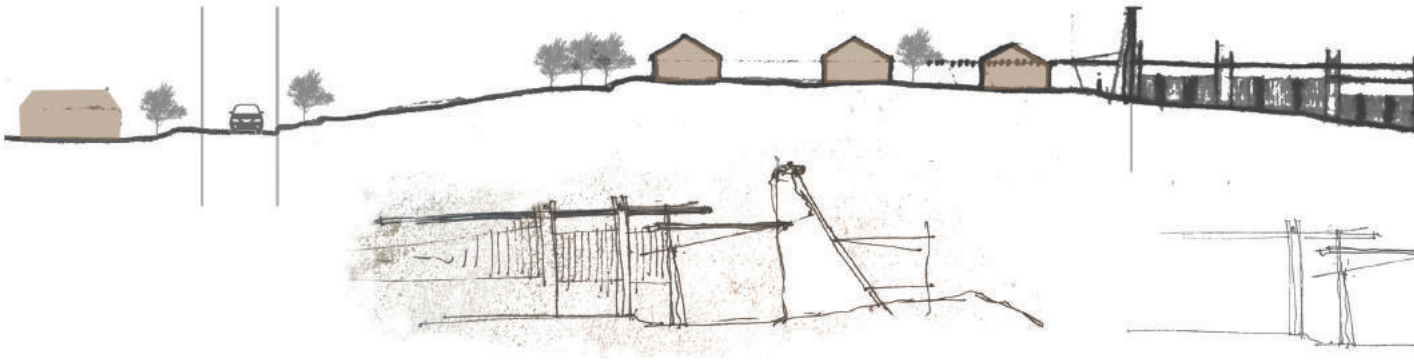
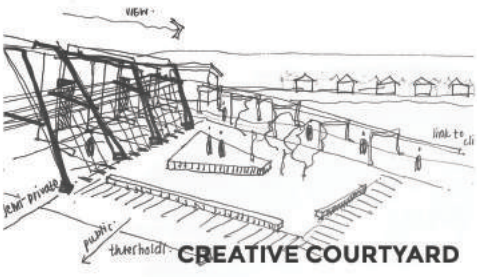


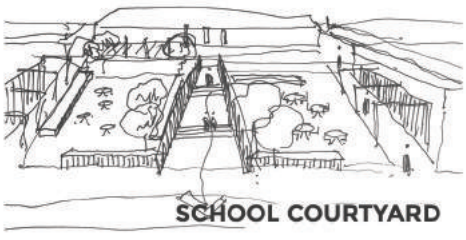
Figure 3.26: Iteration four section process sketches (Author 2018)

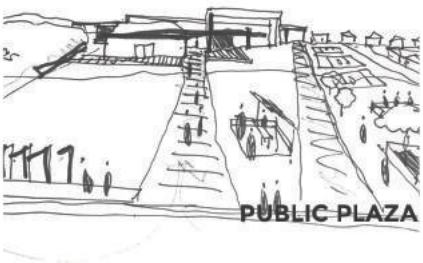












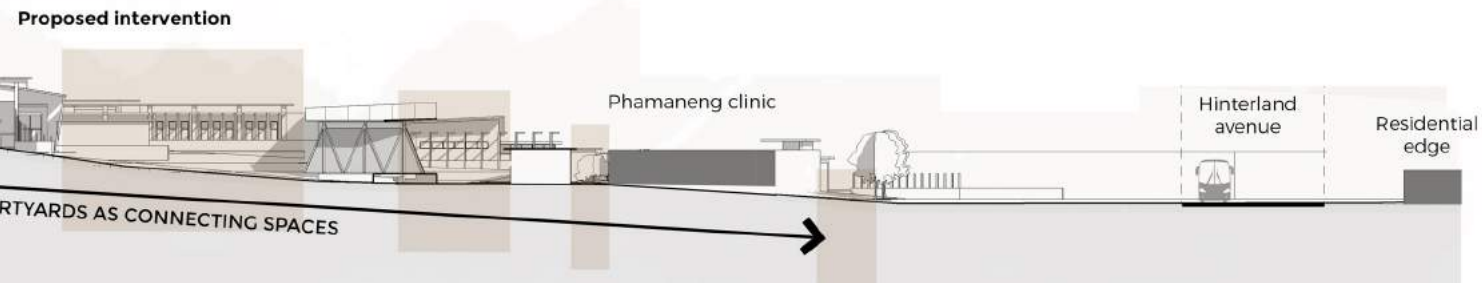


Figure 3.27: Iteration four contextual elevation exploration indicating hierarchy in courtyard spaces as link (Author 2018)

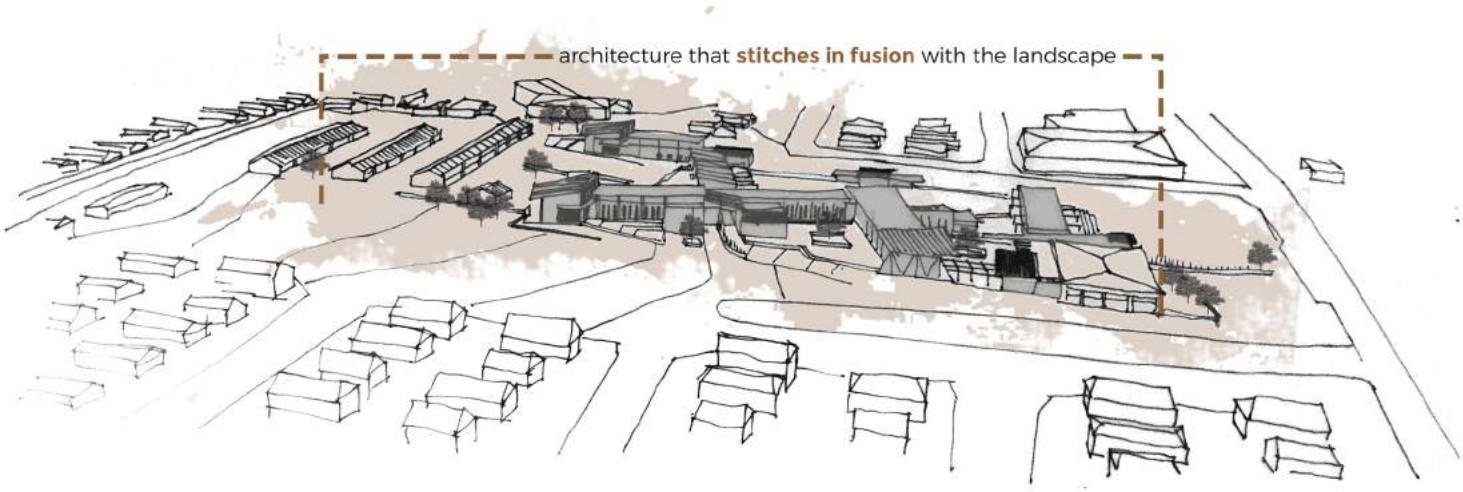


Figure 3.28: Iteration Four perspective explorations (Author 2018)

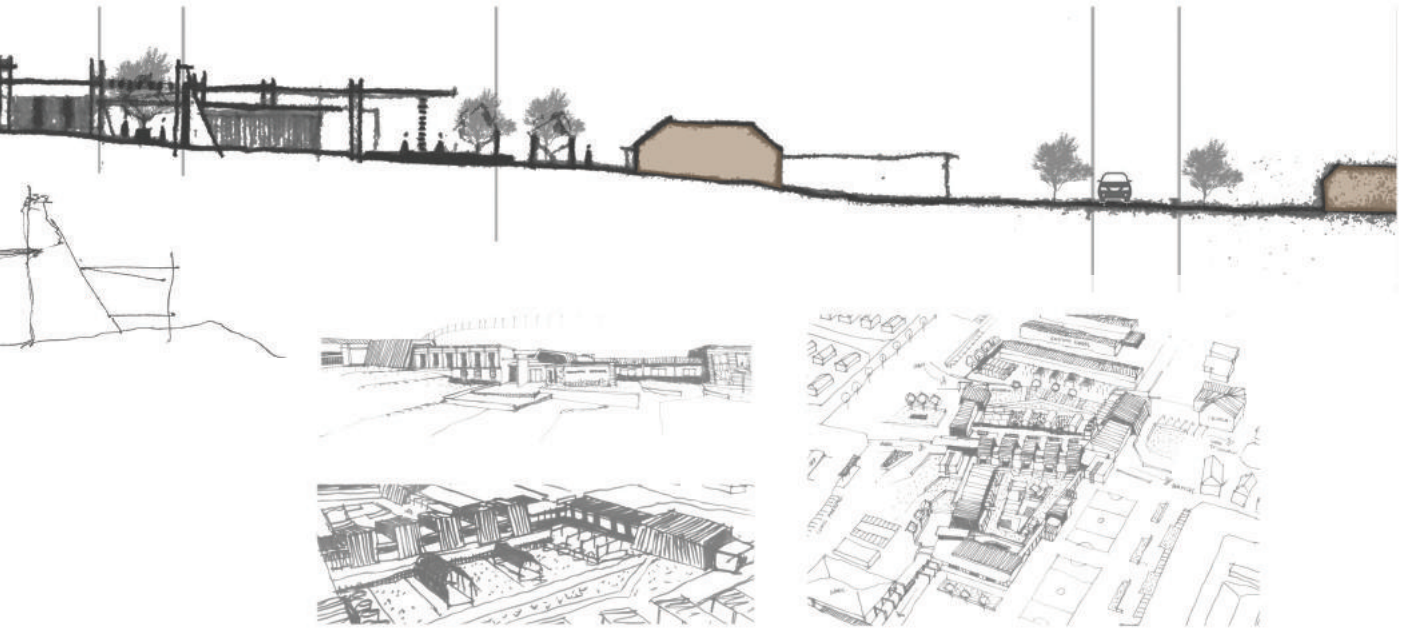


Figure 3.29: Iteration Four process sketches (Author 2018)

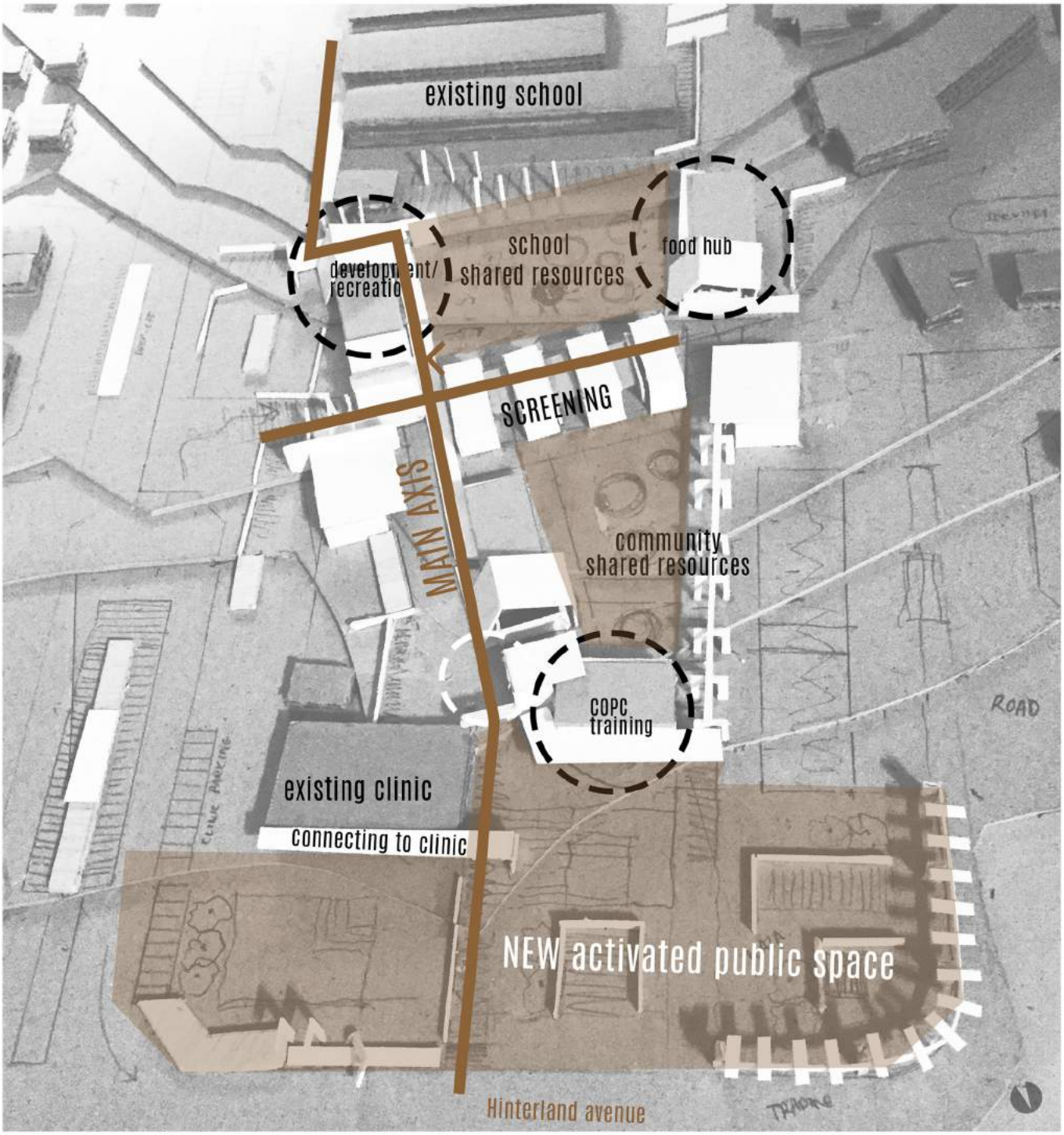


Figure 3.30: Iteration Four second model explorations (Author 2018)

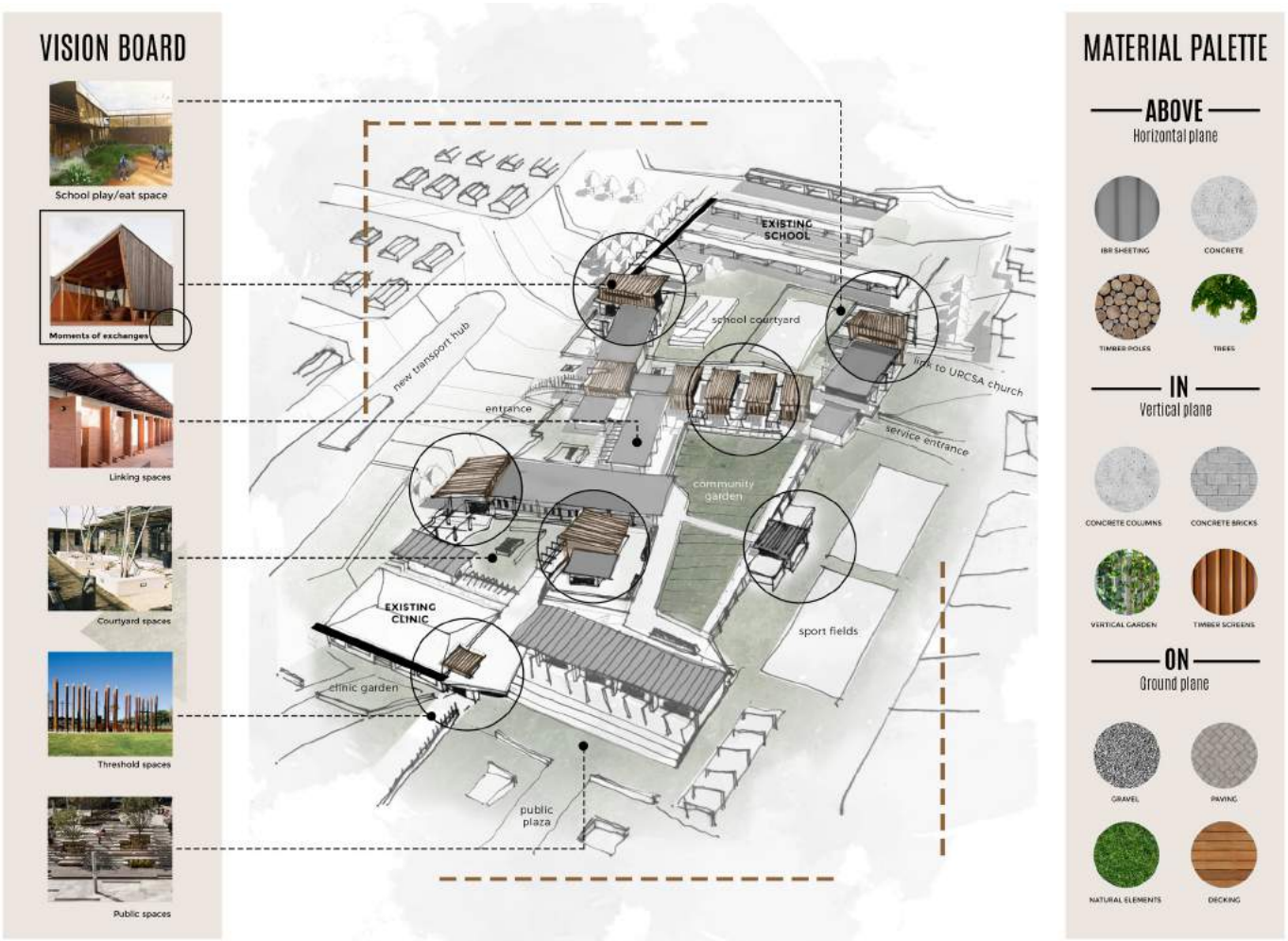


Figure 3.31: Iteration Four initial spatial and material explorations (Author 2018)

Reflection

After evaluation, the fourth iteration revealed shortcomings in terms of hierarchy in spaces and a balance between building and open space to ensure adequate natural environment. As stated by Bowler (Bowler et al 2010:457), connection to the natural environment can have a positive effect on wellbeing and health. Although the functional layout is sufficient in providing shared resources and spaces, the alignment of the new building creates uncomfortable corners and spaces at connection points. The main axis does not establish a clear movement route throughout the facility, removing the salutogenic principle of comprehensibility which argues for an accessible environment to promote wellbeing and development (Ulrich 2006:S39). Therefore, the alignment and orientation ought to be reconsidered to create comprehensible environments. Courtyard spaces are not held by space and do not flow from interior spaces into exterior spaces. The precedent study of the Jetavan Centre (The Architectural Review 2016) can be revisited, as it successfully creates a fusion between interior and exterior spaces with different buildings framing the courtyard space. The hierarchy in courtyard spaces ought to be reconsidered to ensure appropriateness for connecting spaces. The street edge of Hinterland Avenue is not used to its full potential and should rather consider a more public programme instead of the COPC training facility. Similar to the Westbury Clinic (Africa Architecture Awards 2017) transforming the street edge into an activated public plaza, the street edge should be occupied by public programmes such as trading, transport hubs and restaurant spaces.

Figure 3.32: Final design iteration ground floor plan (Author 2018)

3.4.3 Design synthesis

The final iteration was developed through a critical reflection and synthesis of the previous iterations to ensure a holistic design approach which illustrates the design principles derived from the theoretical exploration as well as the conceptual and architectural intentions discussed earlier in this chapter:

Figure 3.33: Diagram depicting movement, orientation, hierarchy and thresholds (Author 2018)

Final design iteration

To adhere to the architectural intention of continuation, The building is oriented within the existing grid of the surrounding context. A strong main axis is established to promote a comprehensible and accessible environment (Ulrich 2006:S39) that creates a link between the various buildings. The various buildings branch off into perpendicular secondary movement spaces for each building.

Courtyard spaces are the overarching architectural organiser which creates natural spaces in between buildings, contributing to the well being and development of users (Bowler et al 2010:457). These also create differentiation through the use of scale and form (Mazuch 2017:42) to distinguish between public and private spaces which contributes to all three of the salutogenic principles.

Figure 3.34: Main axis perspective (Author 2018)

Figure 3.35: Proposed pause courtyard (Author 2018)

Figure 3.36: Final design iteration first floor plan (Author 2018)

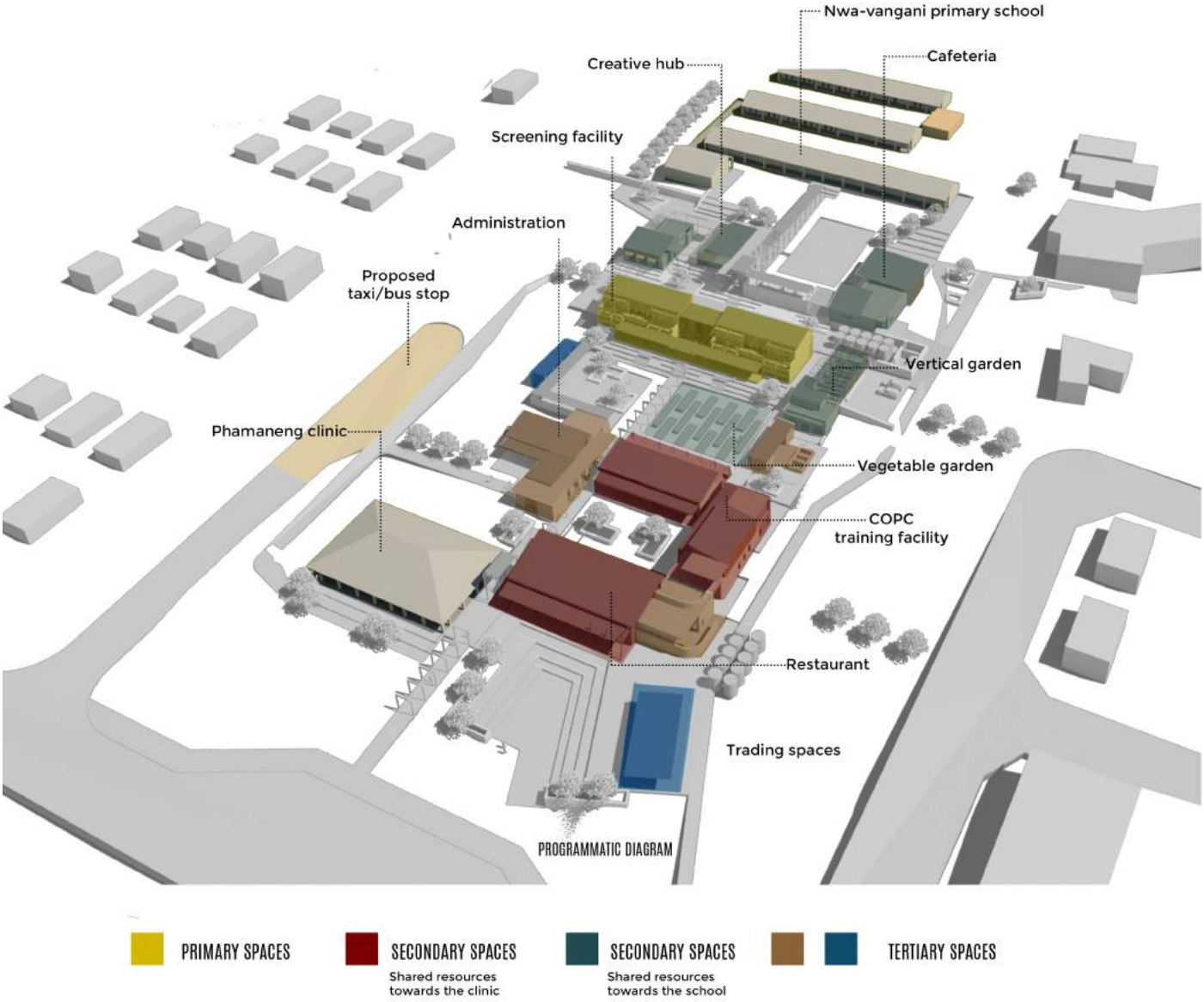
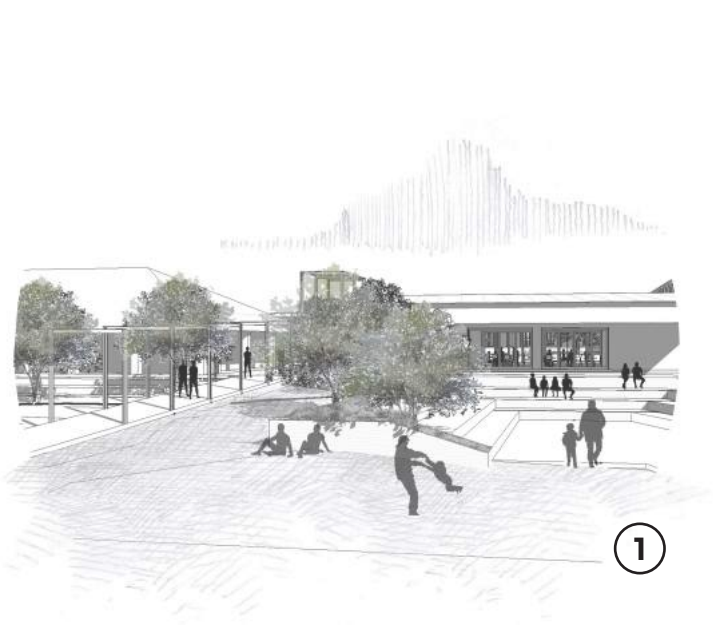
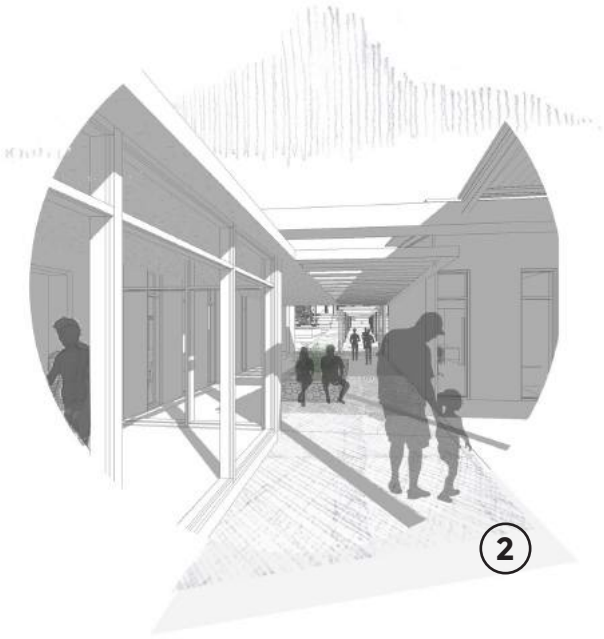
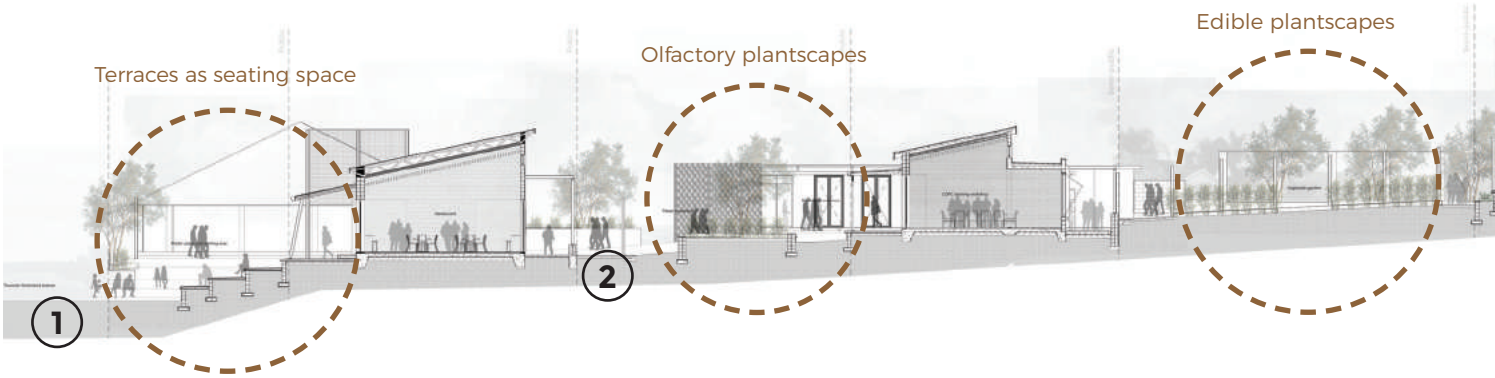


Figure 3.37: Building which stitches together the existing creates meaningful exchanges and provides shared resources through programme (Author 2018)

The design facilitates multi-function programmes to illustrate the architectural intention of re-interpretation of health settings and promotes spaces for exchanges. A unique identity as a public building is created through providing various public platforms. To illustrate the salutogenic principle of comprehensibility, a main axis ensures strong visual links (Ulrich 2006:S39) which connects and creates facilitation between the two existing buildings and functions on site. The layout of the design informed by the proposed site and context places the screening facility at the heart of the new facility, which then branches off in the secondary and tertiary programmes each supporting either the existing clinic or existing school. This reinforces the architectural intention of continuation through connecting and strengthening the existing. Similar to the New Sight hospital (Africa Architecture Awards 2017) which combines health and social spaces, proposed spaces also aim to supporting the existing clinic and school by introducing social spaces hosting various recreational programmes.







To implement the principle of flexibility by creating an interactive environment (Golembiewski 2017:269), the design of the building, which accommodates the screening rooms and consultation rooms, allow for flexibility in programme. These spaces can also be used as occupational therapy spaces and private consultation rooms in support of children as well as parents during periods when screening is not taking place. Similar to the Butaro Hospital (MASS Design Group 2017), the existing topography serve as design informant and encourages multi-functionality through creating various garden terraces at each building which creates generous public space, provide tactile and visual experiences as well as optimal interaction with the natural environment.

Informed by the principle of hapticity and natural environment, planting for courtyard spaces focuses on edible and olfactory plant species to ensure an optimal sensory experience, similar to the Nelson Mandela Children's Hospital (Leonard & Schnaid 2017:66) approach in garden spaces. Plant species in the vegetable garden and vertical garden focus on edible plant species that can provide produce for the proposed restaurant and cafeteria. Plant species in pause and connecting garden spaces focus on olfactory plant species to provide a stimulating experience. A composting yard is added to accumulate all organic waste from the proposed food services and re-use within the garden spaces. This eliminates the need to purchase compost for the garden spaces. The design aims

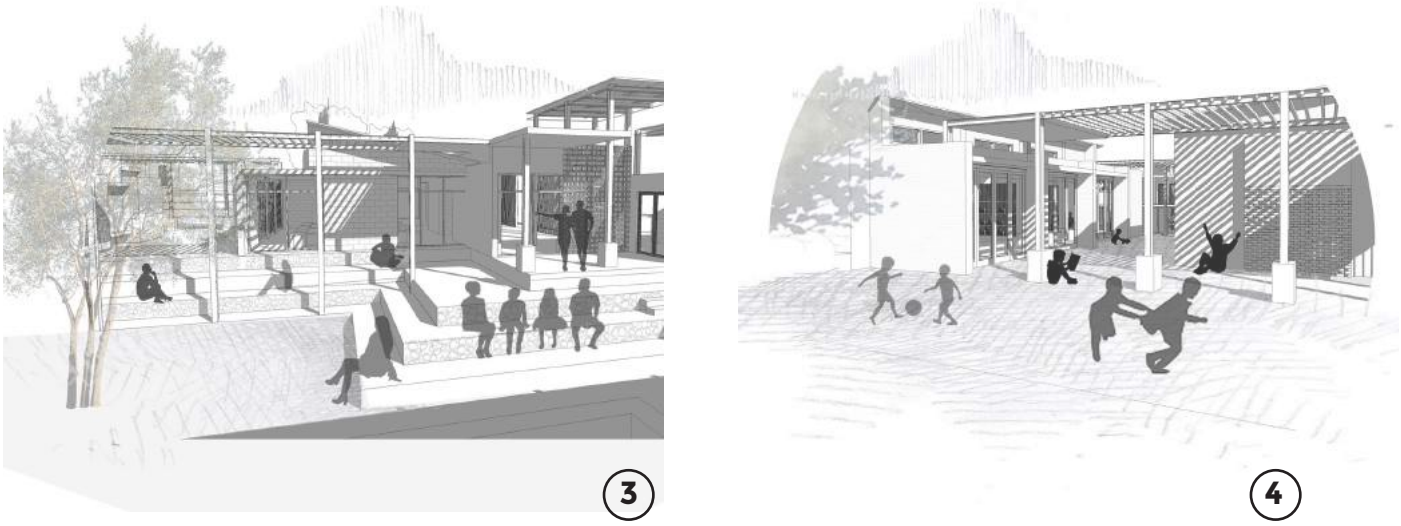


Figure 3.38: Perspective view explorations (Author 2018)

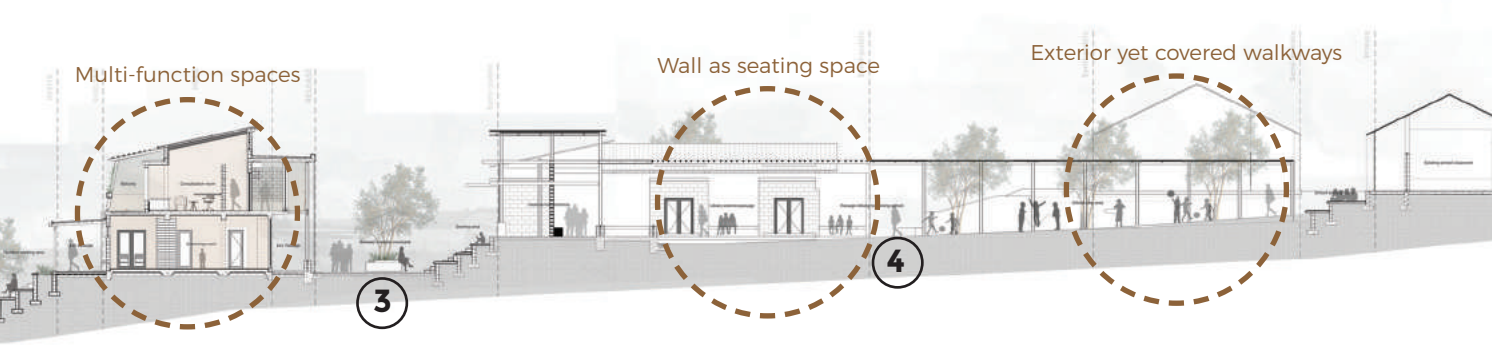
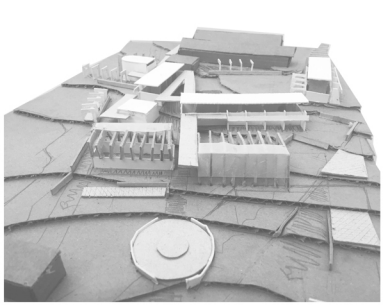


Figure 3.39: Main axis section (Author 2018)

to create harmonious balance between building and nature to allow spaces of experience, familiarity and local celebration.

In support of the principle of visual and natural environment, courtyard and garden spaces aim to fuse interior and exterior spaces to connect the user to nature which promotes well being and development (Bowler et al 2010:457). Scale, volume and form (Mazuch 2017:42) is implemented to encourage the idea of a sensory experience. Public spaces are identified through larger volumes and private spaces located in more intimate volumes of space which relate back to the salutogenic principle of comprehensibility (Golembiewski 2017:270). Similar to the Butaro Hospital (MASS Design Group 2017), all walkways and passages are exterior to allow for pause spaces and additional waiting spaces. This also connects the user directly to natural views and allows for natural lit spaces, which influences well being and health (Ulrich 2006:S39). All walkways are covered to provide adequate shade to still create a thermally comfortable space (Mazuch 2017:46). By allowing architectural elements such as openings to become multi-function elements that can serve as seating space the salutogenic principle of manageability is illustrated. Different textures and patterns are implemented to accentuate moments of experience in the building as well as promote stimulating environment (Institute for Human Centered Design 2009).



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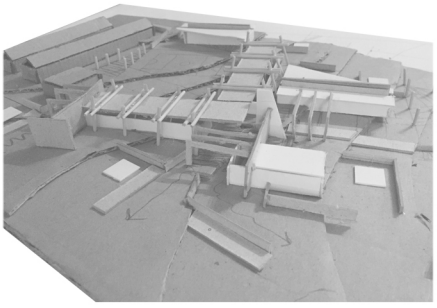

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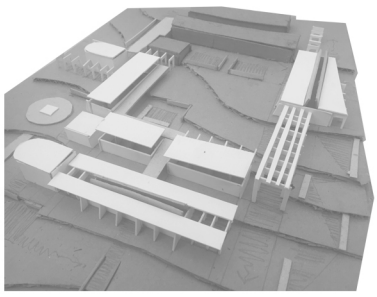
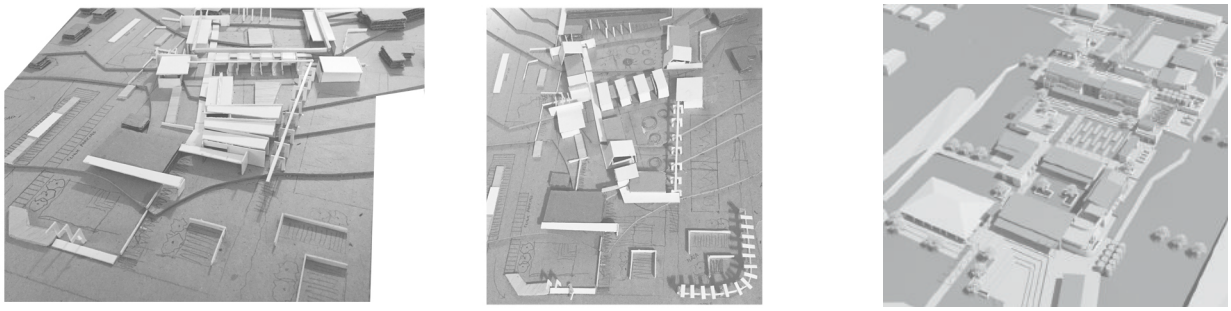


03

3.5 Design conclusion

Concluding the design development, this chapter illustrates the iterative design process undertaken throughout the year in response to the discussed issues, theoretical premise, architectural intentions as well as design informants. Furthermore, the iterative nature of the process demonstrates a holistic approach. A reflection on the final design synthesis reveals that the proposed final design promotes a nurturing and stimulating environment through implementing the set out design principles discussed in the theoretical chapter. The design encapsulates the three salutogenic resources through implementing the principles of natural environment, space and form, visual and flexibility. The principle of natural environment (Bowler et al 2010:457) is demonstrated with the inclusion of various garden spaces that stimulates the olfactory and gustatory senses, optimal visual connection to natural spaces from buildings, courtyard and garden terraces in-between buildings and by providing ample outdoor public spaces. Furthermore, the design illustrates the principle of space and form (Mazuch 2017:42) by making use of scale to differentiate between public and private spaces. The proposed building showcases an appropriate response to the existing school and clinic's form and proportion by connecting to the scale. By creating a series of buildings with a strong main axis as connection, the building demonstrates the principle of visual which ensures a comprehensible and accessible environment for users. Lastly, the principle of flexibility (Golembiewski 2017:270) is incorporated through providing multi-functionality that range from functional elements such as programme that can be adapted, through to architectural elements such as openings and terrace garden spaces that also serve as seating and waiting areas. The remaining two principles namely, the principle of hapticity, which relates to texture, materiality and pattern, as well as the principle of comfort (Mazuch 2017:46), which includes temperature, acoustics and ventilation, relates to the construction and technology of the building and is therefore discussed in the next chapter.



04 FINAL SYNTHESIS

Figure 3.40: Development of model explorations during iterative design process to reach a final design synthesis (Author 2018)

CHAPTER FOUR

Techné

TECHNICAL EXPLORATION

"Architecture has its own realm. It has a special physical relationship with life. I do not think of it primarily as either a message or a symbol, but as ***an envelope and background for life which goes on in and around it, a sensitive container*** *for the rhythm of footsteps on the floor, for the concentration of work, for the silence of sleep."*

(Zumthor 1998:13)

Figure 4.1: The physical environment as sphere of influence (Author 2018)

4.1 Preface

Following the design development chapter, the final design synthesis is further developed and explored in terms of construction and technology as extension of the design. The technical chapter describes the structure, material choices as well as environmental systems and strategies which is proposed as response to the tectonic intention and technical concept introduced. For the technical exploration, the building facilitating the screening and consultation spaces will be focused on in terms of construction and technology, as it encapsulates the most important spaces in terms of health settings. Through the technical exploration, this chapter aims to illustrate how the proposed building can act as tool for experience, familiarity and interaction in the community of Mamelodi East.

4.2 Integrated tectonic intention

In agreement with Mostafa (2014:143), architecture can create specific experiences through the manipulation of space. Therefore, the technical exploration draws from the theoretical premise and the source of meaning the built environment can provide in health settings. The technification of the building continues the design intentions of the physical environment as sphere of influence, and powerful tool in the health environment. Through the lens of salutogenesis and sensory design, the tectonic intent encourages a holistic experience and interaction with the built environment through materiality, construction, systems and detailing.

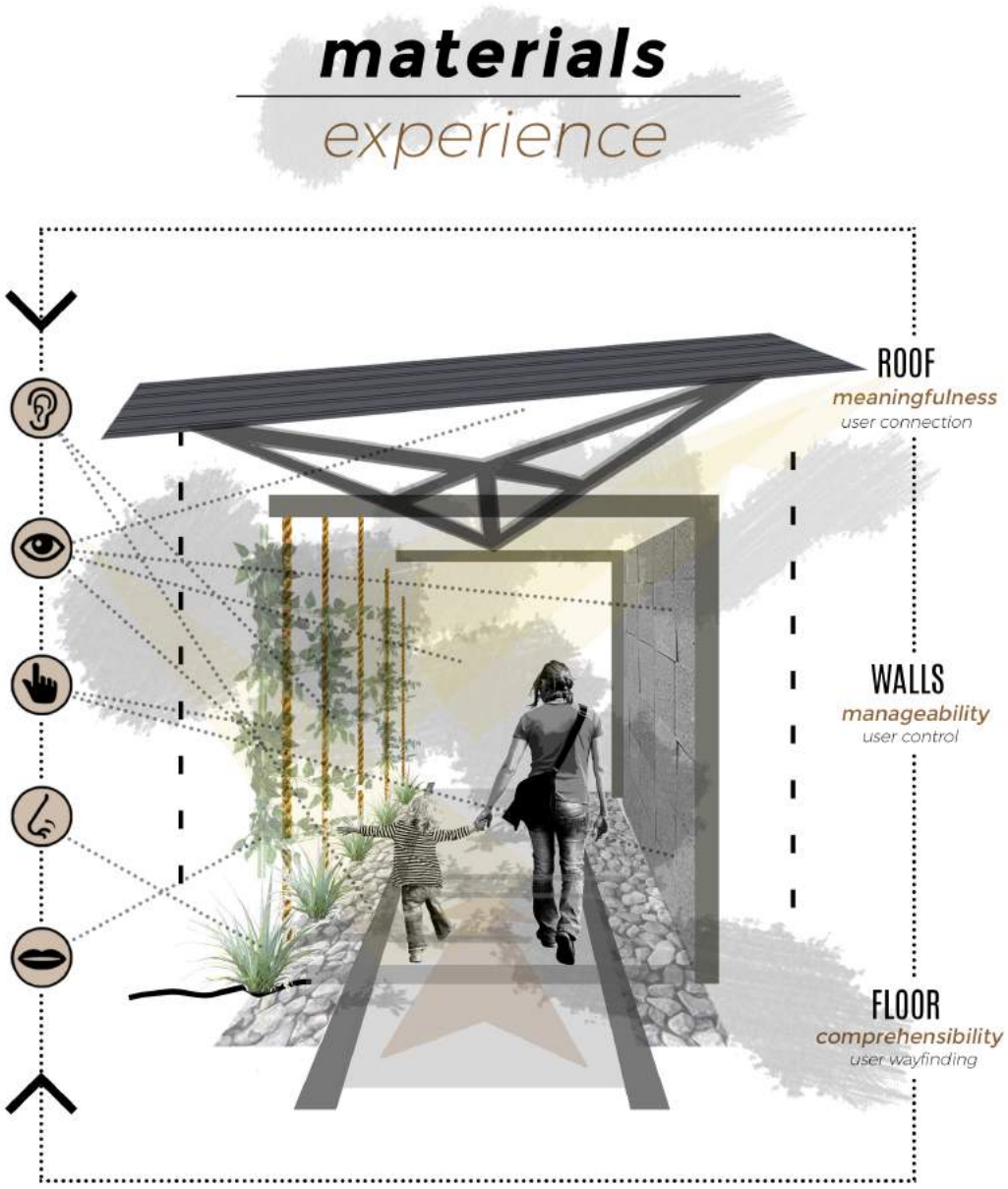


Figure 4.2: Collage depicting the technical concept of building as experience (Author 2018)

4.3 Technical concept

As continuation of the theoretical premise, the basic elements of the structure become representative of the three salutogenic resources as defined by Golembiewski (2017:270). The roof represents the principle of meaningfulness through the notion of familiarity and shelter as well as the use of light to encourage experience and comfort. The walls represent the principle of manageability through granting the user a sense of control over the environment. This is achieved through adaptable elements, tactile wall finishes and a fusion between interior and exterior spaces. The floor plane represents the principle of comprehensibility through guiding the user through the building and spaces. This is achieved through a contrast in textures, materials and colour to assist in wayfinding. Mazuch (2017:47) concurs that the built environment can positively impact the wellbeing of users. Therefore, the technical concept proposes an experiential building that re-imagines health care settings into a nurturing and welcoming environment.

4.4 Responding to local materiality

As discussed under the principle of space and form in chapter two, contextual familiarity plays an important role in creating recognisable environments which results in users feeling a sense of comfort and safety. For this reason, local materiality is incorporated to reinforce this notion. Furthermore, material choices also focus on local materiality and available skills in support of local economic development in the community of Mamelodi East.

4.4.1 Steel and local labour skills

From the field research conducted, steel elements and structures were commonly observed in the urban fabric of Mamelodi East. It usually serves as a basic structural element, which is often left empty with only a steel roof covering or filled in at a later stage. Mamelodi East is also well known for local metal workers that are skilled in welding and crafting steel structures and objects such as gates and fences. For this reason, steel is incorporated into the technical exploration of the building to support local craftsmanship. This further underlines the salutogenic principle of meaningfulness (Golembiewski 2017:270) through incorporating contextual familiarity in the environment by mimicking existing local materiality.

Figure 4.3: Steel structures and objects documented in Mamelodi East (Author 2018)

4.4.2 Clay face bricks

Clay bricks are a common construction material in the urban fabric of Mamelodi East as it is cost effective and durable. As seen in chapter one with the context analysis of the proposed site, both the clinic and primary school is constructed from clay bricks. Field research through photographic documentations (Author 2018) undertaken in Mamelodi East revealed a large operating network of brick makers and the ever-changing urban fabric feeds this growing business network. Many of these entrepreneurs are also skilled bricklayers.

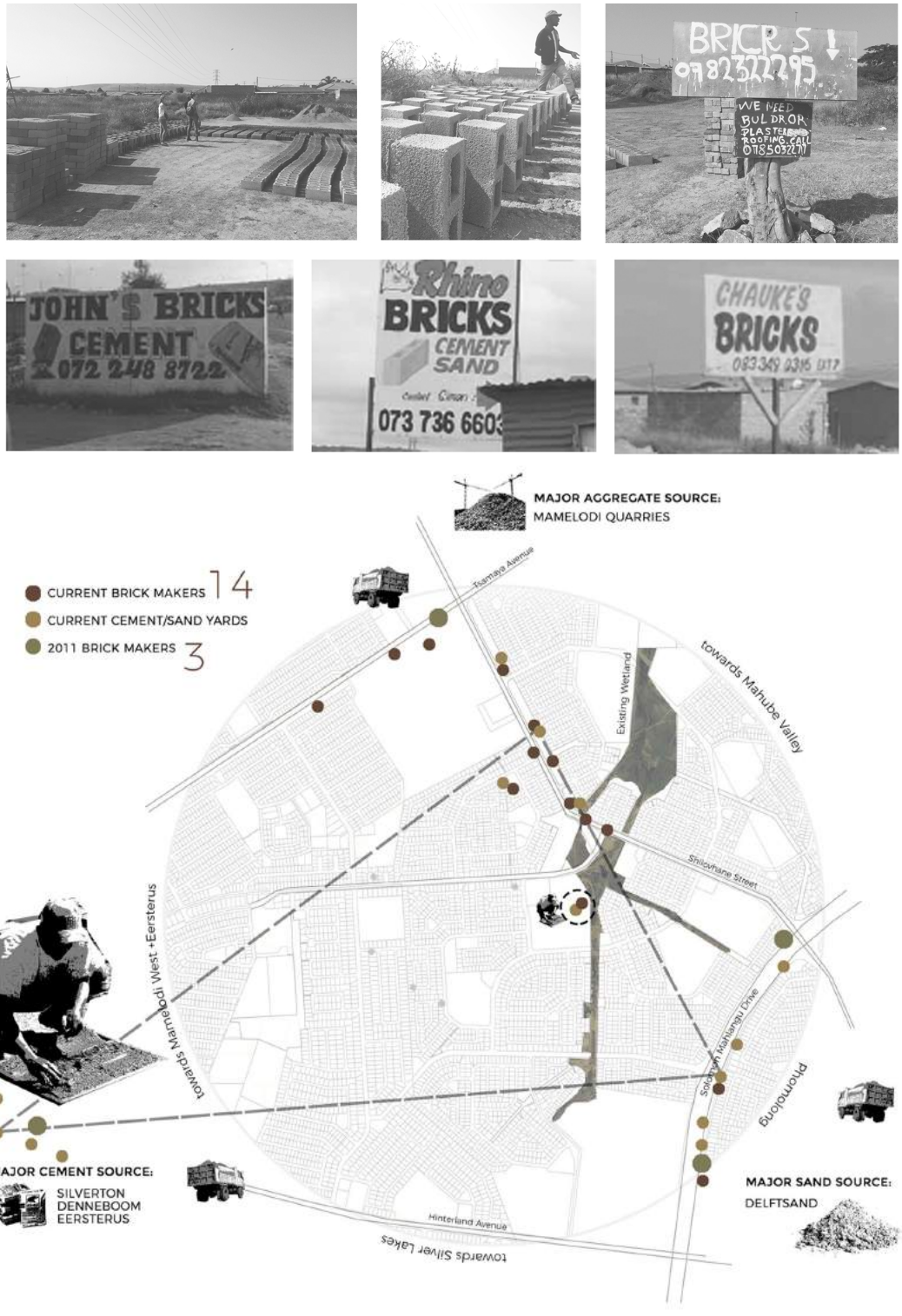


Figure 4.4: Local brick makers and brick network documented in Mamelodi East (Author 2018)

Not only are clay bricks cost effective and durable within the context of Mamelodi East, but it is also implemented for decorative and aesthetic purposes. Photographic documentations collected during field research (refer to Fig 4.5 and Fig 4.6) revealed various brick patterns incorporated in brick houses in the Mamelodi East area. As seen in the precedent of the Hazelwood School (Institute for Human Centered Design 2009), the use of patterns can assist in creating tactile environments which contribute to sensory stimulation and development. In response to the above-mentioned, clay bricks are selected as predominant primary structure. Clay bricks are also implemented to explore the notion of pattern and texture as continuation of contextual familiarity and to create aesthetic elements (refer to Fig 4.7). The selection aids in employment creation during construction and celebrates local expression.

Figure 4.5: Local use of bricks documented in Mamelodi East (Author 2018)

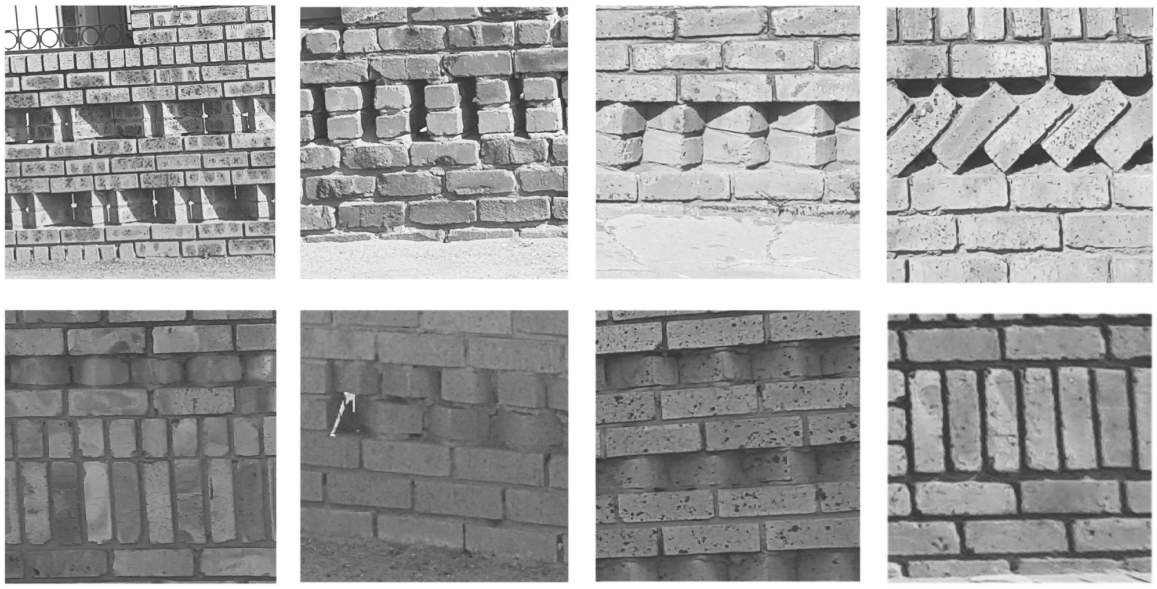


Figure 4.6: Local brick patterns documented in Mamelodi East (Author 2018)

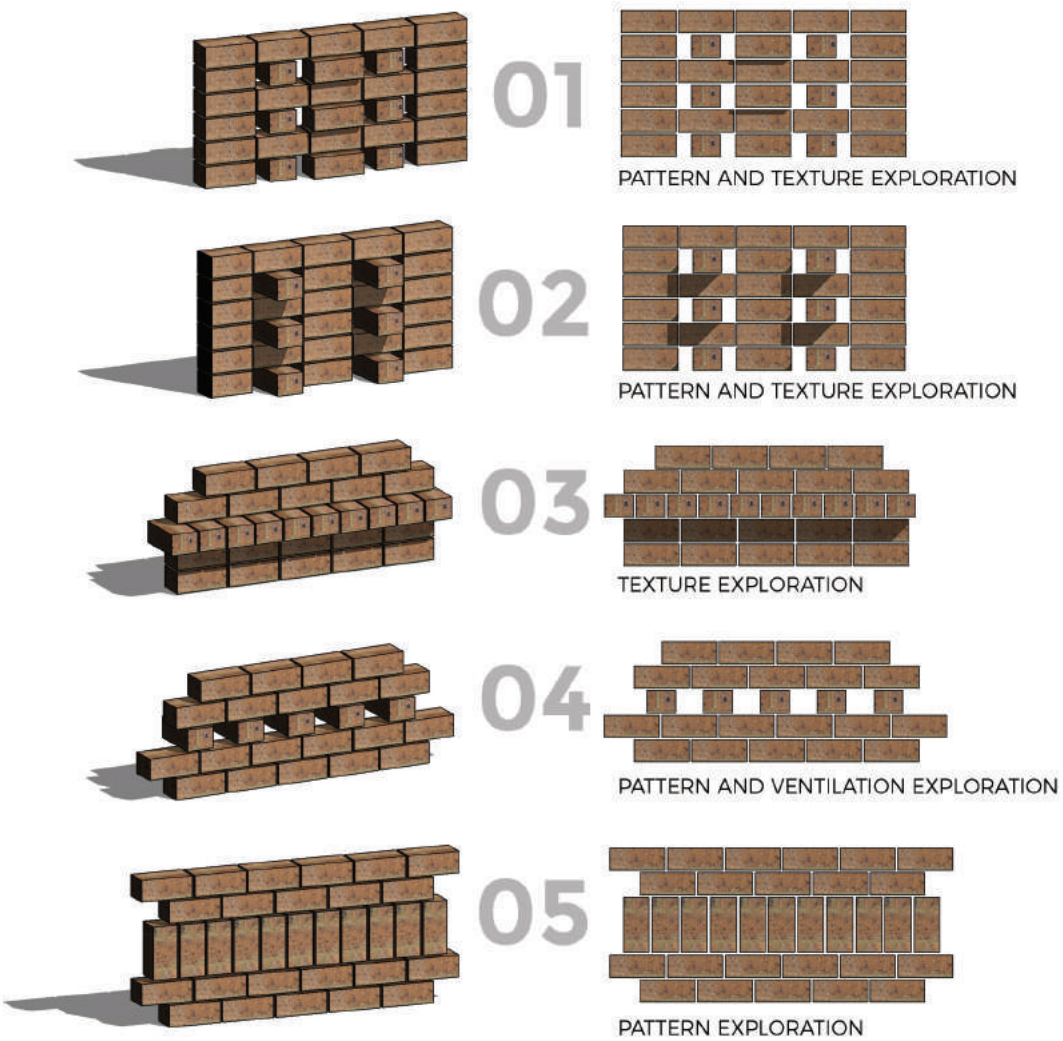


Figure 4.7: Brick explorations to contribute to pattern, texture, aesthetics and ventilation in the building (Author 2018)

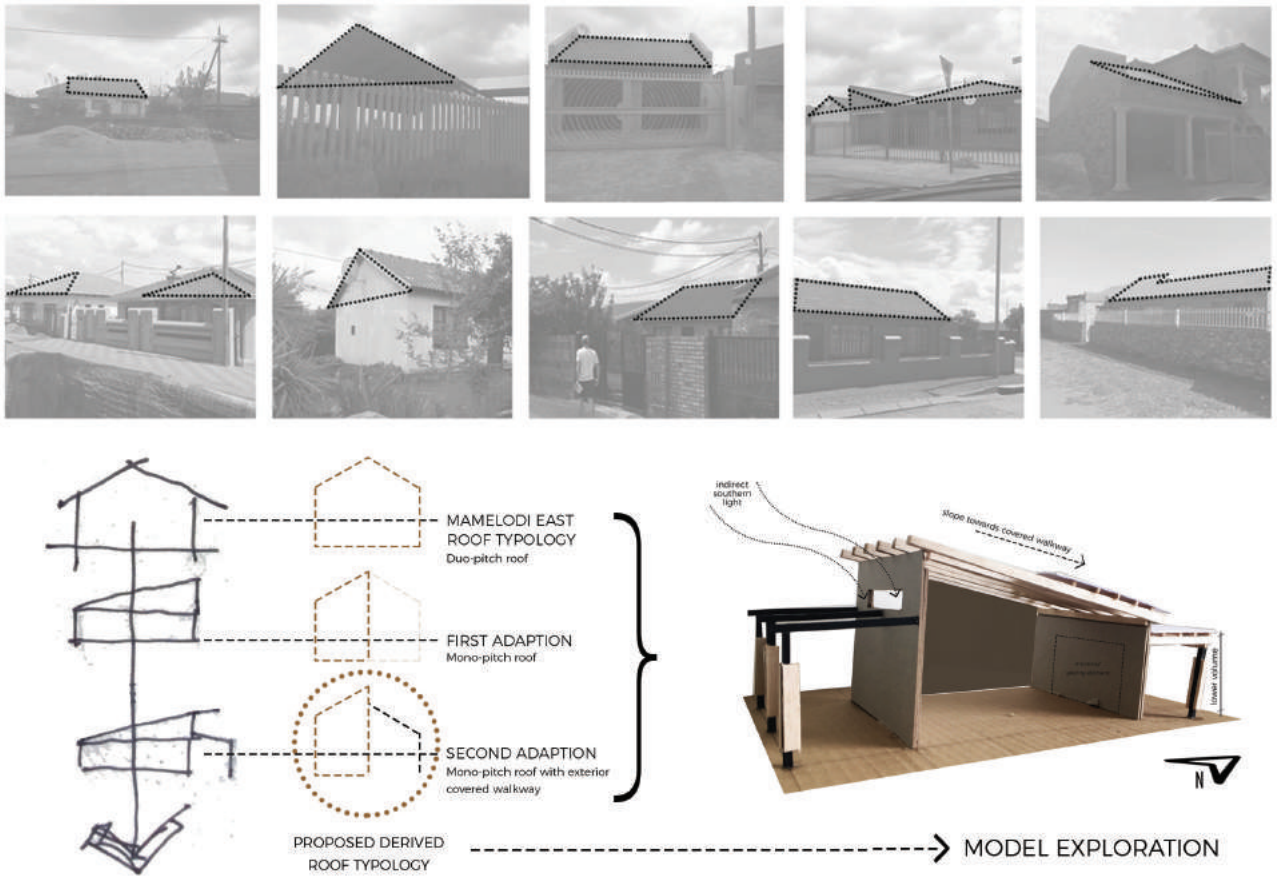


Figure 4.8: Photographic documentation of common roof typology in Mamelodi East as well as the proposed roof derived from this local typology (Author 2018)

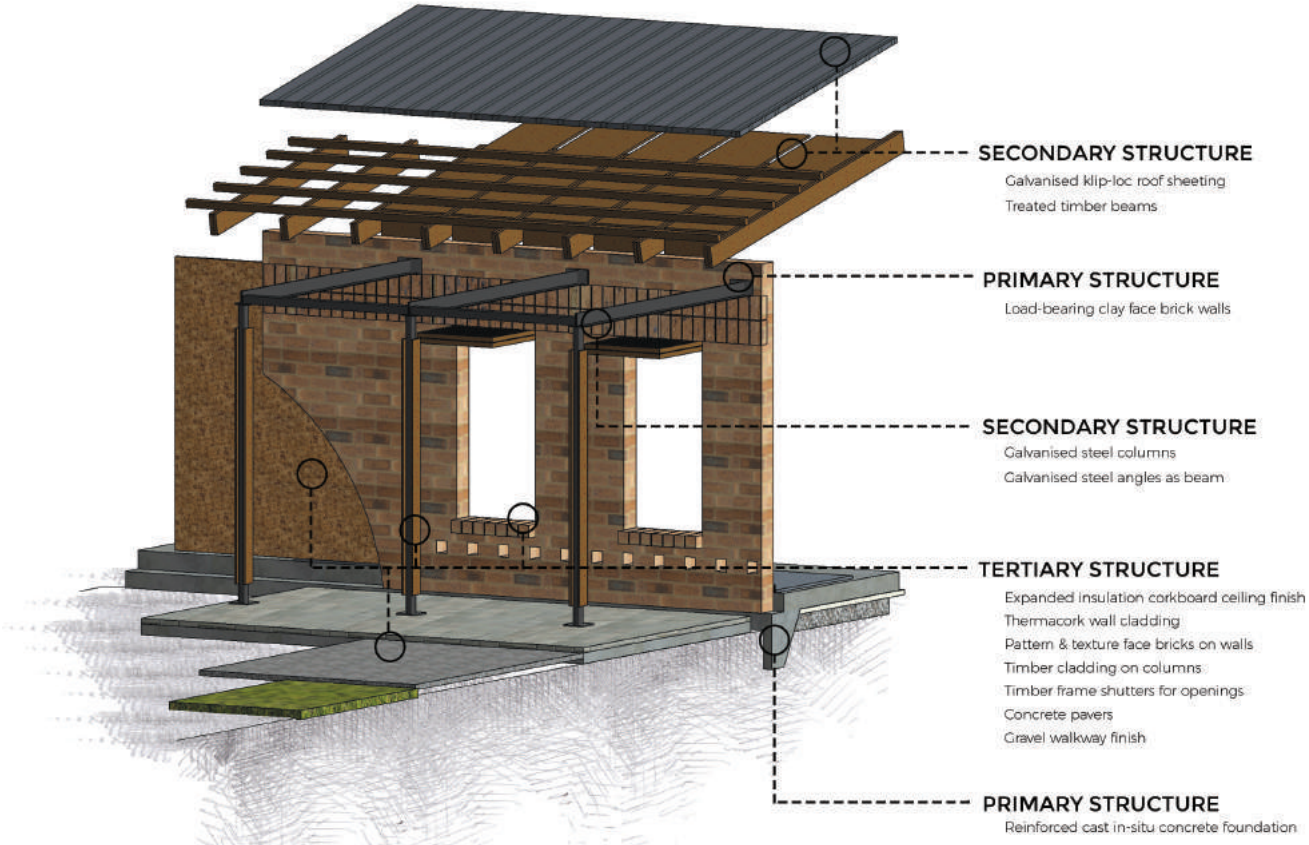


Figure 4.9: The proposed primary, secondary and tertiary structure (Author 2018)

4.5 Structure

4.5.1 Primary structure

As mentioned previously in the discussion regarding the response to local materiality, the primary structure is selected as to continue local typology and materiality to encourage contextual familiarity. Ulrich (2006:S39) emphasises that familiar environments can increase user comfort which lower stress levels. By creating familiarity in the building, the principle of meaningfulness is implemented. For this reason, the primary structure of the building consists of load-bearing clay face brick walls that support the loads of roofs, floors and external cladding elements. Due to the clay quality of soil conditions in the Mamelodi East area, the sub-structure consists of a robust reinforced cast in-situ concrete base that holds the manipulated ground planes on site and provides a stereotomic quality that roots the building.

4.5.2 Secondary structure

Extending the notion of contextual familiarity, galvanised concealed fix klip-lok roof sheeting supported by treated timber beam structure is implemented for the predominant area of the roof supported by the load bearing brick walls. The use of steel roof sheeting also encourages local labour skills and use of local material. Photographic documentations (Author 2018) as seen in Figure 4.8 revealed the duo-pitch roof as common element in Mamelodi East. To express the roof as representation of the principle of meaningfulness (as discussed in the technical concept), the roof profile is derived from local roof typology. It also serves a functional purpose by allowing optimal natural lighting and ventilation within the building. The secondary structure also includes glazing elements that are non-load bearing.

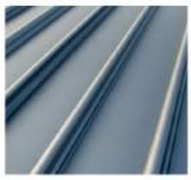
4.5.3 Tertiary structure

Haptic qualities in the built environment can contribute to a user's experience (Mostafa 2014:145) and encourage stimulation and development. For this reason, the tertiary structure comprises of a sensory-oriented skin to create unique experiences. This includes elements such as cork cladding, jute rope dividers, and timber pergola structures that are attached to the primary structure where necessary. Not only do these elements become a critical tool in creating a sensory environment, but they also assist in wayfinding and encourage sensory stimulation (Institute for Human Centered Design 2009). Furthermore, these elements also play a functional role in terms of light, acoustic and thermal control.The tertiary structures also become the elements that can be manipulated or controlled by the user such as adjustable louvres, planted walls or panels that can be pivoted, opened or removed in support of the salutogenic principle of manageability.

4.6 Materiality

With reference to the six principles (hapticity, natural environment, space and form, visual, flexibility and comfort) derived from the theoretical exploration, it is evident that materiality extend a users experience in their environments. Therefore, the selection of materials contributes to the user's experience (Malnar 2004:129) and encourages a sensory experience of the built environment. The selected materials support the tectonic intention through contributing to the experience of the built environment, stimulating the senses using touch, smell, taste, sight and hearing. Furthermore, the material palette aims to establish a fusion of local materials, together with robust and durable materials.

HORIZONTAL PLANE



Galvanised concealed fix klip-lok roof sheeting
Robust and durable material that can be reused.

Treated timber beams
Natural recyclable material that is cost-effective and provides a tactile as well as visual element.

Expanded insulation corkboard
Provides acoustic and thermal insulation, has low embodied energy and is completely recyclable.

Deciduous tree canopies
To create shade for outdoor spaces during summer but also provide haptic experience through fallen leaves in autumn (sound and sight).

VERTICAL PLANE

Mild steel mentis grating grid
Robust and permeable material for dividers. Material defines space but still allow light and visibility.

Thermacork wall cladding
Provides acoustic and thermal insulation, has low embodied energy and is completely recyclable. Also provides a tactile experience.

Jute rope dividers
Stimulate the tactile senses, defines spaces yet still retain light and visibility. Environmentally friendly material that can be recycled.

Corobrick Clay face bricks
Locally manufactured material that is recyclable and celebrates local materiality.

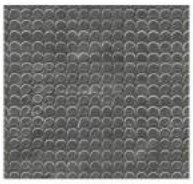
Vertical green walls
Extends the connection between built environment and natural environment.

Galvanised mild steel columns
Robust and durable material that is structural and can be recycled.

GROUND PLANE

Gravel and stone surfaces
To create a contrast in floor planes through sensory experience.

Vegetable and sensory garden
Create a sensory experience through extending the natural environment.



Recycled rubber floors
Absorb sound and reverberations, recyclable, durable and low maintenance.

Cast in-situ concrete floor slabs
Accessible walkway with low maintenance and can be recycled.

Concrete pavers
Locally manufactured material that can be arranged in patterns to create haptic experience.

Figure 4.10: Material palette depicting a combination of sustainability, locality and the experiential (Author 2018)

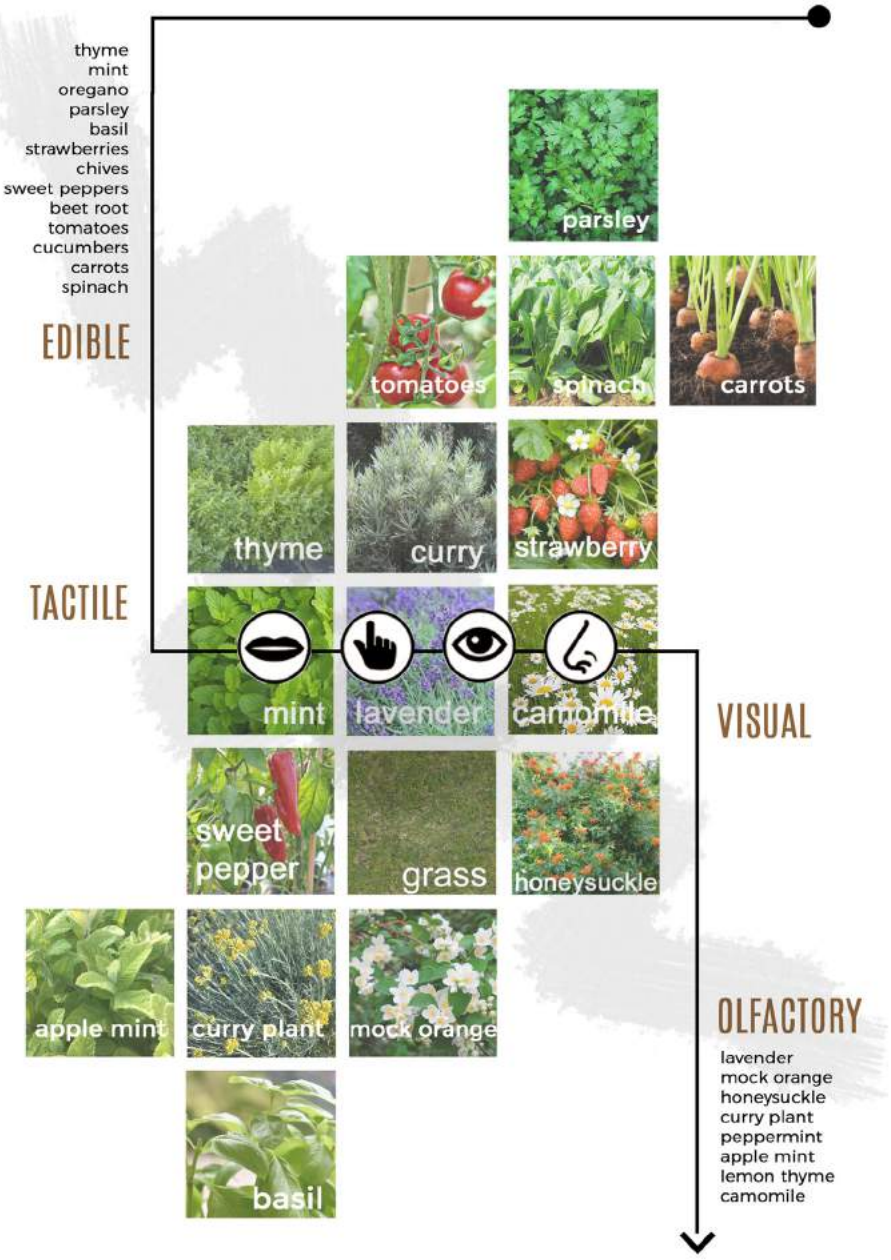


Figure 4.11: Planting palette proposing landscape as material to ensure sensory experience (Author 2018)

4.6.1 Landscape as material

As discussed in the theoretical premise, the natural environment contributes to all three of the salutogenic resources as powerful tool for healing and stimulating environments. It is confirmed by evidence-based research (Bowler et al 2010:457, Shishegar & Boubekri 2016:18) that natural views and spaces influence healing, learning and productivity. Therefore, natural elements and landscapes play a significant role in the building. Similar to the garden spaces at Maggie's Manchester (Foster and Partners 2018), a vegetable and sensory garden is implemented to provide a space for users to interact with nature and participate in the process. This strategy provides a sensory experience for users to eat, touch and smell plants. It also provides a natural environment that establishes a sense of meaning and reconnection to nature within an urban setting, contributing to the principle of meaningfulness (Golembiewski 2017:270). To provide a sensory experience through natural elements as discussed above, a planting palette is proposed as tool to provide healing and stimulating sensory benefits for users.

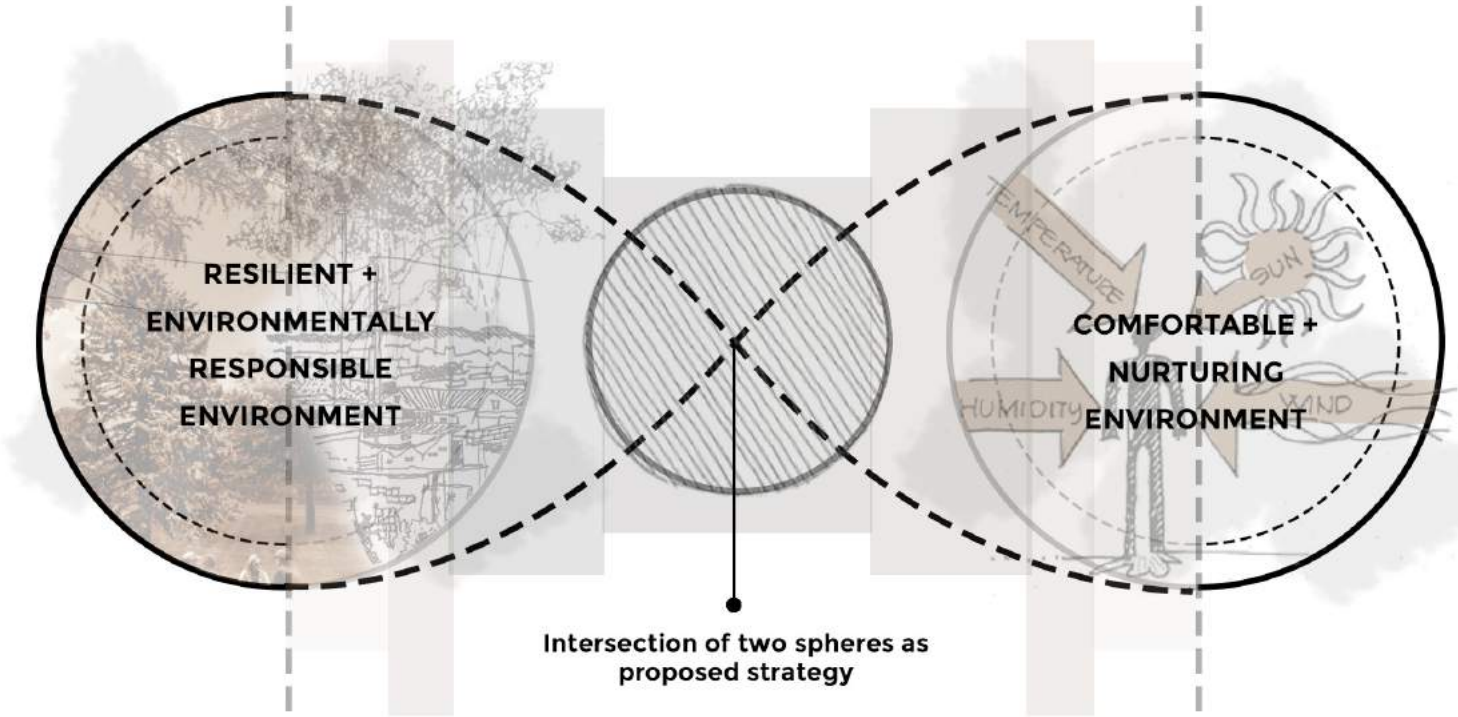


Figure 4.12: Diagram depicting environmental strategy for the project (Author 2018)

4.7 Environmental Systems and strategies

At the rapid rate of population growth, urbanisation and economic development, humanity is causing irreparable consequences such as scarcity of resources, depletion of fossil fuels and loss of ecological systems (Attia 2016:3). The built environment contributes largely to this problem, and therefore Smith (2016:15) calls for a change in the way we build in his book *Architecture in a Climate of Change*.

In this dissertation, the design responds to environmental issues through systems and strategies with the main focus on thermal comfort strategies, water strategies, and materiality. The aim is to demonstrate a resilient and environmentally responsible building that contributes to the community of Mamelodi East.

As discussed in the theoretical premise, the built environment can play a role in the promotion of healing, wellbeing and development. Therefore, the focus is on ventilation and thermal control strategies, water strategies such as rainwater harvesting, as well as acoustics to contribute to a comfortable and nurturing healing environment (Mazuch 2017:46), which contributes to the principle of comfort and natural environment.

4.7.1 Climate conditions

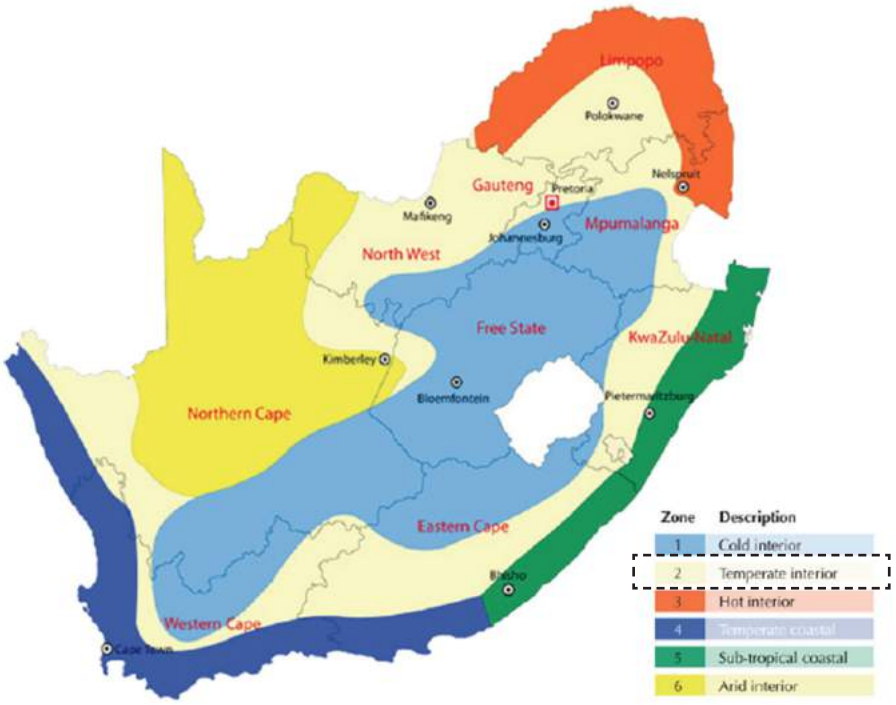


Figure 4.13: Mamelodi East located in Zone two classified as Temperate Interior (Schmidt et al 2013:104)

The consideration of the climate conditions in Mamelodi East serves as important design informant to enable the building to respond in the most energy efficient manner possible.

Mamelodi East is located in Zone Two: Temperate Interior according to the six climatic zones stipulated in the SANS 204 (Schmidt et al 2013:104). This indicates that the region experiences short dry winters and long hot rainy summers. The region experiences the most wind during August to December with average wind speeds of 5-12 kilometer per hour. Wind is mostly from the Northeastern and western direction (Meteoblue 2018). The average annual temperature in the region is 18˚C. The hottest months are in December to February with an average maximum temperature of 25˚C. The coldest months with an average minimum temperature of 11˚C are June and July (Meteoblue 2018). A high incidence of solar radiation is present throughout the year. The changing position of the sun over the seasons impacts the orientation of the building as well as angles of shading elements.

Taking into consideration the climatic conditions of Mamelodi East, the design response aligns with the seven principles proposed by Schmidt et al (2013:104) for an appropriate design response in a temperate interior region:

1. Passive solar principles
2. Maximise north facing walls and openings in habitable spaces with passive solar access
3. Minimise glazing on eastern and western facades
4. Use of adjustable shading elements
5. Cross-ventilation and passive cooling for summer
6. Use convective ventilation and heat circulation
7. Reflective insulation to keep out summer heat

ROOF CATCHMENT AREA:	2260 m²	**TOTAL ANNUAL YIELD:**	2772.83 m³
PAVING CATCHMENT AREA:	2600 m²	**TOTAL ANNUAL DEMAND:**	2483.00 m³

Figure 4.14: Diagram depicting the water catchment strategy (Author 2018)

4.7.2 Water strategy

The built environment can contribute largely to water conservation by implementing alternative water strategies in buildings. Thirty-seven percent of water used in the government sector in South Africa goes to waste (Van Wyk 2015:13). Water conservation strategies need to focus on reduction in water usage, loss and waste to ensure a resilient approach towards water conservation. In conjunction with a resilient approach, water also plays an important role in terms of the natural environment. As stated by Bowler (Bowler et al 2010:457), the inclusion of a natural environment within the building is vital to create a meaningful and healing space. With the inclusion of a vegetable, sensory and vertical garden spaces in the building, water for irrigation purposes is necessary. Therefore, rainwater harvesting and grey water recycling is further investigated as an appropriate water strategy to supply the water demand on site. Black water and water that cannot be recycled or reused, will be directed into the municipal sewer system.

RAINWATER HARVESTING

Rainwater harvesting is implemented to provide water for the vegetable garden irrigation system. Rainwater is harvested from all the roof areas, transported together with water run-off from hard surfaces towards a storage system of reservoirs. Landscape design is implemented to prevent runoff from areas of high erosion vulnerability through efficient storm water management. After collection and before water enters the storage tanks, it is filtered through a first flush diverter to separate and flush away possible contaminated water. When stored, water is used for the irrigation of the vegetable garden and landscaped areas. A drip irrigation system is proposed for the vegetable garden area. Drip irrigation is an efficient water wise system as it allows for the delivery of limited volume of water to soil (Bio-Systems SA 2017). The drip is situated just above the root of each plant, minimising water loss through evaporation or wind. Some of the rainwater collected on site will be separately filtered through a bio-filter. The bio-filter (Areerachakul et al 2009:431) consists a layered system of sand, plant, gravel and stone that act as filter. After the filtering process, water is stored and pumped through a UV filter (Yencho 2011:62) to kill pathogens present in the water. Thereafter, water can be used for cooking purposes and water for wash hand basins.

STORM AND GREY WATER RECYCLING

Grey water and storm water runoff from the building is recycled for the flushing of toilets and yard cleaning purposes on site. The recycling strategy involves the collection of storm water runoff into storage tanks for treatment. Water is collected, treated and recycled for different uses to contribute towards a more sustainable approach. Storm water and runoff is collected on site in catchment channels. Mentis grid is used to cover water channels to prevent large debris from entering the system. From here water moves through a grease trap to prevent grease or oil for entering the weir. After treatment, water is pumped into a separate tank, ready for use in toilets and cleaning purposes.

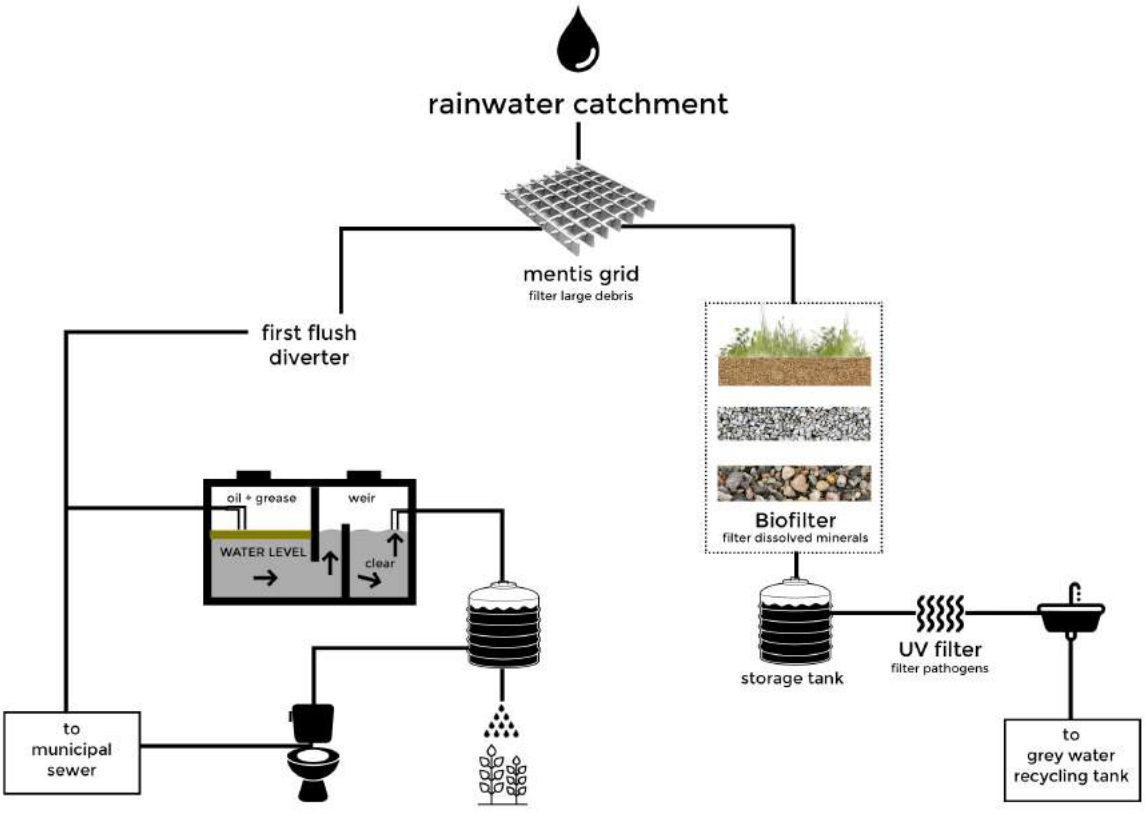


Figure 4.15: Diagram depicting the water strategy for the project (adapted by Author 2018 from Minnaar 2017)

4.7.3 Energy strategy

The spaces and buildings we as architects design create certain conditions for its users, whether or not anticipated. Air movement, humidity, radiation and temperature are all aspects that play a role in the microclimates our buildings envelop. Mazuch (2017:46) concurs that comfort within internal environments can influence a user's experience. Therefore, the goal is to create conditions as close as possible to comfortable for the intended users of the building at the specific location. With the increase of electrical climate control in buildings still prevailing in South Africa, it is necessary to consider alternative design strategies to create favourable climate conditions in buildings (Van Reenen 2014:45). For this reason, heating and cooling strategies and building form is explored in support of the theoretical premise and to ensure an energy efficient building.

Based on SANS 10400 (2011:18) and the REHVA Guidebook (Brelih 2012:8) health related spaces requires 12 air changes per hour and specifies temperatures between 22-24˚C as thermally comfortable. These values are used as criteria for the proposed energy strategy:

BUILDING FORM, ORIENTATION AND PASSIVE FEATURES

Relating back to the principle of space and form discussed in the theoretical argument, the building form, orientation and passive features do not only influence the building shape but also influences the wellbeing and development of users. As result, the building envelope is designed through the lens of salutogenesis to support thermal comfort, minimise cooling and heating requirements and optimise natural lighting. Elements such as external shading, optimal glazing, suitable insulative and reflective properties of roof and wall materials are considered to extend the theoretical argument. These specifications adhere to SANS 10400-XA:2011 (energy usage in buildings) for Climate Zone 2 (Temperate Interior).

Similar to the Hazelwood school's orientation to ensure optimal northern exposure, north-facing walls and openings are maximised in the building to ensure natural light as well as optimal visual connectivity to the outdoor environment and Magalies Mountain range view. The roof profile is designed in such a way as to allow indirect southern light to enter the roof and filter down into spaces to maximise natural lighting. East and West openings are screened to assist with passive design strategies. Screening elements aid in protection from the sun and wind. Apart from the functional contribution, the materiality of screening elements also provide a haptic experience which contributes to the principle of comprehensibility (Golembiewski 2017:270) through assisting in perceptual processes such as wayfinding and tactile stimulation. Shading elements for openings are implemented to ensure exclusion of summer sun and inclusion of winter sun.

VENTILATION

With reference to the principle of comfort discussed in chapter two, sufficient ventilation, issuing fresh air into the space, is vital to sustain a healthy and comfortable environment. Well-designed natural ventilation in spaces also supports thermal comfort when ambient conditions allow. The regulatory aspect of ventilation is adherence to SANS 10400-O: 2011 (Lighting and Ventilation).

As a first iteration, a fully naturally ventilated solution was investigated, as this is inherently the option with lowest cost and energy usage. For full natural ventilation, free area openings will be required to a minimum 5% of the floor area, equally distributed to enhance natural cross flow as prescribed by SANS 10400-O:2011. Incorporating the passive architectural features and building materials previously mentioned, the space was CFD-modelled (Computational Fluid Dynamics) using Design Builder 2018 energy modelling software. Louvered openings equal to 5% floor area were added to the space, satisfying

the regulatory guideline. To make effective use of natural buoyancy and stratification of rising hot air and falling cool air, the openings were positioned at different heights on opposing walls. The first iteration shown in Fig 4.16 indicates that a fully natural ventilated strategy provides spaces with an internal temperature of 28-29˚C in summer and temperatures of 17-18˚C in winter. According to the REHVA Guidebook (Brelih, 2012:18), temperatures between 22-24˚C is recommended to ensure a thermally comfortable environment. Therefore, it is evident that the fully natural ventilated strategy is not sufficient to create a comfortable environment.

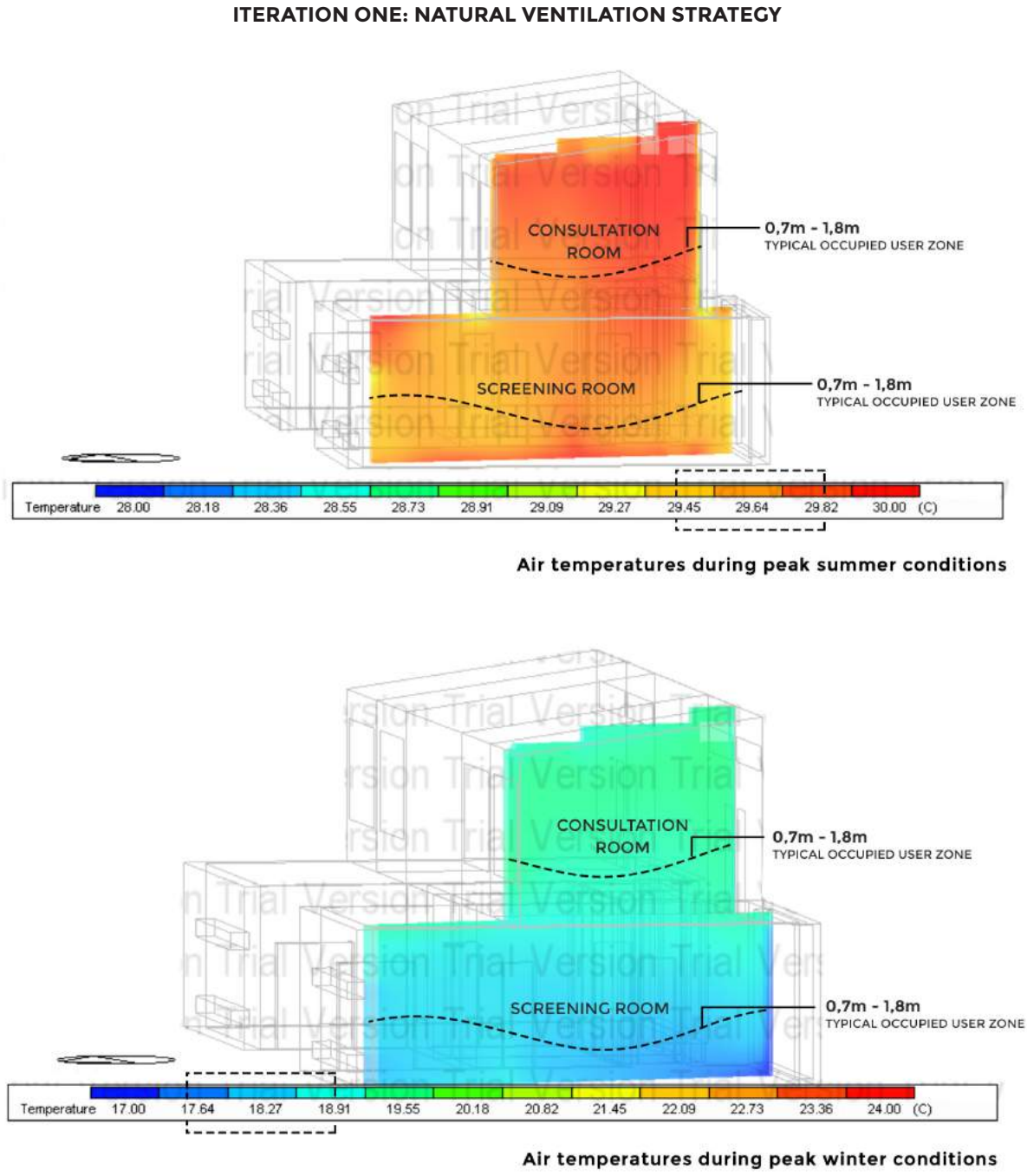


Figure 4.16: Iteration one implementing natural ventilation for thermal control in the building (simulated by Author 2018 on Design builder 2018)

COOLING AND HEATING

Various alternative systems are explored to optimise the cooling and heating requirements for the building and ensure a thermally comfortable space for users to contribute to the previously discussed principle of comfort. To ensure a resilient approach, the required system needs to have a low environmental impact and feasible lifecycle. Alternatives are limited to systems relevant to domestic and small-scale buildings, and more efficient than typical domestic direct expansion (DX) split units. The following descriptions and table indicates a brief comparison between the alternative systems investigated.

ALTERNATIVE SYSTEMS EXPLORED:

EVAPORATIVE

Evaporative cooler using wet packs (kept wet by water supply), blowing fresh air through the packs and using latent evaporation energy from the water to cool down air. Air supplied into space by ducting and fan system (ASHRAE, 2011).

GEOTHERMAL

Heat pump system using refrigeration cycle to move energy from/to low/high temperature spaces as needed. Refrigeration coil transfers heat to/from closed-loop water loop circuit installed underground. Uses constant underground temperatures as heat sink or source, being more efficient than conventional air heat rejection (ASHRAE, 2011).

RADIANT SURFACES

Network of piping manifolds installed either in special ceiling panels (for cooling) or in floor screed (for heating). Water recirculated through piping to heat up or cool down the surface and cool/heat the space via radiation. Heating and cooling source of water can vary, typically using an inverter heat pump (ASHRAE 2011,54.1).

COMPARISON BETWEEN ALTERNATIVE SYSTEMS

Cooling and heating?	No (cooling only)	Yes (heated or cooled air)	Yes (chilled ceiling panels and underfloor heating)
Needs water supply?	Yes	No	No
Recirculation of water?	No	Yes	Yes
Ducted air supply?	Yes	Yes	No
Legionella risk?	Yes	No	No
Full fresh air?	Yes	No	No
Aesthetic impact	Indoor ducting for all supply air Outdoor unit	Indoor ducting for all supply air Outdoor unit Underground piping circuit	Only fresh air ducting (minimal) Outdoor unit Indoor piping to ceiling or floor panels
Cost	Low	High	Medium
Energy usage	Lowest (50% lower than domestic HVAC DX system)	Low (30-40% lower than domestic HVAC DX system)	Low (30-40% lower than domestic HVAC DX system)

Figure 4.17: Comparative table between alternative systems investigated (Author 2018, information sourced from ASHRAE 2011)

PROPOSED COOLING AND HEATING SYSTEM

Although evaporative cooling has the advantage of the lowest cost and energy usage, the high usage of water contradicts an environmentally responsible approach. The high risk of legionella is another heavily weighted disadvantage, specifically in the context of a health environment. Therefore, it was decided to use the second and third systems in combination. The most advantageous attributes of each are implemented for the best results for the specific project requirements.

A COMBINED ALTERNATIVE SYSTEM: GEOTHERMAL AND RADIANT SURFACES

Radiant plasterboard wall panels are placed at wall surfaces, with lightweight aluminium piping circuits installed within the panels (Lindner 2018). Similarly, piping circuits are installed in the floor screed below the tiling. These piping networks are connected with manifolds to insulated supply and return piping connected to a heat pump located outside the building in a screened plant room area. Water is re-circulated through the system and heated or chilled by the heat pump. A set of valves can direct hot water (at 45-50˚C) to the under floor networks during winter and chilled water (at 6-10˚C) to the wall panels during summer to make effective use of the natural flow direction of heated or cooled air. The floor or wall surfaces are then heated or cooled, transferring heat through radiation to occupants (Lindner 2018). Although a conventional heat pump can be used to chill or heat the water circuit, a geothermal heat pump is proposed to increase the energy efficiency as much as possible (ASHRAE 2011). A separate closed-loop water circuit is installed in trenches in the ground outside. This therefore makes use of the relatively constant geothermal temperature (10-15 ˚C at 6-10m) as a heat sink (during cooling mode) or heat source (during heating mode), which can be augmented by the heat pump compressor when ground temperature is insufficient (ASHRAE 2011) . No water is consumed in the process; minimal energy is consumed through the use of geothermal energy; a comfortable indoor area can be attained; and no major ductwork is required, since only piping manifolds are needed.

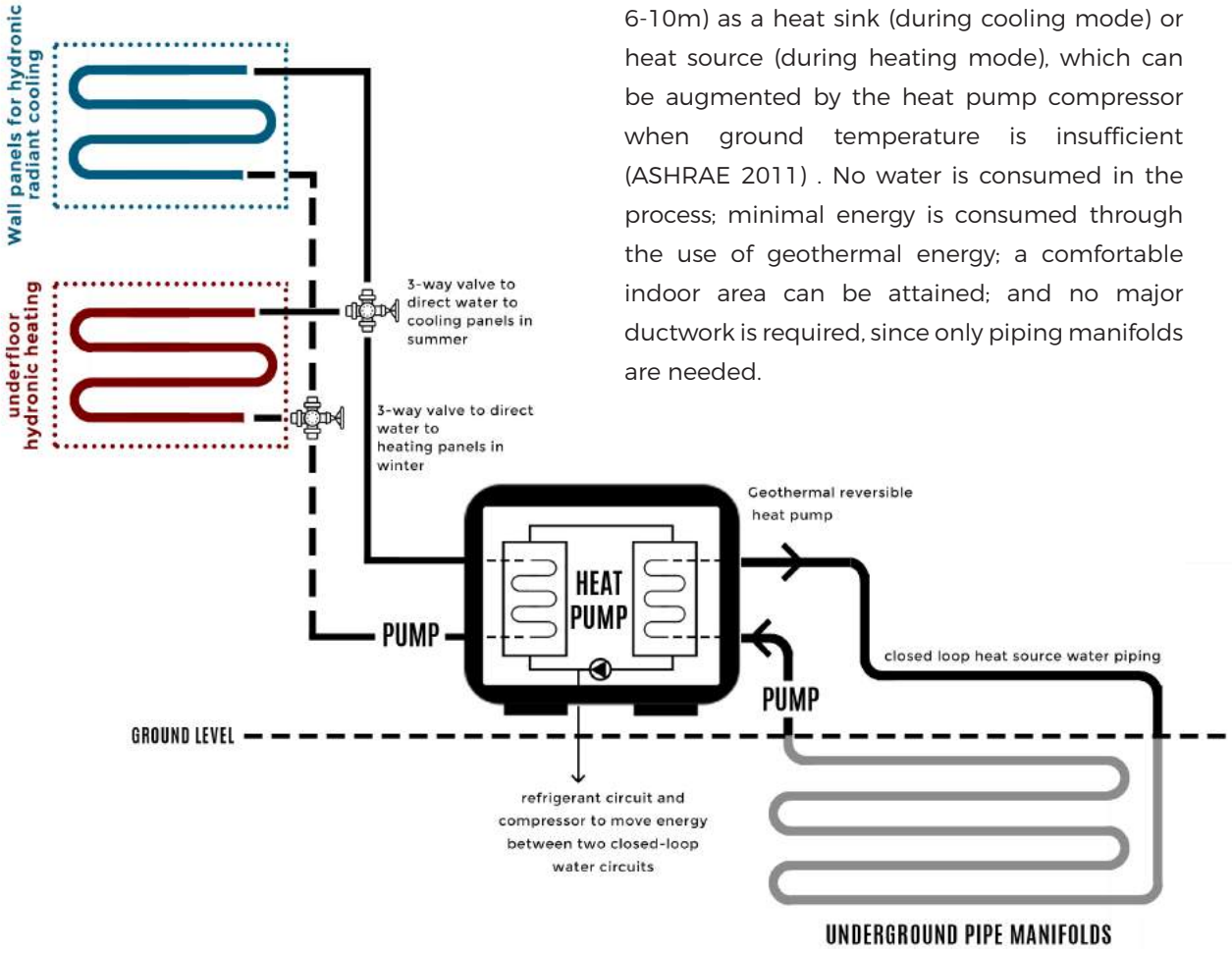
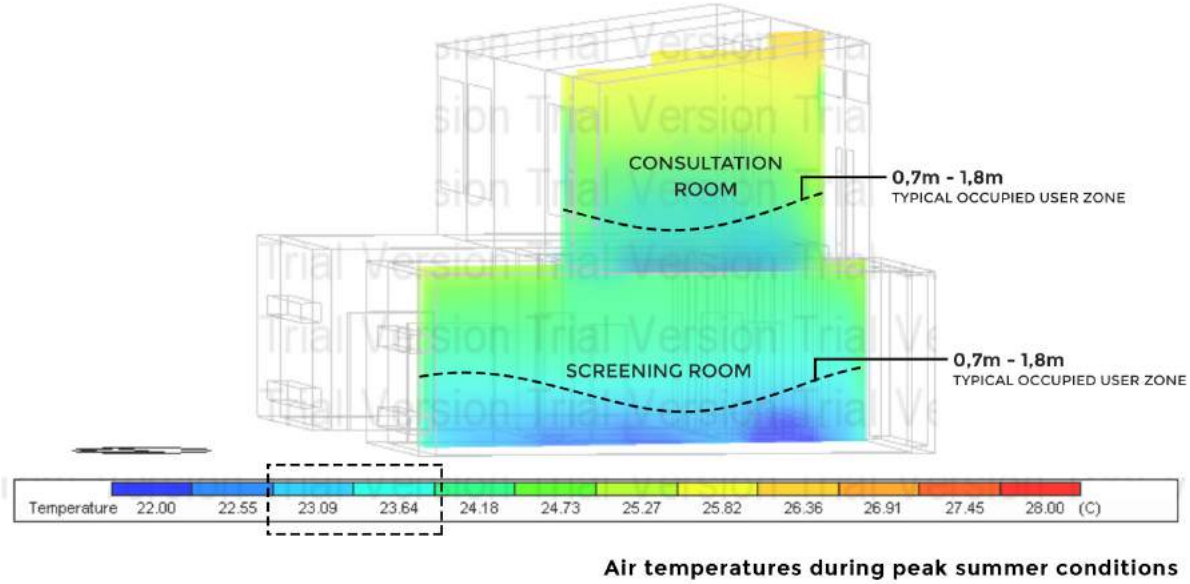
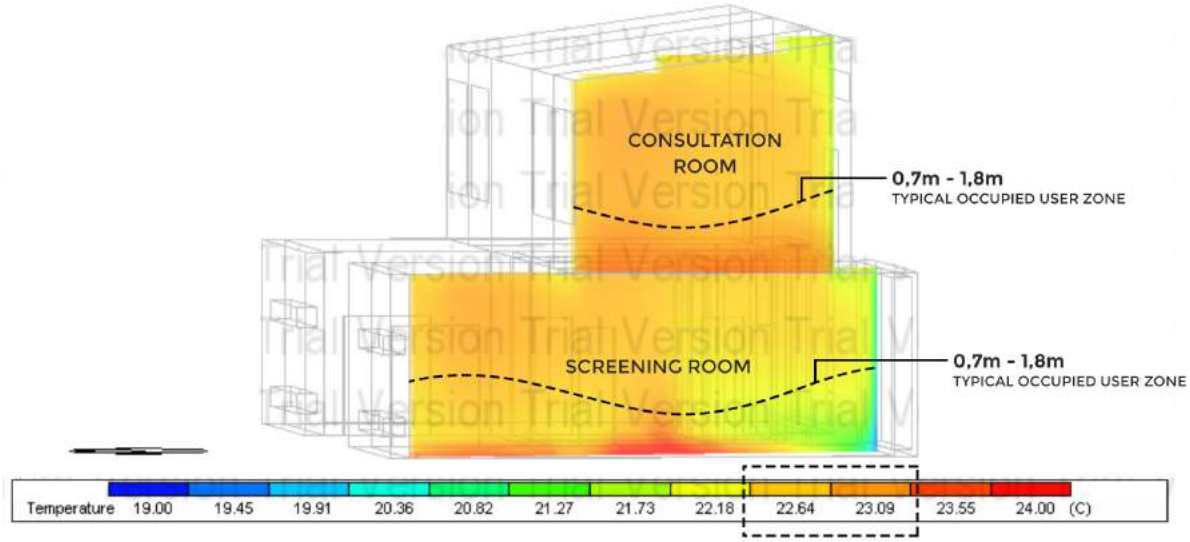


Figure 4.18: Diagrammatic representation of proposed alternative heating and cooling system (Author 2018, information sourced from ASHRAE 2011)

ITERATION TWO: ALTERNATIVE STRATEGY



Air temperatures during peak summer conditions



Air temperatures during peak winter conditions

Figure 4.19: Iteration two implementing combined alternative system for thermal control in the building (Author 2018)

To reduce the heating and cooling load imposed on the geothermal radiant system, a simple mechanical ventilation system needed to be included to replace the natural ventilation openings. This is confirmed by SANS 10400:O-2011, which stipulates that mechanical comfort control of any means cannot be used in conjunction with natural ventilation openings for the same space (minimum mechanical ventilation rates are lower than natural ventilation openings air movement). The ground floor will be supplied with a wall fan in the ablution exterior wall (screened from the outside), extracting air through a door grille in the ablution and using as make-up fresh air source a small louvre on the opposite side of the room at high level. Transfer grilles in the consulting room ensure fresh air is also ventilated through this area. For the top floor, a similar wall fan simply introduces the required amount of fresh air into the space. These ventilation solutions ensure that a healthy and required volume of fresh air is always supplied to users, without compromising thermal comfort or adding unnecessary heating or cooling load to the mechanical system in winter or summer. The second iteration shown in Fig 4.19 indicates that the combined alternative strategy provides spaces with an internal temperature of 23-24˚C in summer and winter. Therefore, the combined alternative strategy for ventilation and thermal comfort proposed is sufficient to create a thermally comfortable environment.

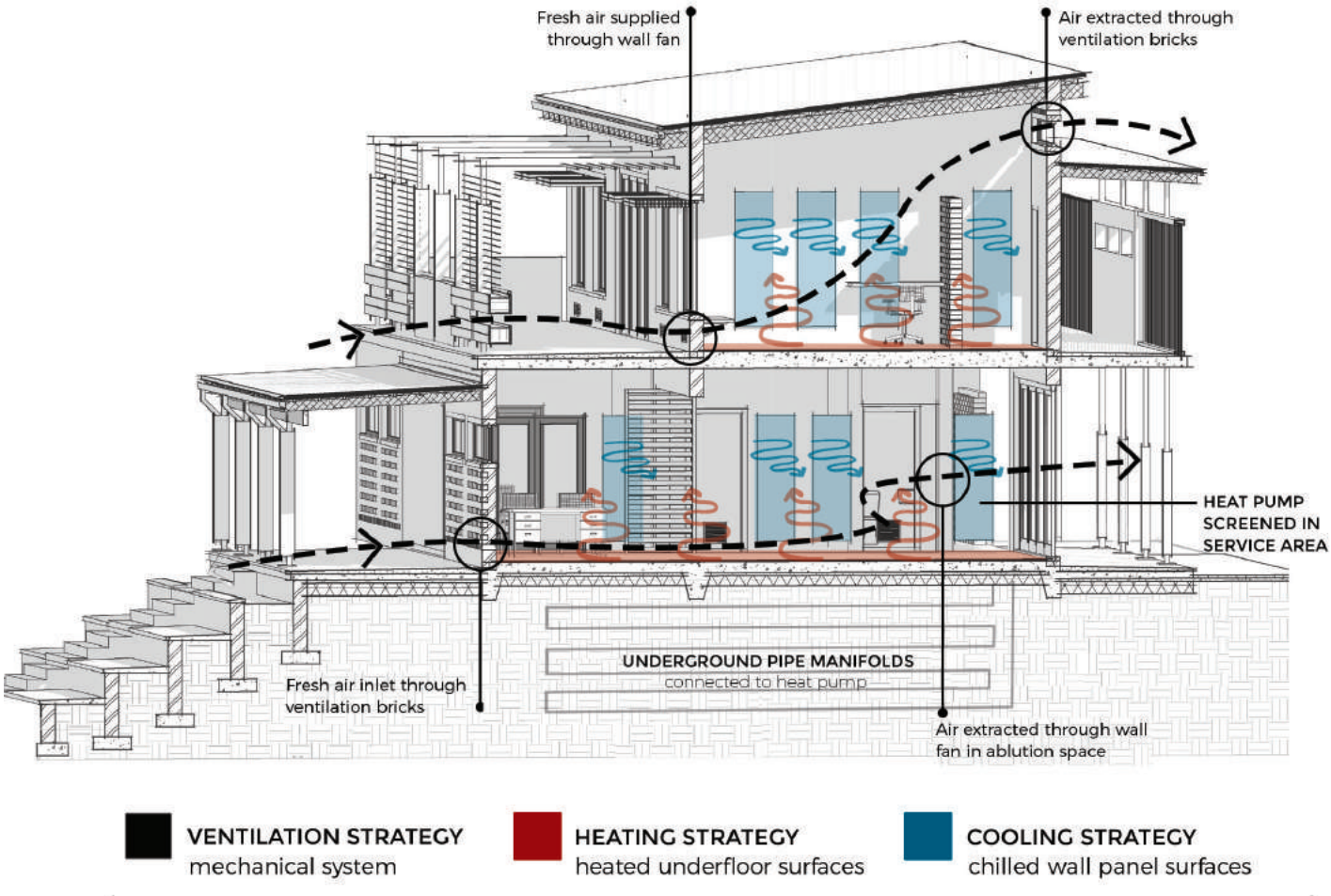


Figure 4.20: Alternative system strategy for ventilation and thermal control (Author 2018)

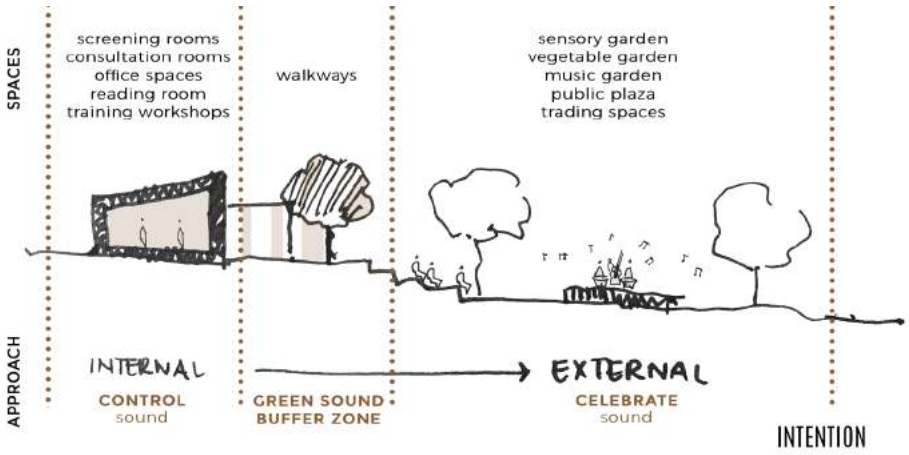


Figure 4.21: Acoustic approach for the project (Author 2018)

4.7.4 Acoustics

In public health settings, acoustic comfort becomes an essential quality as poor acoustics can affect health, communication, productivity and learning (Mazuch 2017:46). In support of the theoretical premise, acoustic design therefore becomes vital in the architecture created. Although focus is placed on controlling sound within internal environments to enhance comfortable auditory spaces, external environments become the platform to celebrate sound and allow auditory expression. According to Ulrich (2006:S38), acoustic comfort in health care settings is determined through the appropriate design of spaces and not by modifying the activity or behavior of users. For this reason, acoustic control in the building is considered according to the type of activity taking place in proposed spaces and designed appropriately. The technical exploration places focus on reverberation within internal spaces. The IUSS Health facility guide (2014) stipulates that material finishes should consider acoustic effects within internal environments. Material choice influences the reverberation time within spaces. SANS 10103:2008 (The measurement and rating of environmental noise with respect to annoyance and to speech communication) prescribes a reverberation time of 0,4 - 0,7 seconds in health-related spaces such as consultation or screening rooms. Therefore, the materiality of internal surfaces such as ceilings, walls and floors are selected to limit reverberation time. As seen in Fig 4.22, expanded insulation corkboard (Thermacork 2018) is used as ceiling finish, Thermacork cladding (Thermacork 2018) as wall finish and recycled rubber as floor finish to minimise reverberation time within internal spaces.

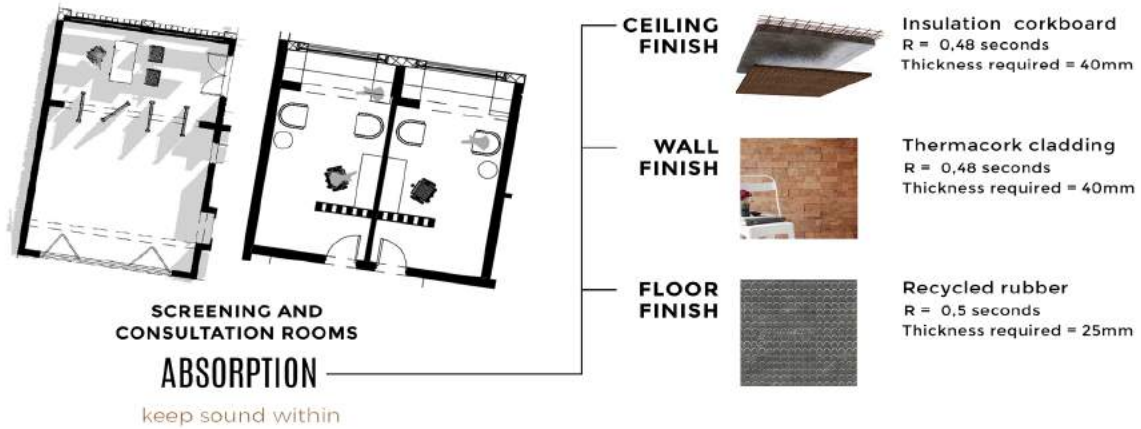


Figure 4.22: Material choices for internal environments complying with prescribed reverberation time (Author 2018)

4.7.5 Sustainable Building assessment tool (SBAT-P)

A sustainable performance rating is done after the architectural intervention on site to analyse the impact of the building on the surrounding environment and community. The Sustainable Building Assessment Tool (SBAT) rating tool (Gibberd 2015) provides a holistic overview with regard to the issues of sustainability in three different categories: social, economic, and environmental.

A target of 5.0 is set out by the rating tool for optimal sustainability performance. From the SBAT rating the intervention scored a 3.8 out of 5.0. The building performed the best in terms of the social sector. The informal nature of Mamelodi East contributes to the neighbourhood's sustainability. Spaza shops, taxis and busses and other small enterprises already contribute greatly to the local economy and sustainability. The intervention only strengthens these existing networks and sectors. The building performed lower in terms of the environmental sector. The assessment revealed waste on site scored the lowest in the environmental sector. As future recommendation for similar interventions, these aspects should be considered to further improve the sustainable performance. Refer to Appendix for report values.

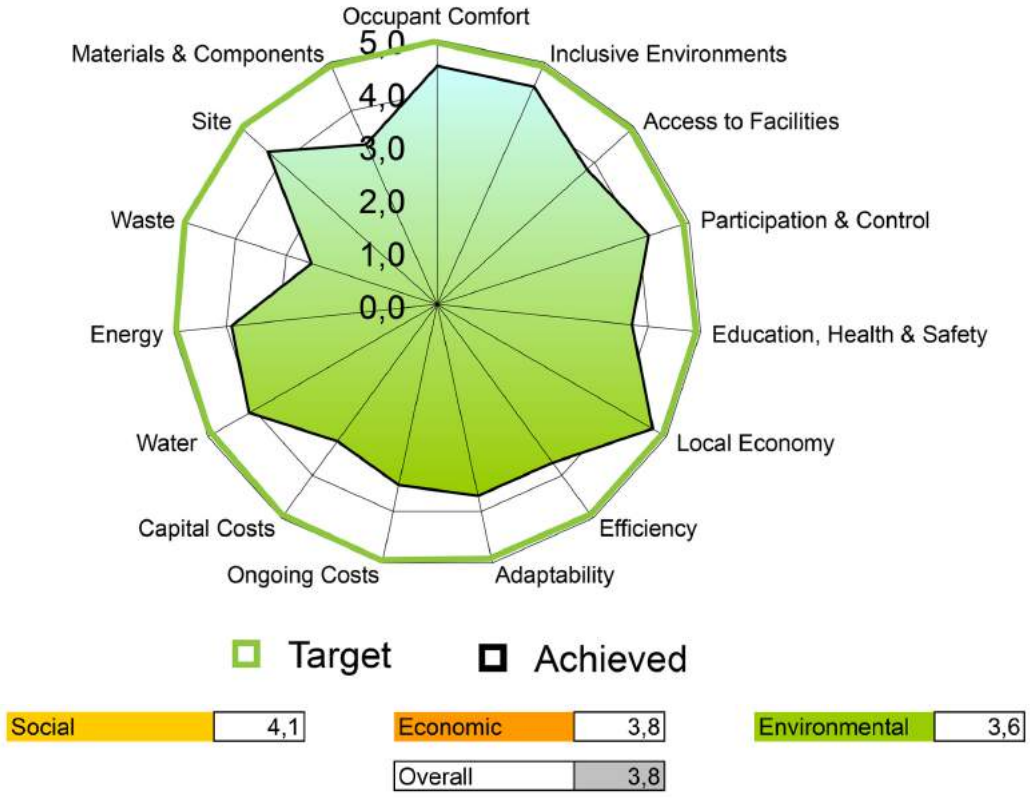
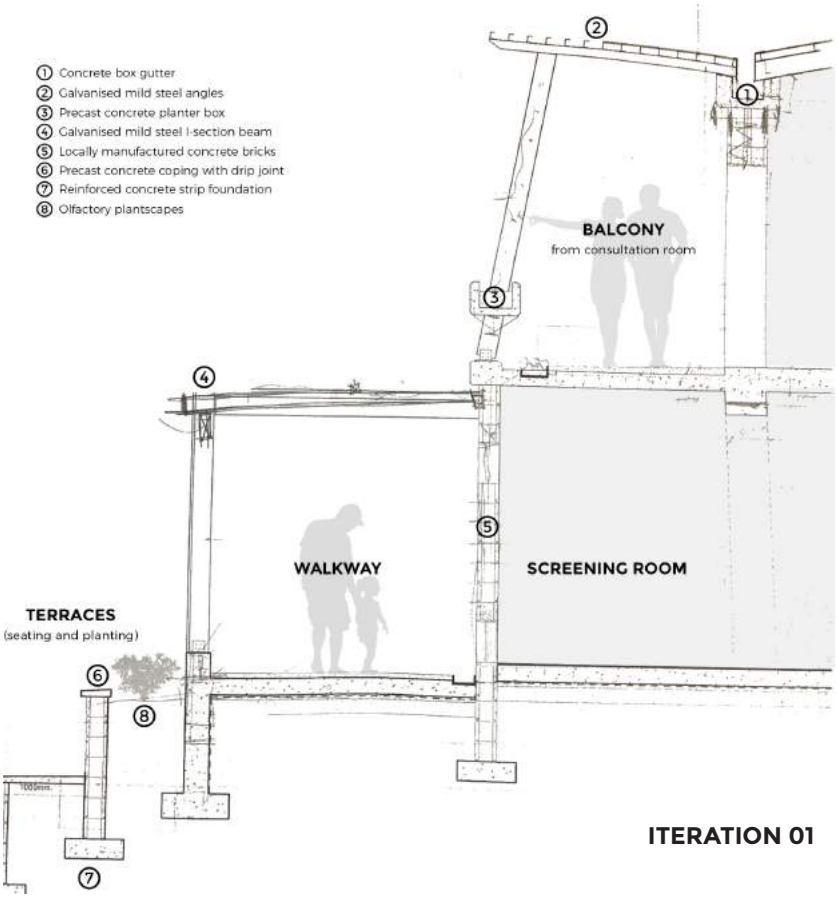


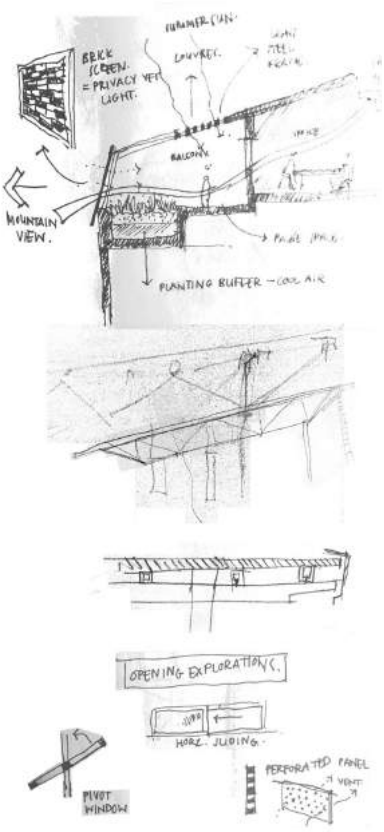
Figure 4.23: SBAT rating results after the intervention indicating a significant improvement (Author 2018)

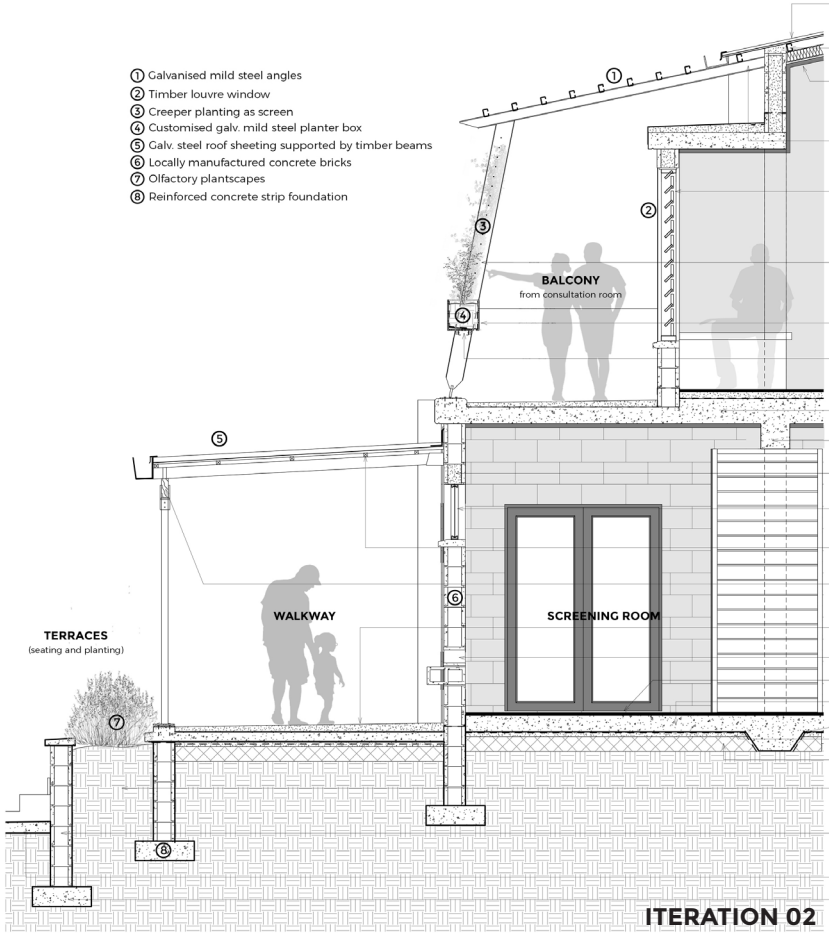
4.8 Technical conclusion

In conclusion, this chapter demonstrates the possibilities in creating a building that does not only encourage a healing and stimulating environment but also promotes resilience through alternative strategies. It highlights the opportunity for sustainable buildings that can maintain themselves and regenerate its surrounding natural environment within the context of Mamelodi East. It also reveals how the built environment can be a tool for experience, celebration and interaction through materiality, construction and systems.

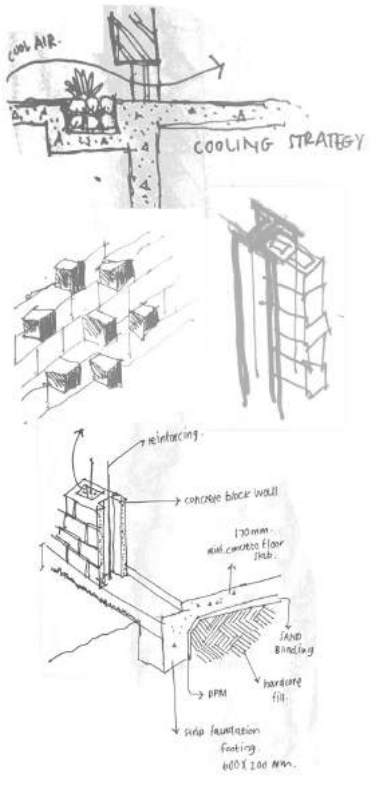


ITERATION 01

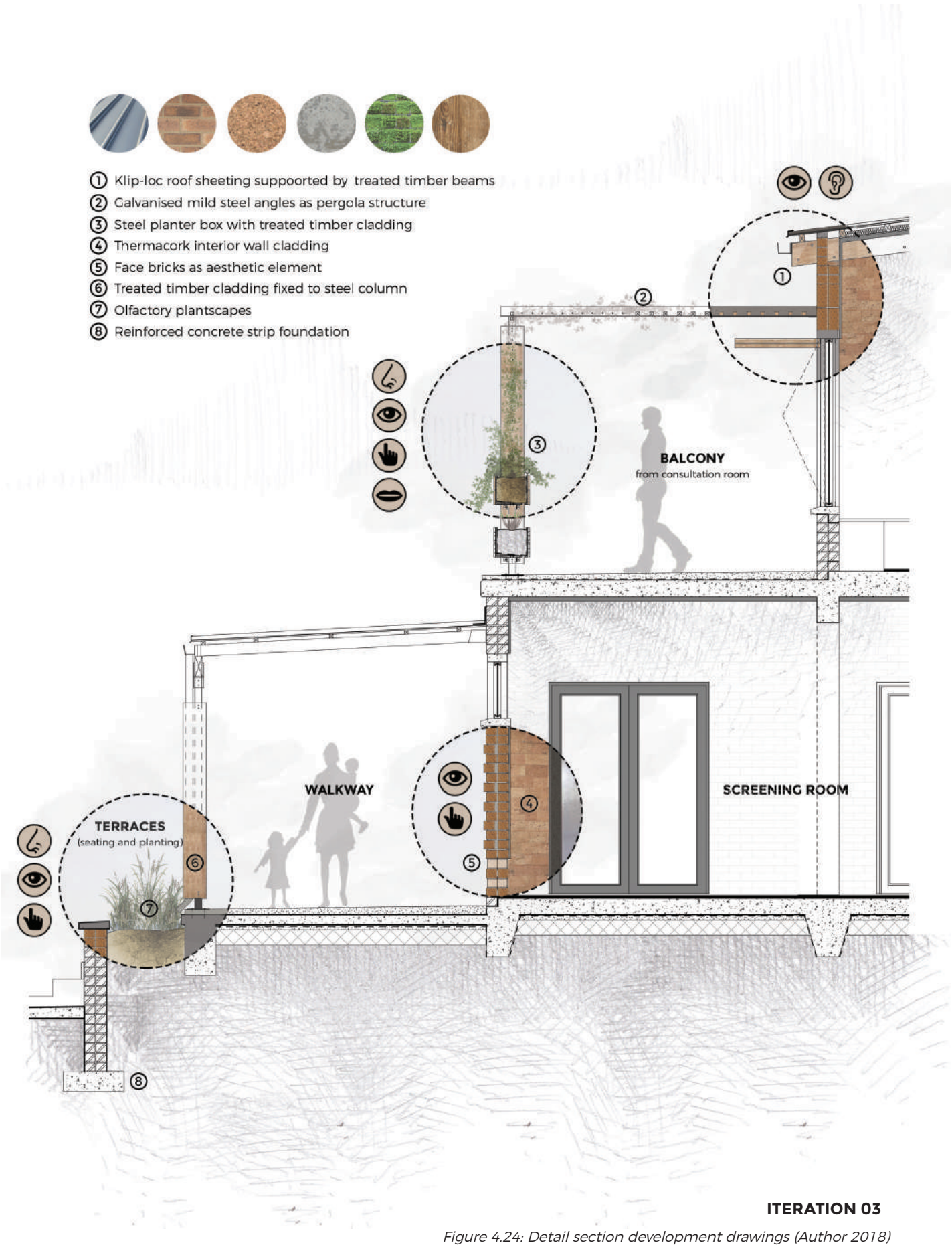




ITERATION 02

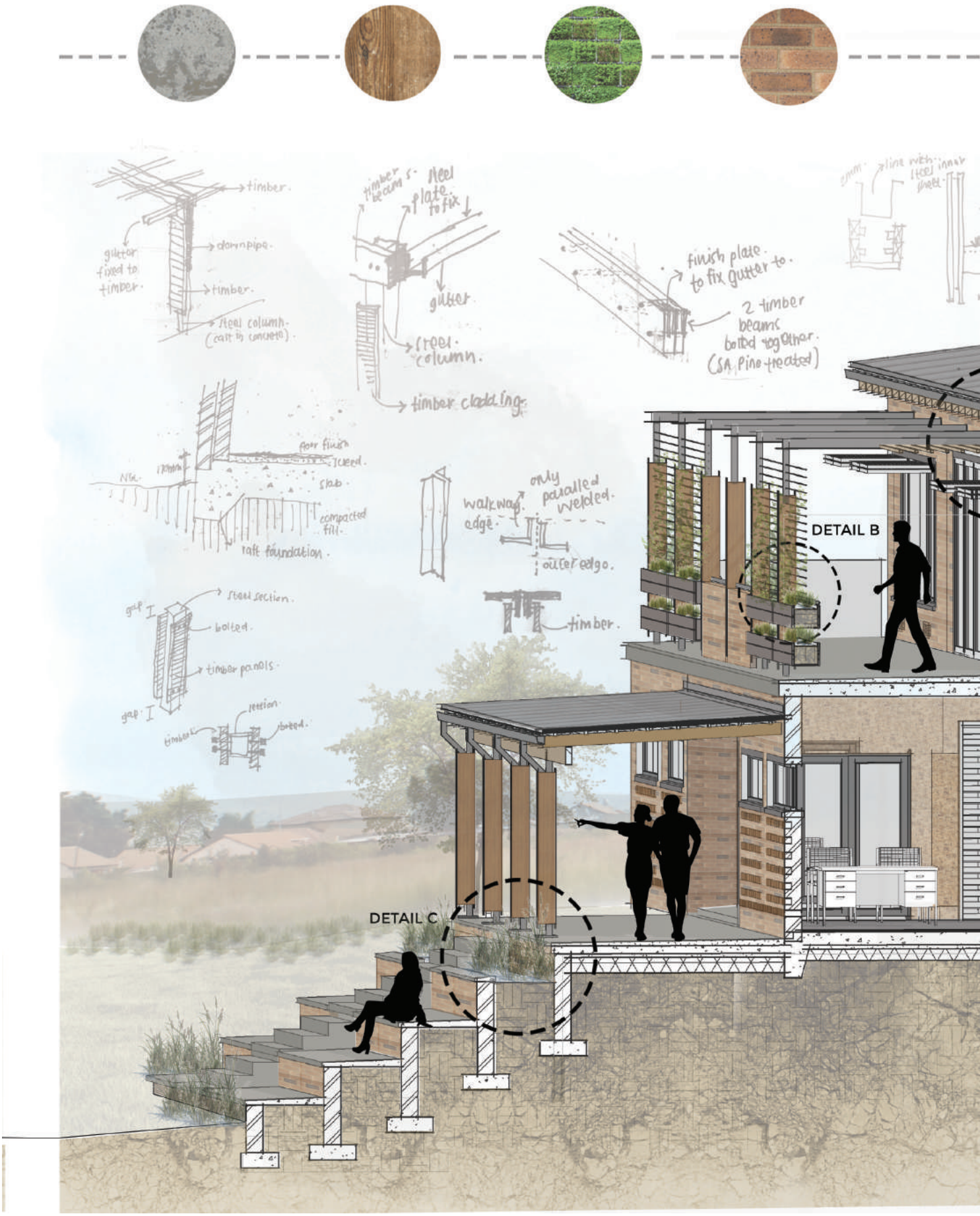


DEVELOPMENT SKETCHES



ITERATION 03

Figure 4.24: Detail section development drawings (Author 2018)



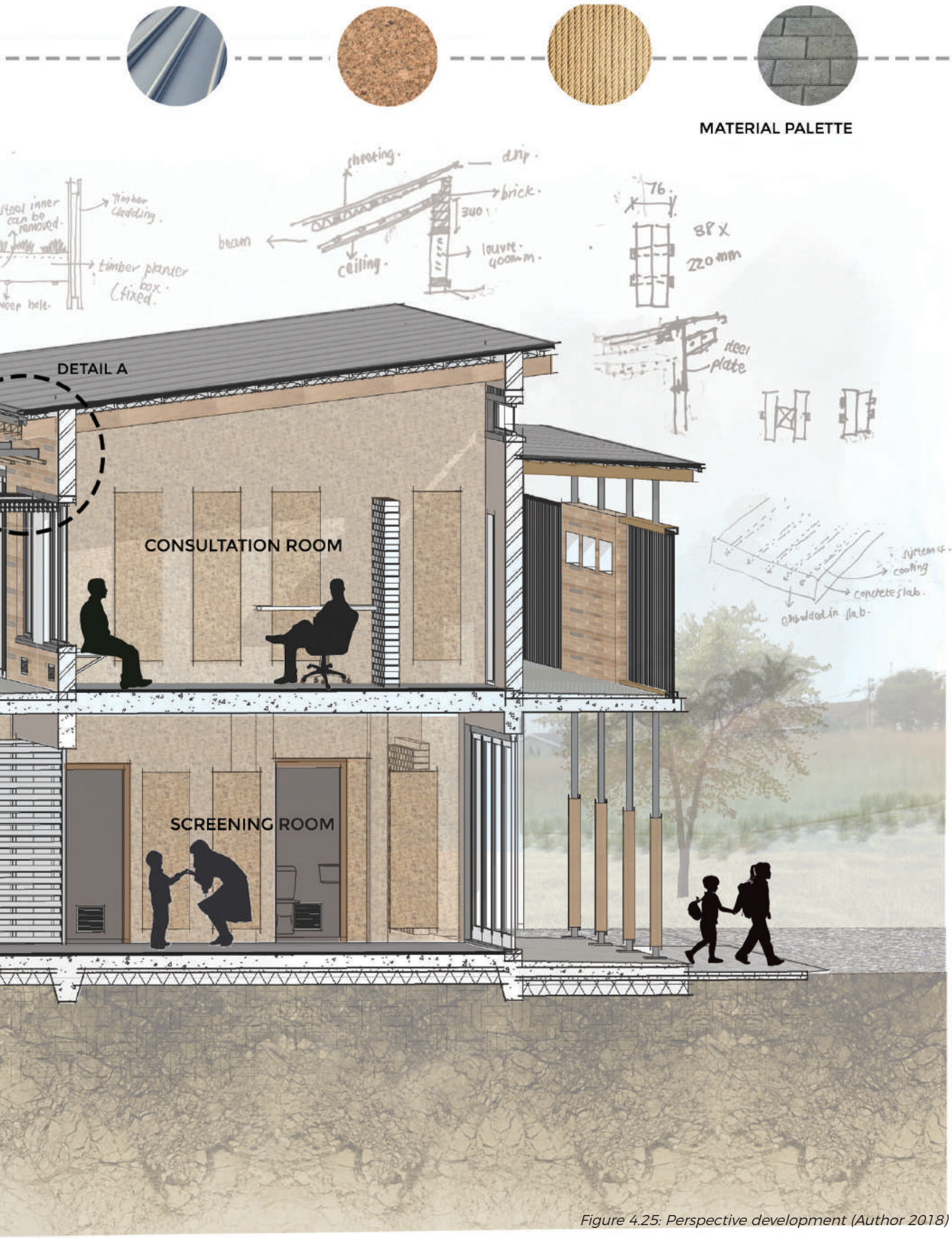
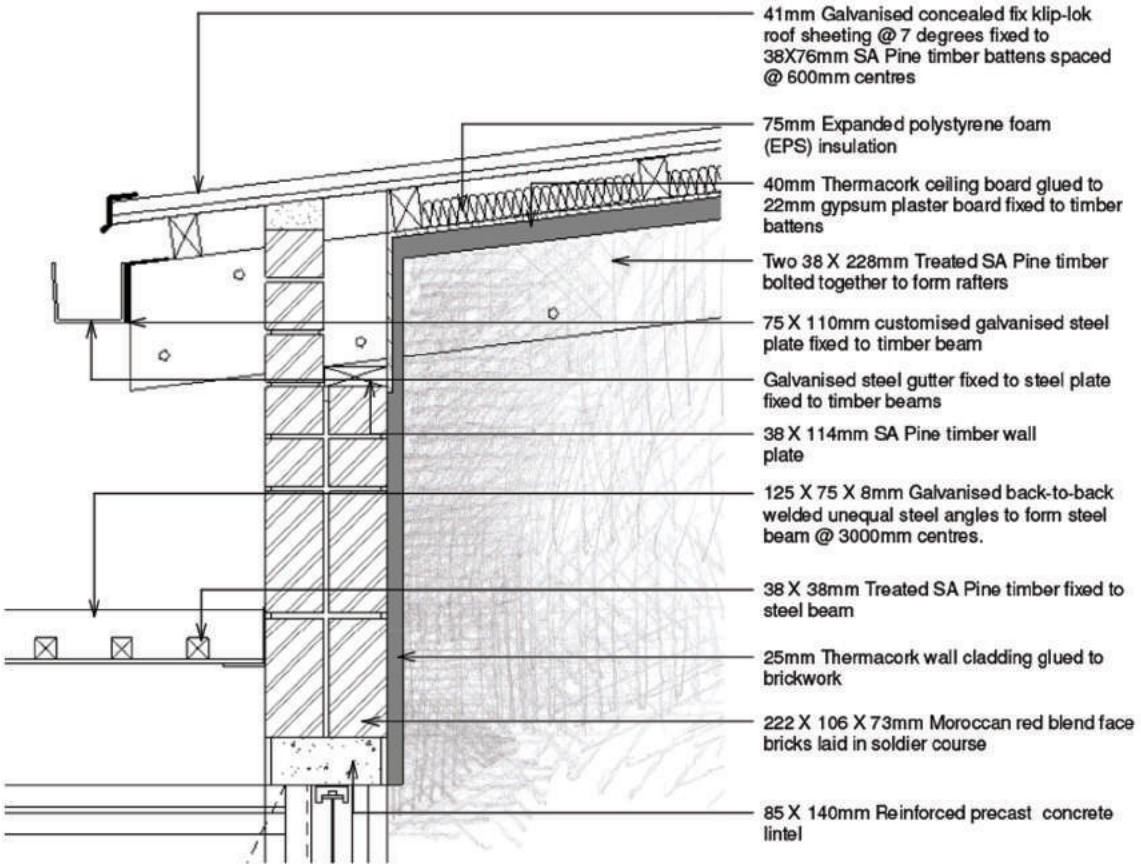
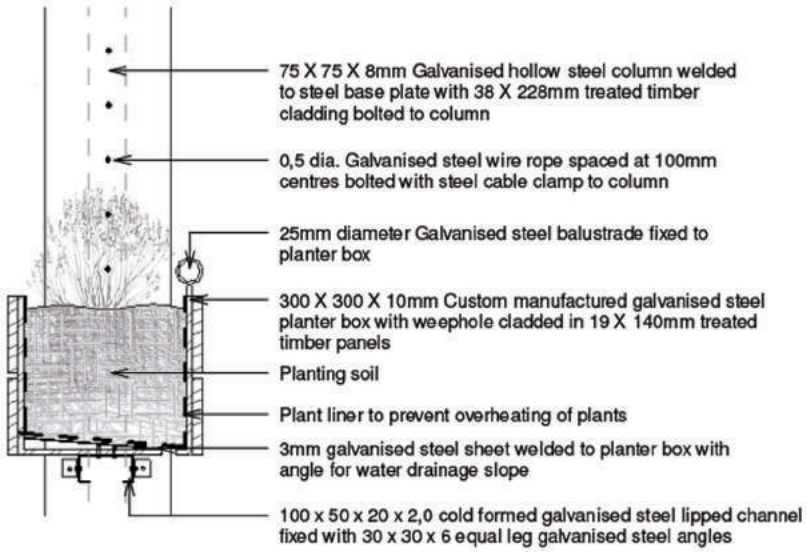


Figure 4.25: Perspective development (Author 2018)



DETAIL A
scale 1:10



DETAIL B
scale 1:10

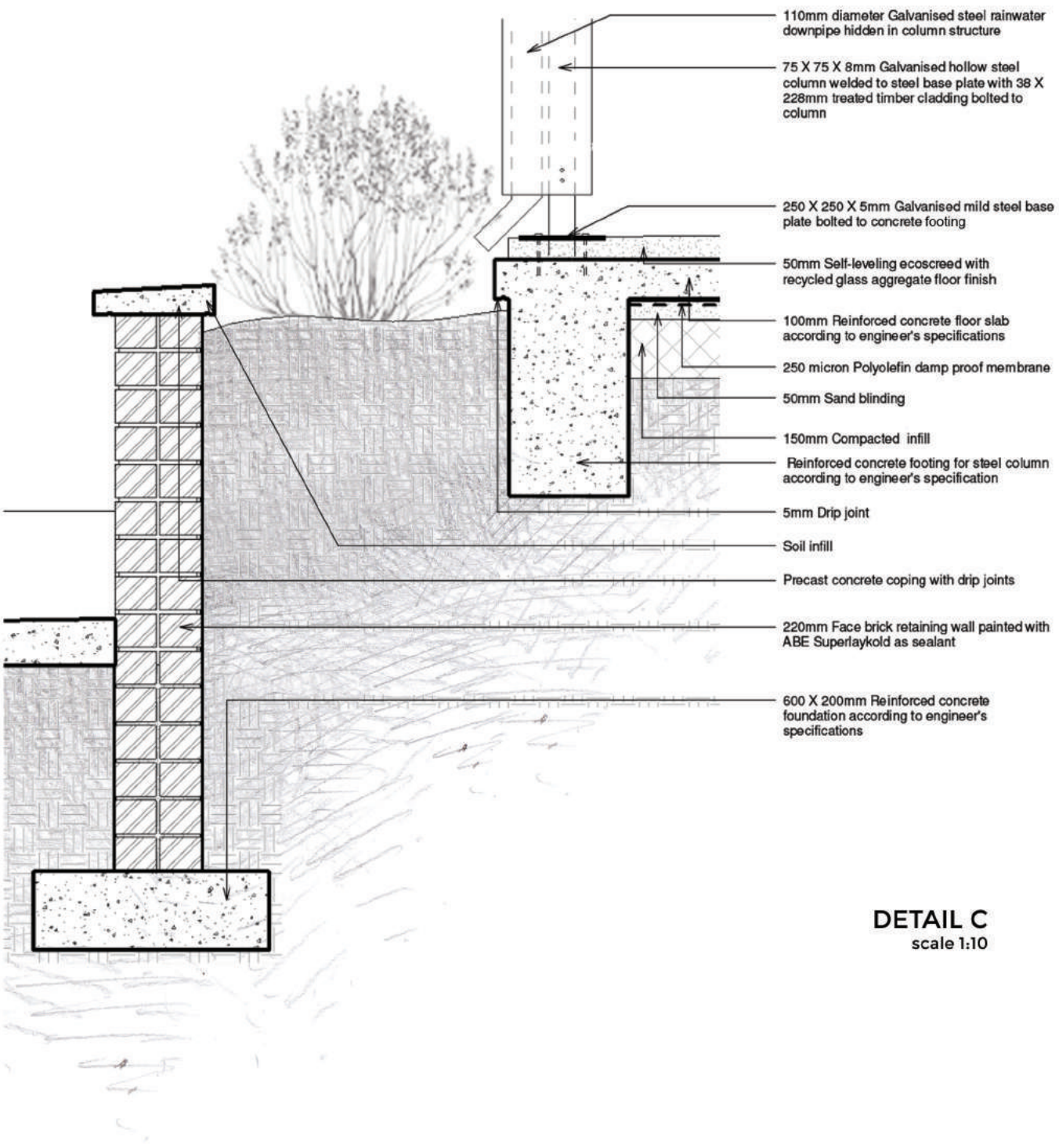


Figure 4.26: Detail development (Author 2018)

CHAPTER FIVE

Conclusion

Creating something essential

Early childhood interventions play a critical role in offering children a head start to a better future. The high primary school enrolment figure suggest that school health interventions have the potential to reach almost 12 million children at this crucial age of development and learning (Shung-King 2013). The image of health care is shifting globally, moving towards health care that does not only offer efficient and affordable health care facilities but also sustainable people-oriented healing environments (Boluijt & Hinkema 2005:4). Evidence-based research and new design tools such as salutogenesis and sensory design can assist architects in the process of designing health care facilities. Through implementing these approaches to design, the built environment, from the tactile detail to the very form, can positively impact health outcomes (Mazuch 2017:47).

Within the context of Mamelodi East, mapping revealed that children under 18 make up for 27% of the population (Wazimap 2016). Therefore, making use of the physical environment as tool in school-based health care settings within the above-mentioned context can be beneficial.

With an existing primary school and existing clinic in Mamelodi East as proposed site, the dissertation explores the application of salutogenesis and sensory design through architecture as tool. An iterative design process illustrates a holistic approach in response to the contextual issues, theoretical premise,

architectural intentions as well as design informants. This lead to a final design synthesis which demonstrates a nurturing and stimulating environment. The final design encapsulates the three salutogenic resources as defined by Golembiewski (2017:270) by implementing the principles of natural environment, space and form, visual, flexibility as well as comfort. Furthermore, the final design is explored in terms of construction and technology as extension of the design intention of building as experience. The structure, material choices as well as environmental systems and strategies aim to create an experiential and comfortable environment as well as promote resilience through alternative strategies. As a result, the technical exploration continues the notion of building as tool for experience, familiarity and resilience in the community of Mamelodi East.

The dissertation highlights the beneficial relationship possible between the built environment and health care. Moreover, it reveals how architecture can aid in stitching together that which is otherwise fragmented, and that it can define and celebrate meaningful public space as well as create beneficial environments through experience. Concluding in agreement with Fottler's (2000:95) statement, the dissertation calls for health settings to be responsive to human needs, and as result provide stimulating and nurturing environments.

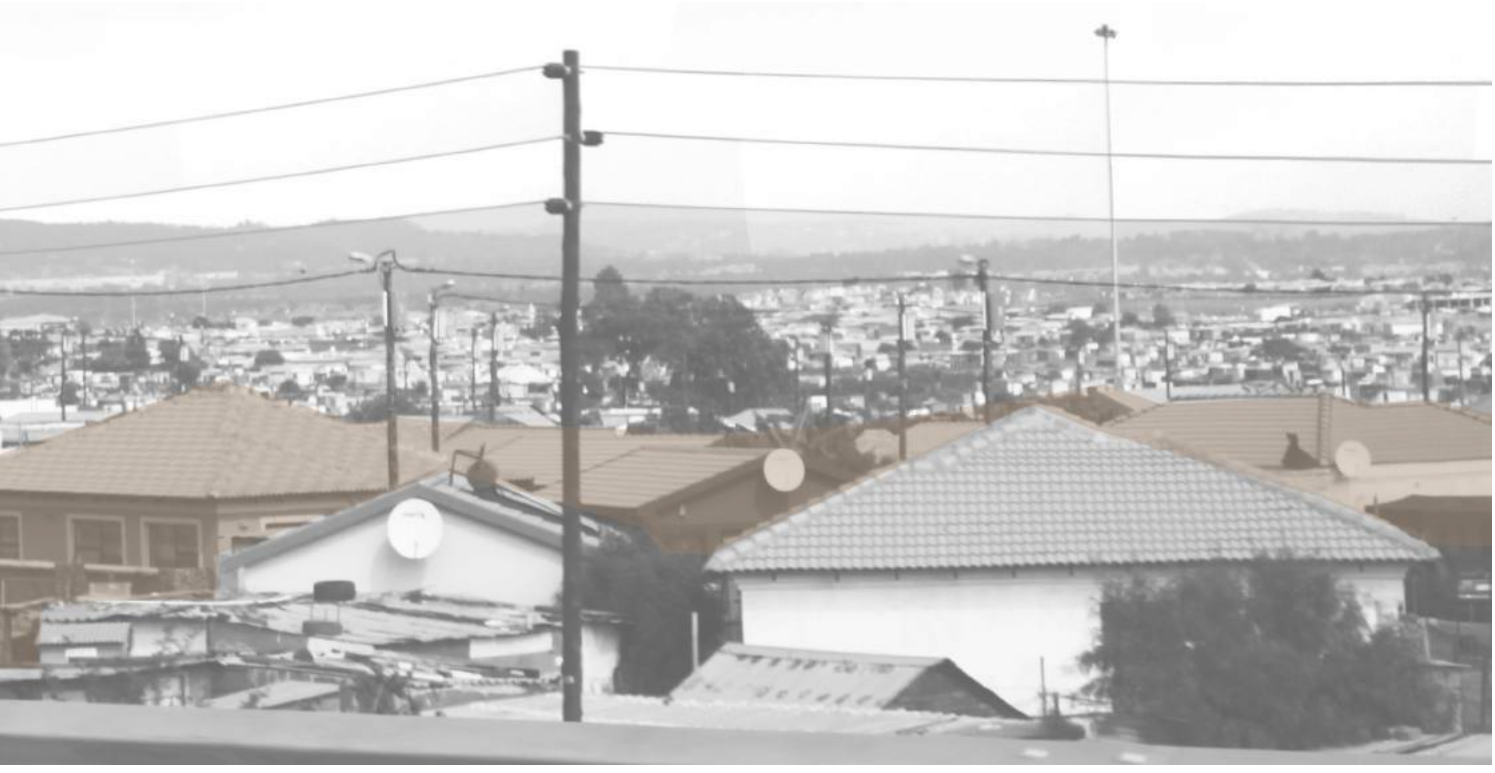


Figure 5.1: The view when departing the mother of melodies (Author 2018)

CHAPTER SIX

Reflection

LARGER CONTEXT

Figure 6.1: Final Site plan (Author 2018)

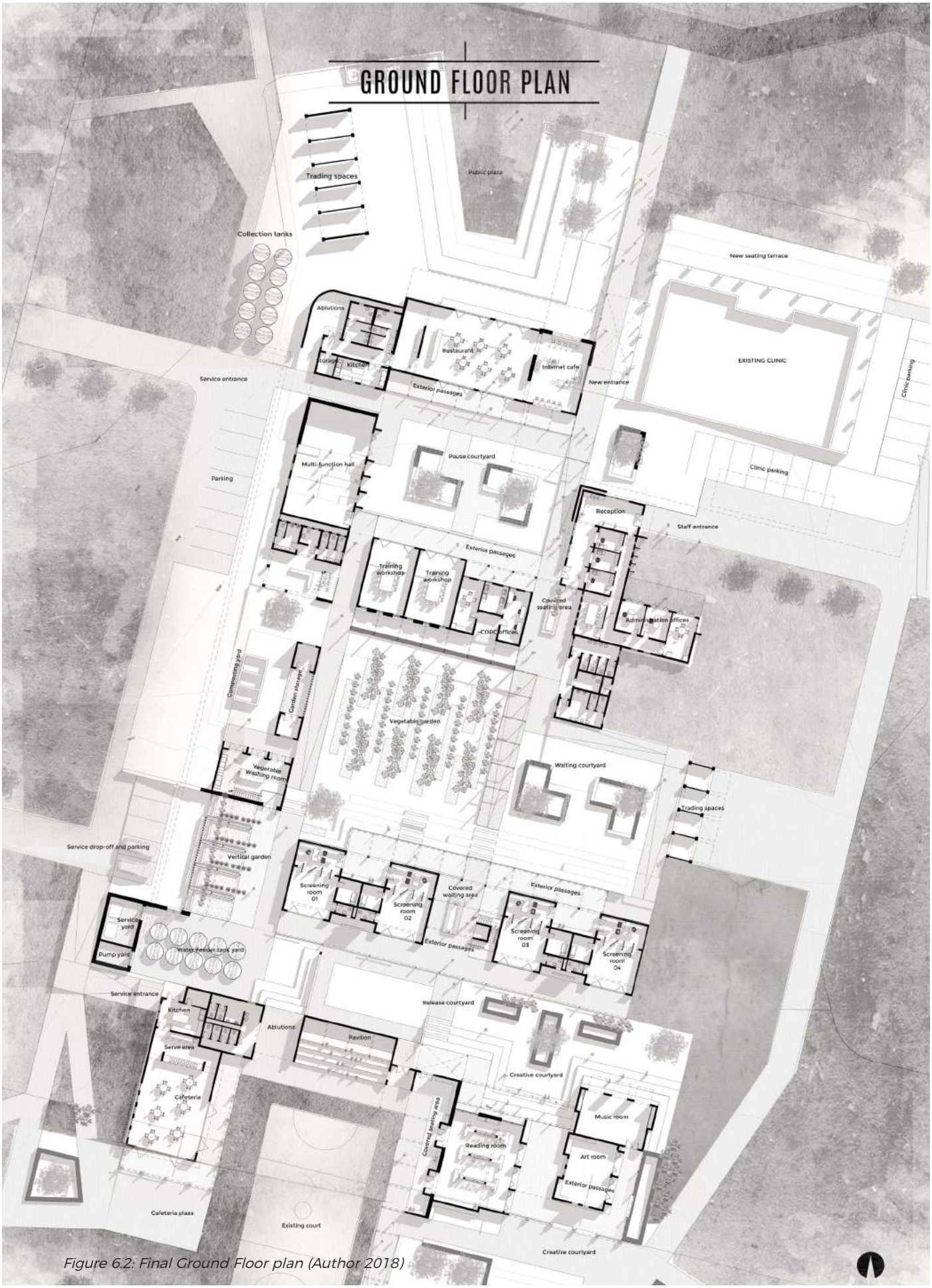


Figure 6.2: Final Ground Floor plan (Author 2018)

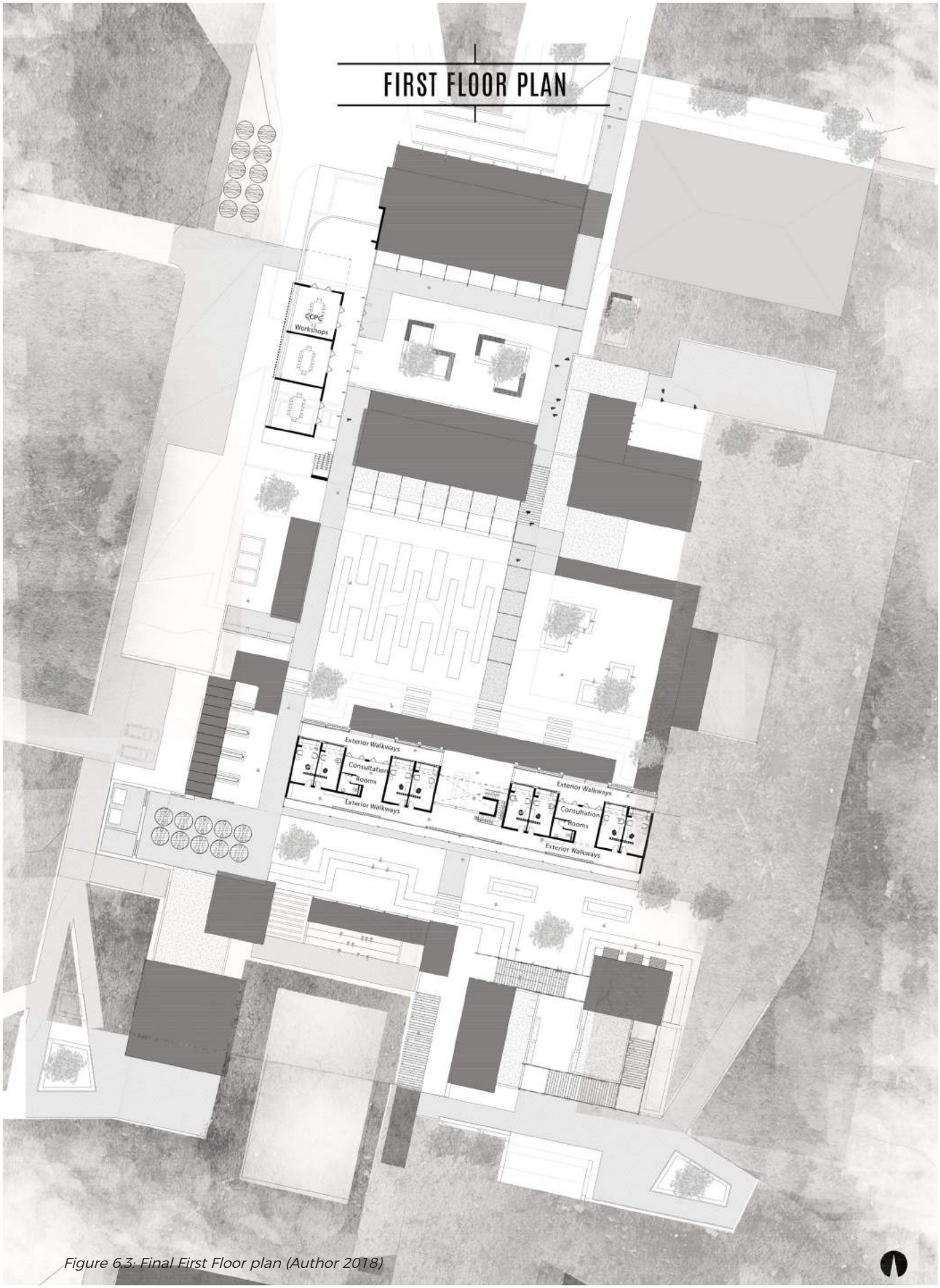


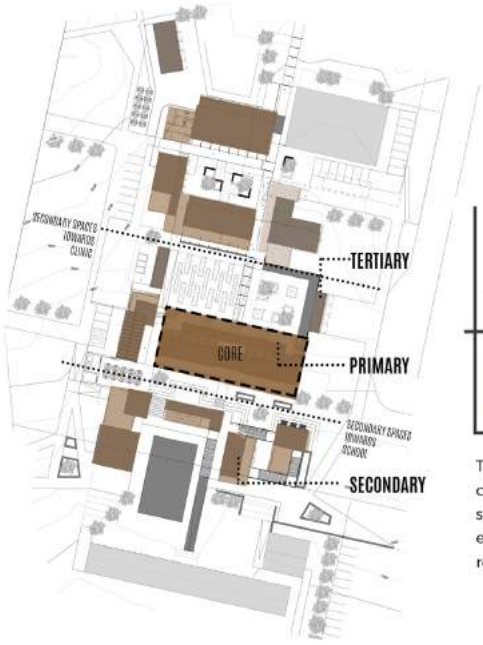
Figure 6.3: Final First Floor plan (Author 2018)

axis and MOVEMENT

connecting to the existing through the main axis aligning with the existing grid layout of the surroundings and secondary movement branching from the main axis through exterior yet covered passages

moments of EXCHANGES

different experiences, textures and spaces accentuate the idea of creating various moments of exchanges in the building, varying from health to educational exchanges



hierarchy and THRESHOLDS

The main core building is located at the centre of the intervention, branching off in the supporting programmes, each relating to either school or clinic to provide shared resources.

Figure 6.4: Final Site plan (Author 2018)

EASTERN ELEVATION
Perspective view

Figure 6.5: Final Elevations (Author 2018)

Figure 6.6: Final Sections (Author 2018)

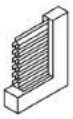
To ensure optimal northern exposure, north-facing walls and openings are maximised in the building to ensure natural light as well as optimal visual connectivity.

The roof profile is designed in such a way as to allow indirect southern light to enter the roof and filter down into spaces to maximise natural lighting.

East and West openings are screened to assist with passive design strategies. Screening elements aid in protection from the sun and wind.

Shading elements for openings are implemented to ensure exclusion of summer sun and inclusion of winter sun.

The building form, orientation and passive features do not only influence the building shape but also influences the wellbeing and development of users.



PASSIVE DESIGN FEATURES

Thirty-seven percent of water used in the government sector in South Africa goes to waste (Van Wyk 2015:13).

In conjunction with a resilient approach, water also plays an important role in terms of the natural environment. As stated by Bowler (Bowler et al 2010:457), the inclusion of a natural environment within the building is vital to create a meaningful and healing space.

RAINWATER HARVESTING AND RECYCLING

Mazuch (2017:46) concurs that comfort within internal environments can influence a user's experience. **Therefore, the goal is to create conditions as close as possible to comfortable for the intended users of the building** at the specific location.

A COMBINED ALTERNATIVE SYSTEM: GEOTHERMAL AND RADIANT SURFACES

VENTILATION, HEATING AND COOLIN

Figure 6.7: Final systems and strategies (Author 2018)

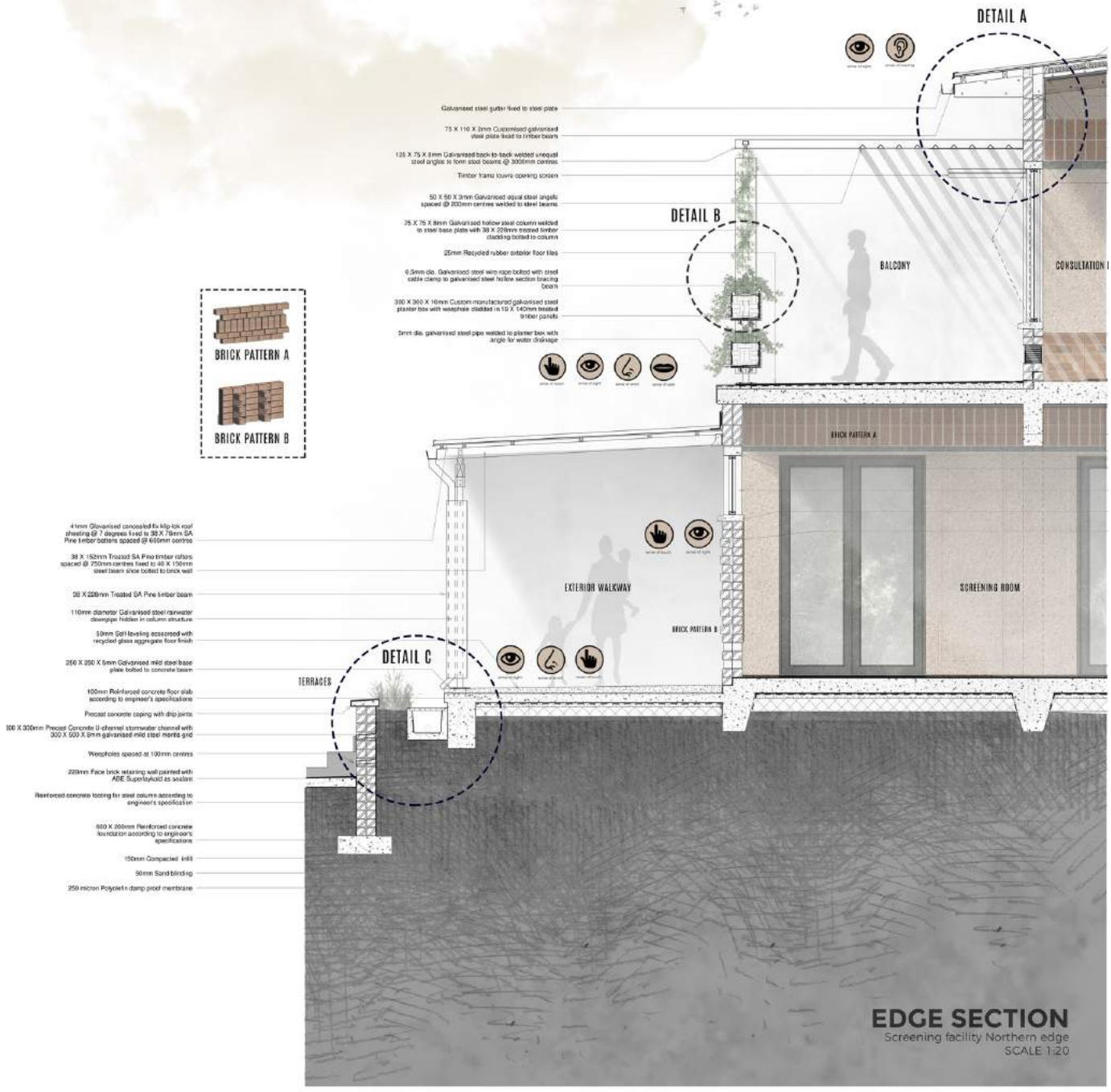
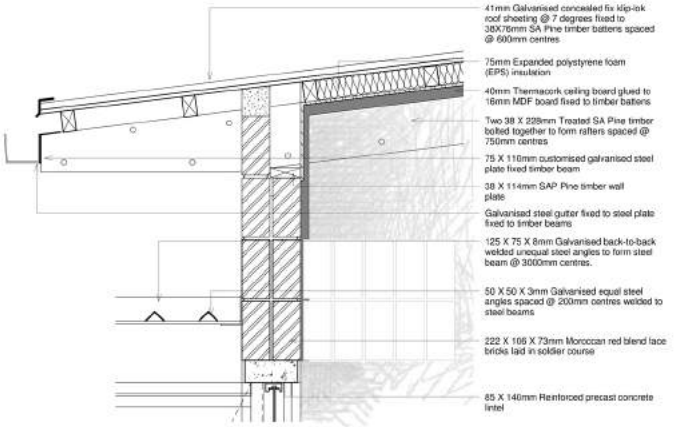
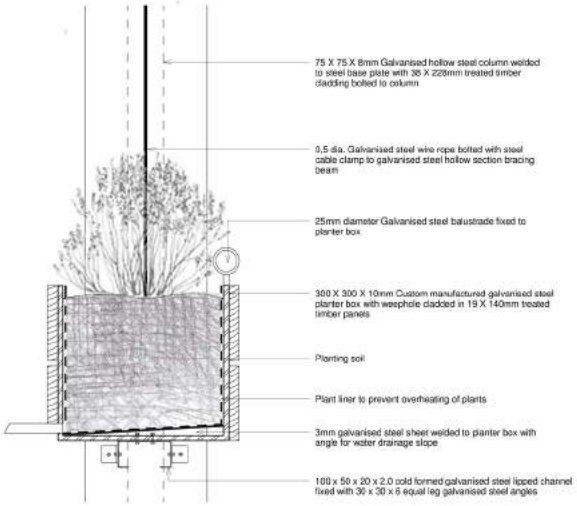


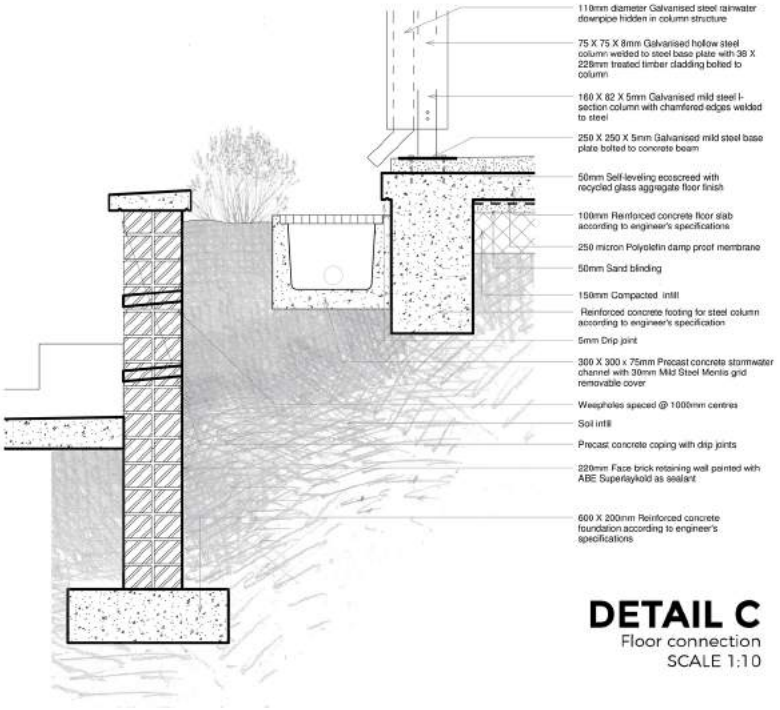
Figure 6.8: Final strip section and details (Author 2018)



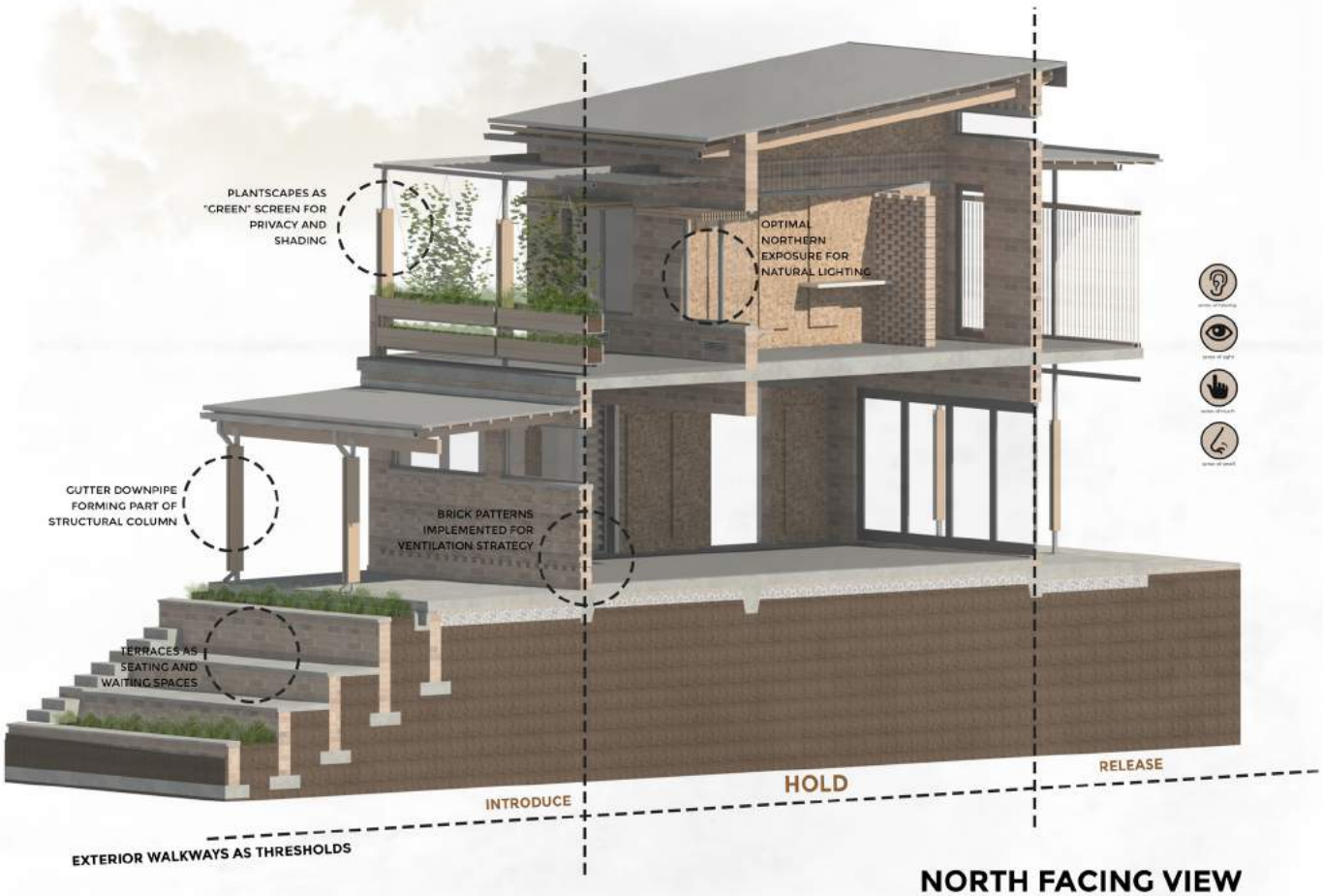
DETAIL A
Roof connection
SCALE 1:10



DETAIL B
Planter detail
SCALE 1:5



DETAIL C
Floor connection
SCALE 1:10



NORTH FACING VIEW
Screening facility perspective section
NOT TO SCALE

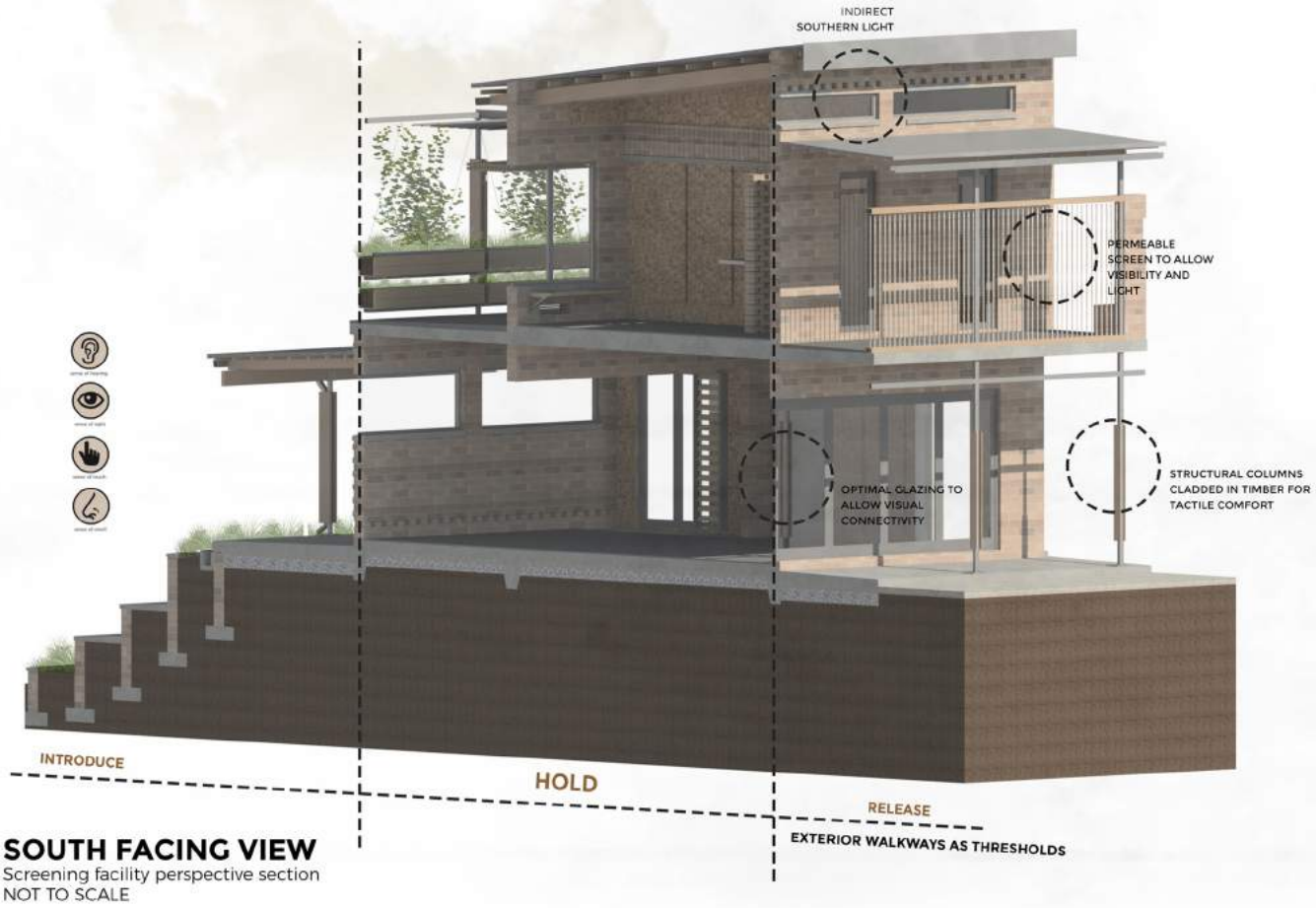


Figure 6.9: Final perspective sectional strip (Author 2018)

Figure 6.10: Final release courtyard (Author 2018)

Figure 6.11: Final pause courtyard (Author 2018)

Figure 6.12: Final creative hub (Author 2018)

Figure 6.13: Final school courtyard (Author 2018)

Figure 6.14: Final Hinterland plaza (Author 2018)

Figure 6.15: Final screening passage (Author 2018)

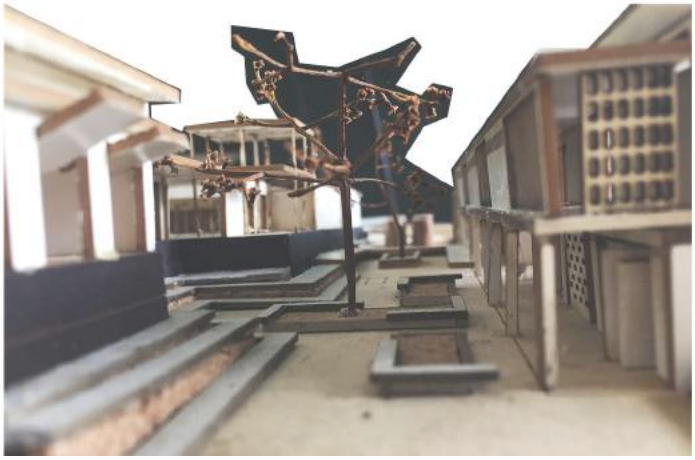


Figure 6.16: Final model images (Author 2018)

Figure 6.17: Final presentation images (Author 2018)

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Appendices

APPENDIX A: Research Article

Architecture, health and the child

Situated in the theoretical context of salutogenesis and sensory design theory, the article illustrates the significant role the physical environment can play in supporting school-based health provision.

Simoné Senekal

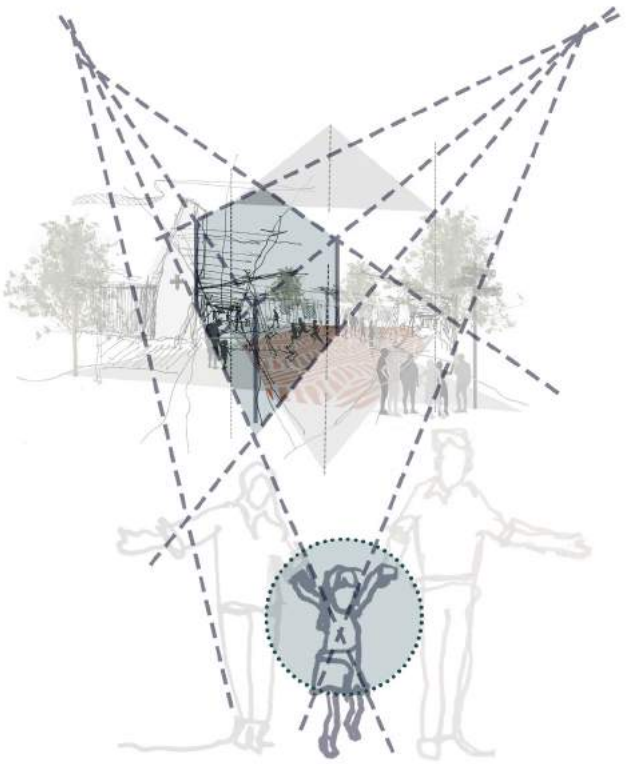


Fig. 01. Above; Re-imagining the physical environment of school-based health care (Author 2018)

INTRODUCTION

The first one thousand days in a child's life could hold the key to unlocking their life-long potential (Statistics South Africa 2018). In these formative years, factors such as adequate health care, good nutrition and stimulating environments influence their capacity for optimal growth and development. It is therefore evident that the role of the physical environment within child health care cannot be ignored.

Children under the age of 15 make up 30% of the total population in South Africa, with median ages at 25% and elderly over 60 years at 7% (WHO 2012:166). In 2015, the Millennium Development Goals shifted international focus to maternal and child health (Bundy 2011:1), which contributed to a renewed emphasis on child health in South Africa. This triggered the implementation of child-centered policies such as the recent *Integrated School Health Policy* in 2012 and the *National Integrated Early Childhood Development Policy* in 2015, which aim to provide children with an early start to a better future (Republic of South Africa 2015:7).

Although these policies set a solid platform for the reformation of child-centered health through a school-based approach, the spatial requirements and settings are still restricted to existing infrastructure of clinics and schools. The spatial experience of these buildings have resulted in people not wanting to go the health related settings as it has become more of an institutional experience rather than a facilitating experience. For this reason it is important to understand the various aspects of school-based health care provision, its shortcomings and opportunities and how these relate to the physical environment.

Fottler states "*[A health care] facility should provide evidence of thoughtful concern for human needs, should be responsive and alive*" (Fottler et al 2009:95). Situated in the theoretical context of salutogenesis and sensory design theory, the relationship between the physical environment and child health care is explored.

Through literature, an overview of the history of health care in South Africa is given to gain a better

understanding of the shift in focus to primary health care provision, specifically focused on school-based health care. Furthermore, the theoretical premise of salutogenesis is discussed, considering the architectural application thereof and how it relates to the physical environment.

A sample set of precedents is investigated to identify common characteristics and features in the physical environment, which represent a salutogenic approach. The findings are unpacked and discussed to illustrate connections to the theoretical premise.

From the findings, a set of design guidelines is derived to apply the proposed salutogenic principles within school-based health environments. These guidelines form a departure point to generate possible architectural interventions, which can improve the wellbeing and development of children in school-based health care settings through their spatial environment.

The article concludes that the physical environment's contribution to health is vital within school-based health care settings. Moreover, existing health care design typologies can potentially be improved through salutogenic architectural principles, thereby contributing to child health care.

THE ROAD TO EQUAL HEALTH CARE ACCESS IN SOUTH AFRICA

South Africa has a complex history with regard to primary health care provision. Dating back to 1940 with the introduction of the groundbreaking Pholela Health care model, health care in South Africa embarked on the journey to reach the worldwide goal of *Health for All* (Barron & Pillay 2011:1). However, with the rise of the Apartheid regime, division started to set in creating a gross inequality in public and private health services. Yet in this biased health system implemented by government, international missionaries and NGOs acknowledged the resilience of the Pholela health care model and implemented primary health care services, especially in vulnerable communities that were disadvantaged (Whitaker 2016:33).

To counteract the inequality set in motion by apartheid, the *National Progressive Primary Health Care Network* (NPPHCN) was developed by numerous organizations and individuals. The main objective was to promote progressive primary health care and provide a platform where government policies could be openly challenged (Whitaker 2016: 34). As a result of democracy in 1994, past inequalities in terms of health care access were addressed through a set of policies and frameworks that proposed a reformation of the existing health system.

The journey to equal health care access already commenced in the new democracy, yet the tiered health system and associated inequalities are still visible today, especially for citizens that rely on the public health sector. Private sector only serves a mere 16% of the population, resulting in 84% of citizens making use of public sector services (Barn et al 2013). This is a clear indication that citizens with the greatest need for health care have the least access. The increasing population growth only intensifies the problem by creating a greater demand for health care. A recent documentary titled *DOC-U-MENTALLY* depicts the crisis state of the public health sector in South

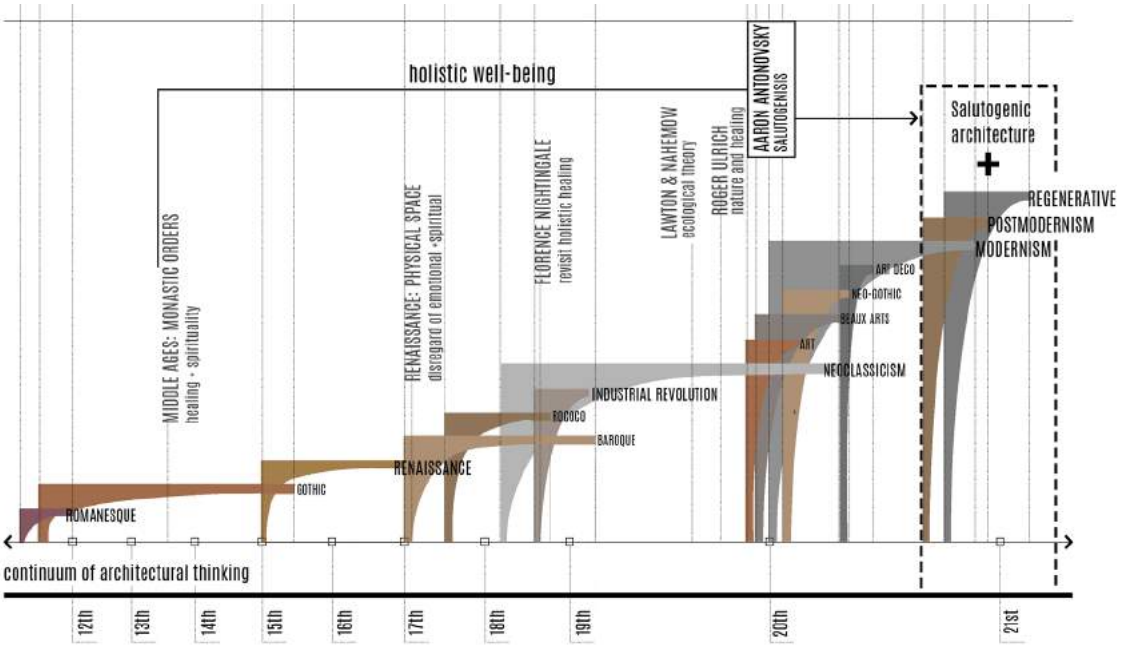


Fig. 02. Left; Salutogenic architecture in the continuum of architectural thinking (adapted by Author 2018 from Minnaar 2017)

Africa, especially within previously disadvantaged communities. The documentary illustrates the reality of current hospitals and clinics being overcrowded, underfunded and understaffed (Carte Blanche 2018).

To start transforming the current tiered health care system the Department of Health's National Health Insurance policy proposes a restructured model that places more emphasis on primary health care. The restructured health care model aims to re-engineer the health care system through placing focus on a preventative approach rather than the traditional curative approach. Primary health care (PHC) facilities, such as clinics and community health care (CHC) centres, are the points of care that are closest to the community and are usually the first point of contact at a health establishment. It then further extends into a continuum of care through regional and tertiary services such as hospitals and specialized care (IUSS 2014:13). To achieve the desired outcome of a "*health for all*", the system relies on effective referral relationships between the various tiers (IUSS 2014:15). Three possible streams of primary health care provision are suggested in the restructured model: municipal ward-based primary health care, school-based primary health care and district-based specialist teams. The school-based primary health care stream is explored in more detail to understand the strengths, shortcomings and opportunities of the approach.

SCHOOL HEALTH IS PUBLIC HEALTH: SCHOOL-BASED HEALTH CARE

Reforming of our health care provision system has resulted in a constant battle to provide cost-effective and accessible primary health care for those still excluded from this basic right. Schools have been identified as effective settings for the provision of primary health care services to start addressing these issues (Broussard 2002:235). The reciprocal relationship between health and education as opportunity in public health is receiving increasing attention across the globe. This connection between two sectors creates the opportunity to be an important component in health care reform. Gene Carter (in Birch 2017:840) summarised the opportunity in the reciprocal relationship between health and education by stating that it is a symbiotic connection. When one fails or succeeds, so does the other (Birch 2017: 840). Brellochs and Fothergill (1995) define a school-based health center as on-site provision of comprehensive primary medical, social and mental health services. School-based health care offers the opportunity to provide primary health care to children that is accessible, convenient, continuous and comprehensive (Larson & Chapman 2014:163).

During the apartheid era, school health services in South Africa operated as a vertical programme that was characterised by racial, socioeconomic and geographic inequalities (Shung-King 2013). As a result the first *National School Health Policy* (NSHP) was developed in 2003. After evaluation in 2009, the performance of the 2003 NSHP presented numerous challenges that hindered successful implementation. The evaluation revealed that coverage of the policy implementation was as low as 10% in some districts whereas other areas attained 100% coverage, still indicating inequalities in access to health (Shung-King 2013). In 2012 a revised policy titled *Integrated School Health Policy* (ISHP) was released, which fundamentally resembles its predecessor, but places more focus on the overall implementation context as well as the strength in collaboration and integration between key stakeholders such as the National Department of Health, Department of Basic Education and the Department of Social Development (Shung-King 2013).

The ISHP proposes a health promotion and preventative school-based health service to optimise the health of children. It forms one of the components in the continuum of child health care, placed between the infant years and adulthood. This approach addresses health barriers to learning and as result increase the possibility of optimal

learning and development. The service provides a safeguard for children who were not exposed to the necessary early childhood interventions. By starting to promote healthy lifestyles at primary school level, children are better equipped for healthier adulthood.

THE RELATIONSHIP BETWEEN HEALTH & THE PHYSICAL ENVIRONMENT

Boluijt and Hinkema (2005:38) emphasise the importance of environmental qualities within health care design and how the interaction with the surrounding environment plays an important role in a patient's well-being. Substantial evidence indicates that aesthetic design in these settings can influence well-being and health outcomes for patients (Ulrich 2006:538). Tsekleves and Cooper (2017:6) argues that the physical environment impacts an individual's health at a holistic level that in return influence wider health aspects that play a significant role in long term wellbeing and development.

The impact of the physical environment on the wellbeing of humans date back almost 5000 years to holistic healers in China and India. As early as the 4th century B.C, the father of medicine, Hippocrates, stressed the role of nature in the healing process. This approach placed emphasis on healing that consider the complete body rather than focusing on specific illnesses or injuries (American Holistic Health Association 2018). It was evident during the middle ages when religion and healing became closely associated due to the compassion ethos expanding into society. This was continued into monastic orders were cloister gardens became part of the architectural blueprint to provide comfort and care (Burpee 2008:1). With the scientific revolution in the 19th century that revealed germs as a disease-causing agent, medicine and healing became more dedicated to intervention (American Holisitic Health Association 2018). The focus on disease and the treatment thereof replaced the notion of holistic healing. The outbreak of numerous wars only increased the demand for physical health care and treatment. Florence Nightingale became an influential figure in health care provision as she re-established the notion of holistic health care after observing the correlation between patient survival and the cleanliness of the hospital wards (Burpee 2008:1). This observation prompted her to write *Notes on Hospitals* in 1863 (Burpee 2008:1) where she stresses the importance of the physical environment in healing environments as well as social welfare of patients. She argued that patients require access to natural light, air, landscape and a hygienic environment.

Unfortunately, with the high demand for hospitals following World War II, large-scale buildings that prioritised efficiency over comfort and healing replaced Nightingale's concept of holistic hospital design (Burpee 2008:2). Only from the 1970's did a re-examination of these machine-like hospitals occur. This re-ignited the concept of holistic healing and the role of the physical environment within it. This concept continued to emerge in health related theories, such as Lawton and Nahemow's (1973) ecological theory that argued for a balance between designing for comfort and mental wellness, as well as Ulrich's (1991) evolutionary hypothesis to explain influences of natural views on health. Although various theories have developed over time to explain some of these influences, most are restricted to specific stimulus. An overarching logic for the effect of design on health and the promotion of health is the salutogenic theory (Lindström 2018:96).

SALUTOGENESIS: HEALTH AS RESOURCE

Salutogenesis provides a way of understanding the complete spectrum of wellness and illness, transcending the differentiation between people, diseases, circumstances and environments (Golembiewski 2017:267). It becomes a useful approach to grapple with overall wellbeing and the complexity of the physical environment's influence on health (Golembiewski 2017:267). The theory of salutogenesis was first created in the 1990's by sociologist

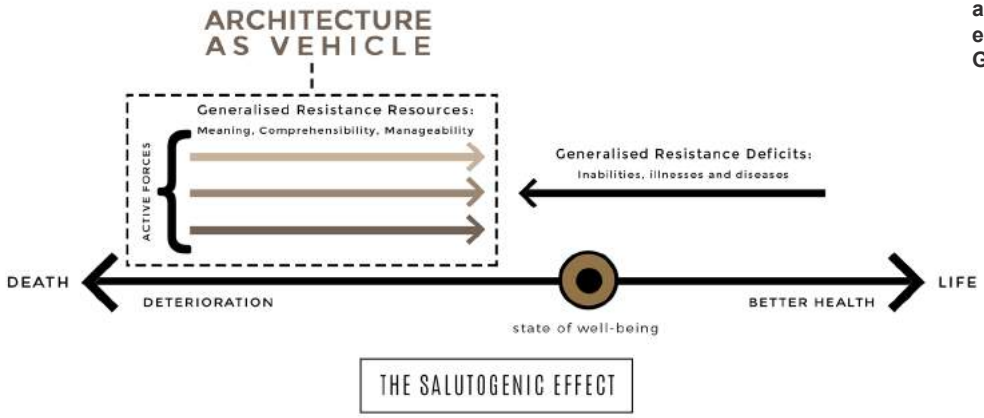


Fig. 03. Left; The salutogenic effect and how it relates to the physical environment (adapted by Author from Golembiewski 2017:4)

Aaron Antonovsky who argued that it is more important to focus on people's resources and capacity to create health instead of the traditional focus on ill health and disease (Jonas et al 2014:82). Salutogenesis is the opposite approach of pathogenesis, which is described as the process of disease, illness generation and breakdown of function. The theory suggests that good health is maintained through a dynamic ability to adapt to changing circumstances (Lindström 2018:96). He argues the shift to a preventative approach rather than a curative approach. The theory establishes that a "sense of coherence" (SOC) is an essential part of the healing process and it is reinforced by three main resources namely comprehensibility, manageability and meaningfulness. Golembiewski (2017:268) defines Antonovsky's comprehensibility as a person's ability to make sense of one's life. He continues that the essence of comprehensibility is the understanding of one's life narrative, context and circumstances. By understanding, one can make the most of them. Manageability refers to a person's ability to manage day-to-day physical activities in order to maintain physical life, such as remaining nourished, rested and comfortable (Dilani 2008:56). The final principle of meaningfulness forms the foundation of the desire to live and is possibly the most important of the principles. Found in personal connections and aspirations with the outside world, meaningfulness is also the most intangible as meaning is difficult to define and differs from person to person (Golembiewski 2017:268). People find meaning in different social settings and conditions and within this differentiation people find the basis of identity (Dilani 2008:56). If meaningfulness is absent, people find themselves without motivation or desire to act.

SALUTOGENIC ARCHITECTURE

Sir Winston Churchill (1944) stated "*we shape our buildings; thereafter, they shape us*". This illustrates the essence of the salutogenic theory applied in the built environment. All of the above mentioned principles could be influenced by architectural design (Golembiewski 2017:269). Therefore the salutogenic framework is a valuable design driver for primary health care settings, as it recognises the physical environment as a source of meaning and sphere of influence (Golembiewski 2017:270). Salutogenic architecture is taking its rightful place within the built environment by promoting preventative care strategies that have the potential to shape not only buildings but also the wellbeing of its users. The main focus of the approach is to create a healthier society by addressing societal sectors such as where human beings live, work and play. The focus shifts "*from risk factors and treatment of disease to a more holistic understanding and evolution towards a healthier society*" (Dilani 2017). This approach also provides a different perspective for the role of architecture in health and wellbeing. South African guidelines such as the IUSS Health Facility Guide document for primary health care facilities (IUSS 2014:34) encourage the implementation of salutogenic design to improve user outcomes in public health care buildings. An architectural extrapolation of the salutogenic theory by Golembiewski (2017:269) provides an architectural translation of the three salutogenic resources to achieve a sense of coherence:

1. COMPREHENSIBILITY
Ensuring perceptual cues to assist perceptual processes. This includes the use of texture, materiality, environmental features and sizing of spaces.
2. MANAGEABILITY
Allowing users to exercise control of the environment. This can be achieved by details such as opening windows, temporary elements and provision of recreational facilities.
3. MEANINGFULNESS
Enriching the environment with complexity, order, familiarity and aesthetic elements. This includes meaningful space for waiting areas and interaction with the natural environment.

From the architectural translation, it is apparent that interaction with the physical environment plays an important role in achieving a sense of coherence. The way humans experience built environments

are to a great extent guided by their sensory experiences (Malnar 2004:129). Therefore, it is essential to understand the notion of sensory design and how it is interwoven with salutogenic architecture.

SENSORY DESIGN: SENSE-SENSITIVE ENVIRONMENTS

Mostafa (2014:143) defines architecture as the science of environment creation that deals with the manipulation of space to serve certain programs and users, evoke certain behaviors or create specific experiences. The built environment is the setting in which people spend most of their time in, near or influenced by. Very few people, apart from architects, think about architecture and the built environment, but many feel it (Day 2017). The sensory environment – auditory (sense of sound), visual (sense of sight), tactile (sense of touch), olfactory (sense of smell) and gustatory (sense of taste) – plays an important role in the perception of and influence of the built environment. This is due to the fact that our sensory system forms part of our nervous system, which is responsible for information processing to generate responses or reactions. Our sensory system is complex and includes various components that collect information (Abraham et al 2015:3):

•The Auditory System: the sense of hearing
•The Olfactory System : the sense of smell
•The Oral Sensory Processing : the sense of taste
•The Tactile System : the sense of touch
•The Visual System: the sense of sight
•The Vestibular System : to sense where our bodies are in space
•Hapticity : to experience through the contact with our skin
•Proprioception : to sense the way our bodies move
•Kinaesthesia : to experience through the movement of our bodies
•The Interoceptive system responsible for sense of our body's physical condition, such as hunger, thirst and internal discomfort
•Synaesthesia : the phenomenon of sensory information transferred from one sense to another

The Sensory Design Theory is based on the concept that the sensory environment influences the process of perception and development (Mostafa 2014:145). It argues that sensory experiences are key elements in creating beneficial environments and should be considered equally significant as form and function during the design process. The theory proposes that a tangible input could encourage an intangible output. Commonly in health care settings, the sensory environment is manipulated through design to form certain meanings and experiences to users. It becomes crucial to ensure that environments do not become over stimulating, especially for children, as it can result in confusion, unresponsiveness and negative behaviours (Abraham et al 2015:3). Rather, the sensory environment should be considered with great care to ensure sensory information can be easily processed to generate appropriate responses.

METHOD

The interpretative paradigm is selected as framework for the article as it speaks to the notion of understanding the world as others experience it. From this viewpoint, the descriptive case study is chosen as research method. This method provides a systematic way to collect data, analyse information and report on results. Ritchie et al. (2013:89) define the main features of a case study as exploring multiple perspectives, which are established in a specific context. Case study research is commonly criticised for the reason that richness and complexity of data can result in potential bias interpretations. Yin (2011:6) argues that the approach is best implemented for analytical generalisations, where the intention is to generalise a particular set of results to a broader theoretical framework. In this case, the method proves beneficial in exploring multiple perspectives on the application of architectural principles, situated within the theory of salutogenesis.

The selection criteria to identify case studies is limited to design projects that demonstrate a salutogenic or sensory design approach, a child-centered focus or is regarded as a health or education institution. For the purpose of this article, three design projects were selected as fair sample size for data analysis and interpretation. This permits for thorough and detailed data analysis of each case study.

According to Thomas (2010:317) the search for meaning through direct interpretation of what is observed plays an important role in data analysis of a qualitative study. The aim of data analysis in qualitative studies is to reveal patterns, concepts or themes. Thematic analysis is chosen as method of data analysis as it provides a flexible approach for identifying, analysing and reporting on themes discovered within the data set (Braun, Virginia & Clarke 2006:8). The method of data analysis is widely implemented in health and wellbeing research, the reason therefore being that it offers a toolkit to conduct sophisticated analyses of qualitative data, yet present the findings in a basic and accessible manner (Braun, Virginia & Clarke 2014:2). The flexibility of the method is often criticised as the wide range of analytic options results in a broad data set. This can paralyse the researcher in trying to determine which aspects of the data to focus on (Braun, Virginia & Clarke 2006:29). In this case, an existing theoretical framework is used to anchor the analytic process and indicate the aspects that need to be focused on in the data set. Instead of generating themes from the processing of the raw data set, themes for this particular data analysis are determined from the previously discussed theoretical framework. This ensures a condensed data set as result, which is thoroughly interpreted and linked to the theoretical premise.

The process of data analysis in this article is guided by an interpretation of Braun, Virginia & Clarke's guide (Braun, Virginia & Clarke 2006:17) to applying thematic analysis. The selected case studies are analysed according to the three main resources of the salutogenic theory, namely comprehensibility, manageability and meaningfulness, which form the predetermined main themes. Components of the sensory system

Fig. 04. Opposite Top Left; Bright coloured, story telling passages in the Nelson Mandela Children's Hospital (Author 2018)
Fig. 05. Opposite Bottom Left; A tranquil gathering space in the Manchester Maggie's Centre with garden as backdrop (Foster and Partners 2018)

relating to each of these resources form supporting sub-themes. The sub-themes assist in giving structure to the main themes and illustrate the hierarchy of meaning within the data.

The first step in the data analysis is to observe and identify the predetermined main themes within the selected case studies. Thereafter, initial codes[1] are generated from the data to identify elements or features within the raw data, which can potentially contribute to the main themes. This presents a data collection that starts to give a sense of the main themes, sub-themes and extracts of data coded in relation to these. The third step involves the refinement of the set of themes to ensure each theme consists of a coherent data set, which is clearly distinguishable from other themes. The fourth step attempts to identify the essence in each theme and sub-themes. The final step of data analysis concludes in describing and presenting the set of determined themes and sub-themes in a logical manner.

Reicher and Taylor (2005:549) highlight that rigorous data analysis is presented when the assumptions are congruent with the conceptualized matter. Through unpacking the analysed themes, a better understanding of the salutogenic resources and their relevance to the physical environment is provided. The identified themes point towards common characteristics and features within the architectural environment that represent a salutogenic approach. As result, it becomes evident how the theoretical framework and findings become interwoven.

REVEALING SALUTOGENIC THEMES THROUGH PRECEDENTS

Concluding from the data analysis, the selected precedents are discussed to highlight the key observations and findings from the visual thematic analysis:

NELSON MANDELA CHILDREN'S HOSPITAL

The newly built Nelson Mandela's Children's Hospital located in Parktown, Johannesburg aims to create a state of the art health care facility that allows a playful, family oriented space within a natural environment for its patients as well as staff (Leonard & Schnaid 2017:66). Moving away from a single block massing building, artificial lit corridors and excessive white walls typical of many health care designs, an extended courtyard typology with six wings is implemented to allow maximum connection to the natural environment. A central 'street' function as connection between the individual wings. Colour schemes are creatively implemented in each wing to create distinction between different functions and specialties. The idea is extended to the exterior of the building on the horizontal shading screens (Leonard & Schnaid 2017:67). Bright signage and infographics assist with easy way finding in the building creating a fun and playful experience, which purposefully alleviates the heaviness of the program.

The use of texture, light and interactive elements does not shy away from the importance of the child as main user within spaces. Many features in and around the building are included as result of child participation workshops involving prospective users such as children, parents and staff (Leonard & Schnaid 2017:67). Clay inspired seating, story-telling wall art and screening elements designed from children drawings speaks of a welcoming family-centered environment. A series of different garden spaces, ranging from play gardens to healing gardens, echoes the interior spatial intentions through continuing the child-centered experience. A balance is achieved to ensure a welcoming and hopeful environment for patients without compromising clinical functionality (Leonard and Schnaid 2017:67). The design team succeeds in moving beyond the functional requirements of a health care building and creates an inclusive place of healing that accommodates both users and staff. It innovatively guides and engages the user through space that is comprehensible, welcoming and functional.

MAGGIE'S MANCHESTER

Forming part of the collection of Maggie Centres[2] across the globe, the Maggie's Manchester Centre designed by Foster and Partners creates a unique sanctuary for cancer patients. The project illustrates the concept of "*a home away from home*" (Foster and Partners 2018). The power of architecture is put to use to create comforting spaces that move away from institutional references. The light-filled building with a timber structure echoes a strong domestic atmosphere. Located on a sunny site with a single storey scale, the building reflects the residential scale of the surrounding streets. The structural beams are innovatively incorporated to act as natural partitions within the interior spaces and gradually dissolve into the surrounding gardens (Foster and Partners 2018).

A central spine acts as connection between a variety of spaces. Home-like spaces such as intimate library niches, exercise rooms and a large communal kitchen banishes all institutional stereotypes. A warm material palette with natural wood

and tactile fabrics compliment the sanctuary nestled within its green setting. Natural light and nature views are the heart of the centre with most of the areas opening up towards garden spaces. The Southern end of the building merges with a greenhouse in celebration of light and nature (Foster and Partners 2018). It serves as gathering space, a quiet retreat or a therapeutic workspace for green fingers that want to embrace the outdoors. The garden filled with flowers and other produce does not only provide a natural backdrop for the building but also gives patients a sense of purpose during vulnerable times (Foster and Partners 2018). Within the heaviness of the program, a sense of meaning is established through the use of architecture, by providing an intimate sanctuary of comfort, harmony and nature.

HAZELWOOD SCHOOL

The award-winning project located in Glasglow, Scotland set out to create a facilitating learning environment for children with disabilities to be independent and safe. The building consists of a single story with a series of garden spaces that encourage outdoor learning opportunities and more intimate experiences. The distinctive curving interior spine allows for easy navigation throughout the building (Institute for Human Centered Design 2009). Cladded in cork material, the corridor creates a warm atmosphere and provides tactile cues to assist users in the way finding process. The curved form also reduces the visual scale of the circulation route and aid in creating a more facilitating experience, moving away from long single corridor spaces.

The school accommodates children with limited abilities, such as hearing, vision or physical limitations. The tactile sensory system is majorly depended on to create user-friendly legibility in the design through the use of patterns, texture and natural materials. Signage is throughout the school is presented in a simplified form such as pictures and braille which enables an effective and familiar form of communication. Subtle

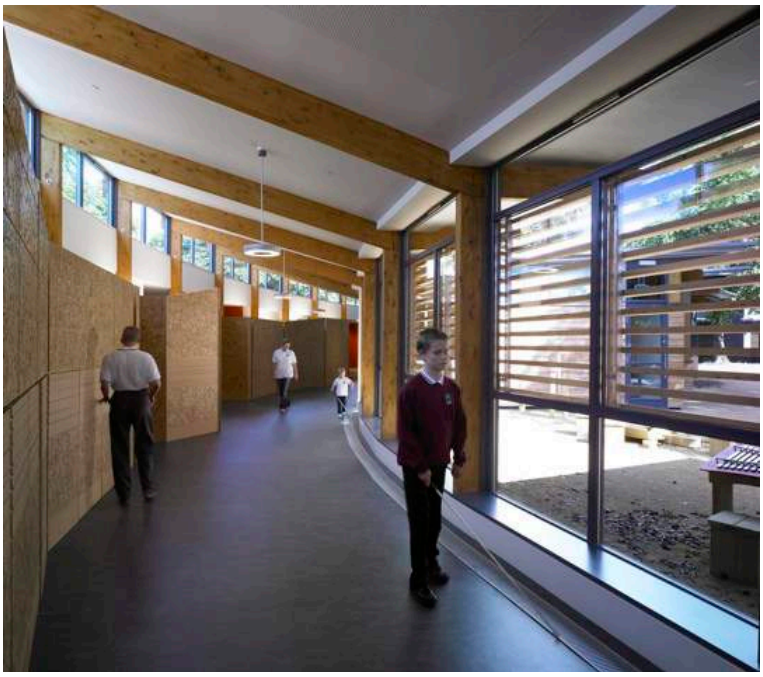


Fig. 06. Left; The curved circulation space with cork-textured walls as navigation device in the Hazelwood School (Institute for Human Centered Design 2009)
Fig. 07. Opposite; Design guidelines developed from the salutogenic theory through case study analysis (Author 2018)

colours, contrast and adaptable lighting elements are used to accommodate users with residual vision. A calming atmosphere is promoted in classroom spaces through uncluttered walls and minimal furniture to ensure children are not overwhelmed by visual stimulations. Distinctive finishes, ranging from gravel to recycled rubber, define each pathway and circulation route, with a unique tactile and auditory experience. Common architectural elements such as floor finishes and window sills innovatively double as navigation devices. Acoustic-specific ceilings are incorporated to control reverberation (Institute for Human Centered Design 2009). Orientation of the building takes advantage of northern light exposure and opens up into quiet garden spaces to minimise visual distractions for children. The implementation of innovative solutions to accommodate the specialised user-group is evident and results in a nurturing and stimulating environment for children.

TRANSLATING THEMES INTO PRINCIPLES

Common themes that illustrate a salutogenic approach in the selected case studies are identified within the data analysis. The identified themes reflect how architecture can contribute to health and development. It illustrates the physical environment as valuable tool and sphere of influence, which can be optimised in health settings. The themes are developed into a set of design guidelines categorised under the three salutogenic resources namely comprehensibility, manageability and meaningfulness. These guidelines offer a design tool for applying salutogenic architecture, especially in health care settings. To conclude the findings, a summary of the results is represented with a diagrammatic representation to illustrate the major themes identified in the analysis.

CONNECTING ARCHITECTURE, HEALTH AND THE CHILD

In order to connect architecture and child-centered health the critical question should be asked: How can the physical environment, through salutogenic architecture, support school-based health provision? Through this lens, the findings from the case study analysis are critically evaluated. The guidelines are categorised according to six principles: hapticity, natural environment, space and form, visual, flexibility and comfort.

HAPTICITY

Discussed in the theory of sensory design, the sensory system is responsible for how users experience their environments. The role of the tactile sensory system in architectural design is explored through the notion of hapticity. Papale (2016:866) defines hapticity as "*the sensory integration of bodily percepts*." In agreement with Mostafa (2014:145), tactile based perception and imagery play a pivotal role in the architectural experience. Therefore, through understanding haptic qualities and the associated experiences they create, designers can deliver optimal healing health care settings for children. This principle contributes to the salutogenic resource of comprehensibility through assisting in the perceptual process. As seen in the Hazelwood school case study, contrast in textures and materials can serve a greater purpose other than aesthetics. It can assist in wayfinding through buildings and provide tactile stimulation through unique experiences. Ultimately, designers can enhance the child's experience of space through incorporating relevant haptic qualities to contribute to a more comprehensible and stimulating environment.

NATURAL ENVIRONMENT

A growing body of evidence indicates that natural views and spaces within the built environment can contribute to healing, learning and productivity (Ulrich 2006:S39, Bowler et al 2010:457, Shishegar & Boubekri 2016:18). The natural environment contributes to all three of the salutogenic resources on various levels. The Nelson Mandela's children's hospital incorporates the use of sensory gardens to create meaningful and healing spaces for children, parents as well as staff. Maggie's Manchester implements the idea of

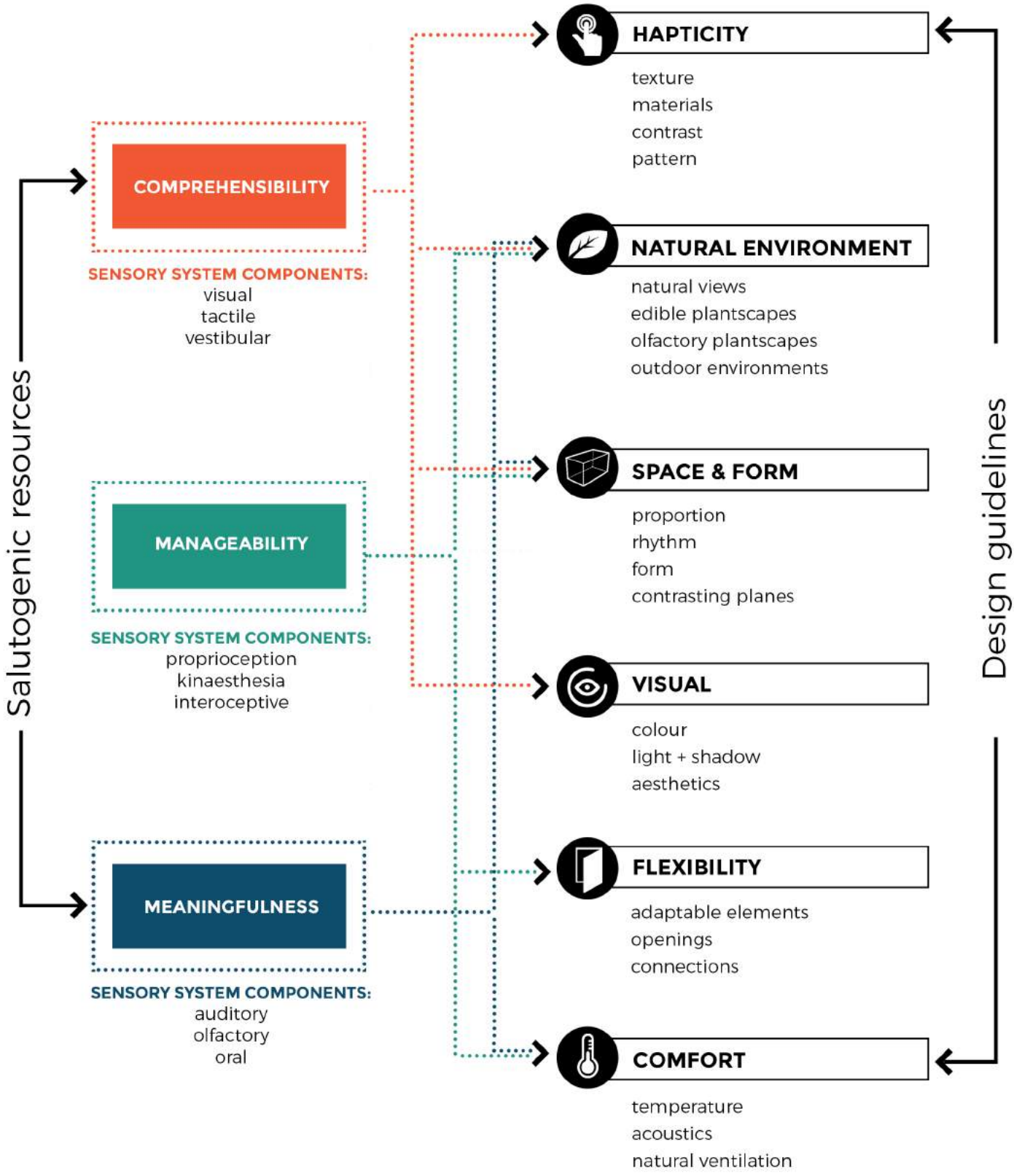

Salutogenic resources
COMPREHENSIBILITY
SENSORY SYSTEM COMPONENTS:
visual
tactile
vestibular
MANAGEABILITY
SENSORY SYSTEM COMPONENTS:
proprioception
kinaesthesia
interoceptive
MEANINGFULNESS
SENSORY SYSTEM COMPONENTS:
auditory
olfactory
oral
HAPTICITY
texture
materials
contrast
pattern
NATURAL ENVIRONMENT
natural views
edible plantscapes
olfactory plantscapes
outdoor environments
SPACE & FORM
proportion
rhythm
form
contrasting planes
VISUAL
colour
light + shadow
aesthetics
FLEXIBILITY
adaptable elements
openings
connections
COMFORT
temperature
acoustics
natural ventilation
Design guidelines

Fig. 08. Opposite Right; Design guidelines translated into a design toolkit for implementing a salutogenic approach (Author 2018)

edible and olfactory gardens, which gives patients the opportunity to take care of the garden to offer a sense of meaning and purpose in their lives. The Hazelwood School extends the notion of classroom into exterior garden spaces to minimise visual distractions and engage children within nature. Therefore, it is clear that the natural environment principle can be implemented as various elements in the built environment, offering a powerful tool that provides healing and stimulating benefits for children.

SPACE AND FORM

A salutogenic approach to design have the potential to shape not only our buildings but also the wellbeing and development of its users. Mazuch (2017:42) agrees that the very form and massing of health care environment can influence health outcomes. The principle of space and form stretches across all three salutogenic resources and encourages the creation of as many spatial conditions as possible. The use of scale and form can organize spaces in logical hierarchy and assist users in orientating themselves. The curved circulation core at the Hazelwood School illustrates the use of scale and form as spatial organiser and promotes easy navigation throughout the building. Contextual familiarity in space and form also becomes important as it creates recognisable environments resulting in users feeling a sense of comfort and safety. The Nelson Mandela Children's Hospital makes use of seating elements in passages that resemble children clay-models. As result, children can associate with the environment through familiarity.

VISUAL

From all the sensory systems, the visual system is mostly relied on to perceive our surrounding environments. Through ensuring environments are accessible and easy to understand, users experience a sense of comfort, which lowers stress levels that are usually associated with health care settings (Ulrich 2006:S39). Colourful signage and infographics in the Nelson Mandela Children's Hospital is a good example of accessible way finding in complex built environments. It encourages a fun, accessible and learning experience for children. The Hazelwood School implements neutral colours and uncluttered wall to provide a calming atmosphere in classroom spaces as to minimise overstimulation. Maggie's Manchester celebrates the use of light and nature through providing maximum connection and visual links to the surrounding plantscapes, moving away from institutional references. Thus, visual elements such as colour, light, art and natural views become useful tools in creating more comprehensible and stimulating environments for children.

FLEXIBILITY

Supporting the salutogenic principle of manageability defined by Golembiewski (2017:15), flexibility in the built environment provides users the opportunity to interact and alter their surrounding environment. This includes different types of flexibility such as adaptability, movability and transformability, situated in-between the scale of permanence and temporality of the built environment. The garden spaces at the Nelson Mandela Children's Hospital emphasise the importance of the child as main user through providing movable and interactive play elements. Flexibility in the built environment, such as window openings, play areas, multi-purpose elements and adaptable spaces, create interactive spaces where users can have a input in their surrounding environment, even if only temporary.

COMFORT

Focused more on the technical and functional qualities of a building, comfort of internal environments can influence a user's experience (Mazuch 2017:46). Considering internal environment qualities such as temperature, acoustics, background noise and ventilation offer numerous benefits especially in health care settings. Ulrich (2006:S38) argues that quiet health care settings are mainly determined through the appropriate design of the physical environment, not by modifying users' behaviour. Acoustic control should be considered accordingly to the type of activity taking place within spaces. As seen in the Hazelwood School case study, acoustic considerations become vital as to ensure reverberations and background noise are minimised to avoid overwhelming children within internal spaces.

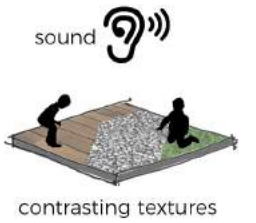
From the findings and discussion, it is evident that the salutogenic framework can be a valuable design driver for primary health care settings. The guidelines are further refined to architectural principles to allow for adaptation and various implementation levels. Thus, the guidelines can be altered to suit any contextual setting. It gives designers the opportunity to envision and experiment how the physical environment can contribute to improved health care. Ultimately, the guidelines aim to assist designers during the design process to generate built environments that not only provide efficient health care settings but also healing and stimulating environments.

DESIGN TOOLKIT

HAPTICITY

SALUTOGENIC RESOURCE:

Comprehensibility



contrasting textures

different materials

patterns

NATURAL ENVIRONMENT

SALUTOGENIC RESOURCE:

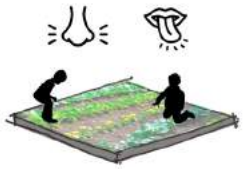
Comprehensibility

Manageability

Meaningfulness

natural views

edible + olfactory plantscapes



play space; outdoor areas

SPACE & FORM

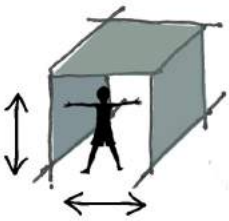
SALUTOGENIC RESOURCE:

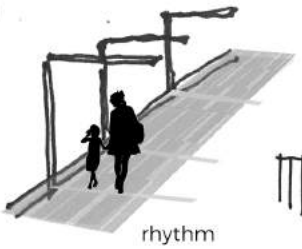
Comprehensibility

Manageability

Meaningfulness

scale + form; proportion





rhythm

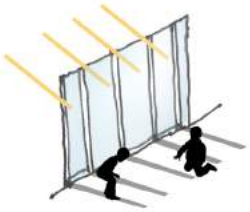
multi-planes

VISUAL

SALUTOGENIC RESOURCE:

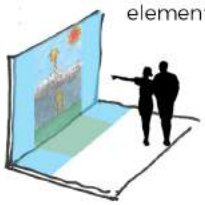
Comprehensibility

use of colour; signage



light and shadow

aesthetic elements; art



FLEXIBILITY

SALUTOGENIC RESOURCE:

Manageability

multi-function elements

openings

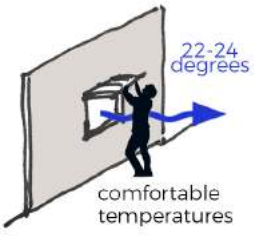
adaptable elements; temporary

COMFORT

SALUTOGENIC RESOURCE:

Manageability

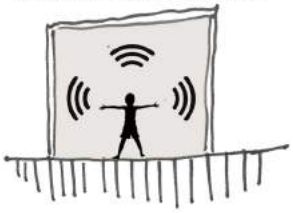
Meaningfulness

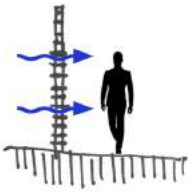


comfortable temperatures

acoustic considerations

background noise, reverberations





natural ventilation

Fig. 09. Left: The reciprocal relationship possible between architecture, health and the child (Author 2018)

CONTRIBUTION TO HEALTH CARE ARCHITECTURE IN SOUTH AFRICA

Even though the Bill of Rights states that access to basic health care is a right in South Africa, access to good architecture is unfortunately not (Viviers 2015). The health system's historical socio-economic fragmentation is causing gradual transformation towards a primary health care with constant pressure to meet the demands of equal and uniform health access. In terms of infrastructure provision, designers are pressured to deliver quality and healing environments within allocated budgets and restricted resources. Designers are expected to provide quality spaces that actively contribute to patient and staff wellbeing, work within tight construction schedules and policies. Viviers (2015) therefore compares the process of designing of a health care facility to "*doing open-heart surgery with a spoon*".

As seen in the discussion, evidence-based research and new design tools such as salutogenic architecture and sensory design can assist designers in the process of designing health care facilities. Through implementing these approaches to design, the built environment, from the tactile detail to the very form, can positively impact health outcomes (Mazuch 2017:47).

CONCLUSION

Early childhood interventions play a critical role in offering children a head start to a better future. The high primary school enrolment figure suggest that school health interventions have the potential to reach almost 12 million children at this crucial age of development and learning (Shung-King 2013). The image of health care is shifting globally, moving towards health care that does not only offer efficient and affordable health care facilities but also sustainable people-oriented healing environments (Boluijt & Hinkema 2005:4). Therefore, making use of the physical environment as tool in school-based health care settings can prove beneficial. The article highlights the possibilities for a beneficial relationship between the physical environment and child health care. The theoretical premise of salutogenesis offers evidence that the impact of physical environments on people offers a valuable tool when designing for health settings. An alternative approach for the design of school-based health care is suggested through the lens of salutogenic architectural principles. The article concludes in agreement with Fottler's statement, which calls for health settings to be responsive to human needs, and as result provide stimulating and nurturing environments, especially for children.

LIST OF FIGURES

ENDNOTES

1. The term "coding" refers the method of identifying a feature of the data collected. A code is "the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon" (Boyatzis 1998:63)
2. The concept of the Maggie centre's are inspired by the late Margaret Keswick Jencks, a cancer patient as well as designer, who promoted the notion that good design within cancer treatment environments can drastically improve the well-being and comfort of terminally ill patients.

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APPENDIX B: Water calculations

AREA CALCULATIONS

Catchment	Area, A (m^2)	Runoff Coefficient,	
		C	C (weighted)
Roof	**2260**	**0,9**	0,42
Paving	**2600**	**0,8**	0,43
TOTAL	**4860**		**0,846502058**

TOTAL YIELD

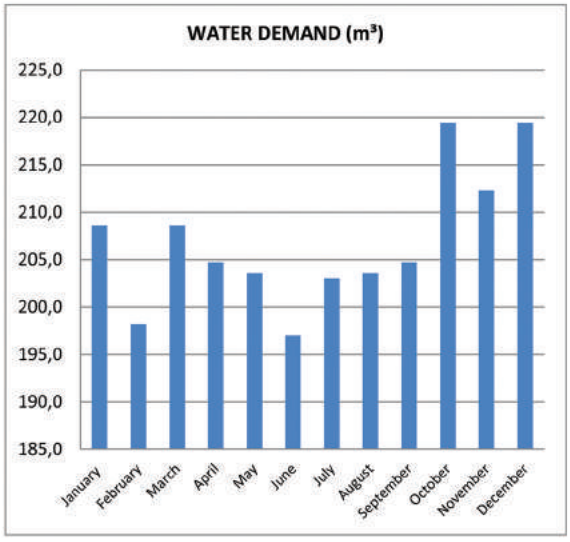
Month	Total Yield (m^3/month)
January	**559,504**
February	**308,55**
March	**337,348**
April	**209,814**
May	**53,482**
June	**28,798**
July	**12,342**
August	**24,684**
September	**90,508**
October	**292,094**
November	**403,172**
December	**452,54**
ANNUAL TOTAL	**2772,836**

RAINWATER YIELD CALCULATION

Month	Ave. rainfall, P (m)	Yield (m^3) (Yield = PxAxC)
January	0,136	**559,504**
February	0,075	**308,55**
March	0,082	**337,348**
April	0,051	**209,814**
May	0,013	**53,482**
June	0,007	**28,798**
July	0,003	**12,342**
August	0,006	**24,684**
September	0,022	**90,508**
October	0,071	**292,094**
November	0,098	**403,172**
December	0,11	**452,54**
ANNUAL AVE.	**0,674**	**2772,836**

IRRIGATION DEMAND

Month	Planting area (m^2)	Irr. depth / week (m)	Irr. depth / month (m)	Irrigation demand (m^3/mont
January	**180**	**0,04**	**0,117**	**21,06**
February	**180**	**0,04**	**0,16**	**28,8**
March	**180**	**0,04**	**0,117**	**21,06**
April	**180**	**0,03**	**0,129**	**23,22**
May	**180**	**0,02**	**0,089**	**16,02**
June	**180**	**0,02**	**0,086**	**15,48**
July	**180**	**0,02**	**0,086**	**15,48**
August	**180**	**0,02**	**0,089**	**16,02**
September	**180**	**0,03**	**0,129**	**23,22**
October	**180**	**0,04**	**0,177**	**31,86**
November	**180**	**0,04**	**0,171**	**30,78**
December	**180**	**0,04**	**0,177**	**31,86**
			ANNUAL TOTAL	**274,86**

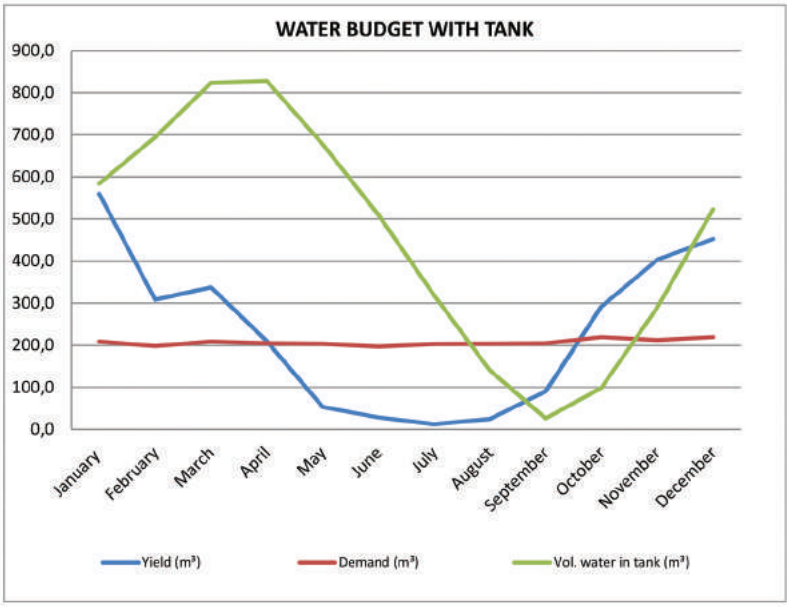


WATER BUDGET

Month	Yield (m³)	Demand (m³)	Monthly balance
January	559,5	208,6	**350,9**
February	308,6	198,2	**110,4**
March	337,3	208,6	**128,7**
April	209,8	204,7	**5,1**
May	53,5	203,6	**-150,1**
June	28,8	197,0	**-168,2**
July	12,3	203,0	**-190,7**
August	24,7	203,6	**-178,9**
September	90,5	204,7	**-114,2**
October	292,1	219,4	**72,7**
November	403,2	212,3	**190,9**
December	452,5	219,4	**233,1**
ANNUAL AVE.	2772,836	2483,11	

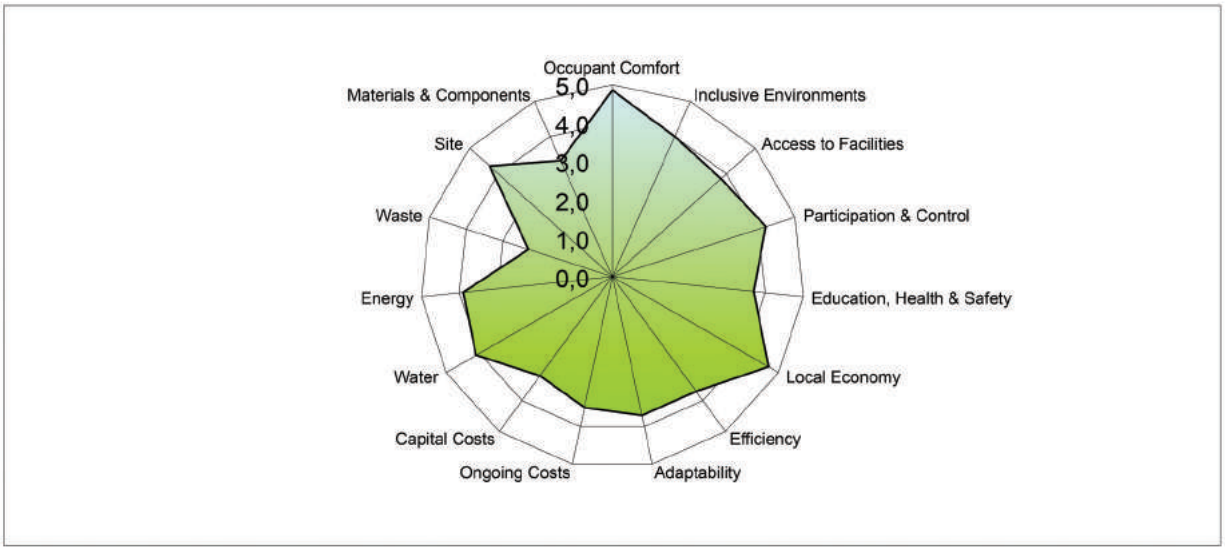
WATER BUDGET (ACCUMALATIVE)

Month	Yield (m³)	Demand (m³)	Monthly balance	Vol. water in tank (m³)
January	559,5	208,6	350,9	**584,0**
February	308,6	198,2	110,4	**694,4**
March	337,3	208,6	128,7	**823,1**
April	209,8	204,7	5,1	**828,2**
May	53,5	203,6	-150,1	**678,1**
June	28,8	197,0	-168,2	**509,9**
July	12,3	203,0	-190,7	**319,2**
August	24,7	203,6	-178,9	**140,4**
September	90,5	204,7	-114,2	**26,2**
October	292,1	219,4	72,7	**98,8**
November	403,2	212,3	190,9	**289,7**
December	452,5	219,4	233,1	**522,9**
ANNUAL AVE.	2772,836	2483,11		



APPENDIX C: SBAT-rating values

PROJECT		ASSESSMENT	
Project title:	Paediatric screening facility and resources hub	Date:	
Location:	Mamelodi East	Undertaken by:	
Building type (specify):	Residential/Community/Commercial	Company / organisation:	
Internal area (m2):		Telephone:	Fax:
Number of users:		Email:	
Building life cycle stage (specify):	Design		



Social	4,1	Economic	3,8	Environmental	3,6
		Overall	3,8		
		Target	5,0		

Building Performance - Environmental

	Criteria	Indicative performance measure	Measured	Points
EN 1	**Water**	Explanatory notes		4,1
EN 1.1	Rainwater	% of water consumed sourced from rainwater harvested on site	60	0,6
EN 1.2	Water use	% of equipment (taps, washing machines, urinals showerheads) that are water efficient	100	1,0
EN 1.3	Runoff	% of carparking, paths, roads and roofs that have absorbant/semi absorbant/permeable surfaces (grassed/thatched/looselaid paving/ absorbant materials)	50	0,5
EN 1.4	Greywater	% of water from washing/relatively clean processes recycled and reused	100	1,0
EN 1.5	Planting	% of planting (other than food gardens) on site with low / appropriate water requirements	100	1,0
EN 2	**Energy**	Explanatory notes		3,9
EN 2.1	Location	% of users who walk / cycle / use public transport to commute to the building	90	0,9
EN 2.2	Ventilation	% of building ventilation requirements met through natural / passive ventilation	70	0,7
EN 2.3	Heating & Cooling	% of occupied space which relies solely on passive environmental control (no or minimal energy consumption)	80	0,8
EN 2.4	Appliances & fittings	% of appliances / lighting fixtures that are classed as highly energy efficient (ie energy star rating)	100	1,0
EN 2.5	Renewable energy	% of building energy requirements met from renewable sources	50	0,5
EN 3	**Waste**	Explanatory notes		2,3
EN 3.1	Toxic waste	% of toxic waste (batteries, ink cartridges, flourescent lamps) recycled	50	0,5
EN 3.2	Organic waste	% of organic waste recycled	100	1,0
EN 3.3	Inorganic waste	% of inorganic waste recycled.	30	0,3
EN 3.4	Sewerage	% of sewerage recycled on site	0	0,0
EN 3.5	Construction waste	% of damaged building materials / waste developed in construction recycled on site	50	0,5
EN 4	**Site**	Explanatory notes		4,3
EN 4.1	Brownfield site	% of proposed site already disturbed / brownfield (previously developed)	80	0,8
EN 4.2	Neighbouring buildings	No neighbouring buildings negatively affected (access to sunlight, daylight, ventilation) (100%)	100	1,0
EN 4.3	Vegetation	% of area of area covered in vegetation (include green roofs, internal planting) relative to whole site	70	0,7
EN 4.4	Food gardens	Food gardens on site (100%)	100	1,0
EN 4.5	Landscape inputs	% of landscape that does not require mechanical equipment (ie lawn cutting) and or artificial inputs such as weed killers and pesticides	80	0,8
EN 5	**Materials & Components**	Explanatory notes		3,3
EN 5.1	Embodied energy	Materials with high embodied energy (aluminium,plastics) make up less than 1% of weight of building (100%)	80	0,8
EN 5.2	Material sources	% of materials and components by volume from grown sources (animal/plant)	40	0,4
EN 5.3	Ozone depletion	No materials and components used requiring ozone depleting processes (100%)	100	1,0
EN 5.4	Recyled / reuse	% of materials and components (by weight) reused / from recycled sources	20	0,2
EN 5.5	Construction process	Volume / area of site disturbed during construction less than 2X volume/area of new building (100%)	90	0,9

Building Performance - Social

	Criteria	Indicative performance measure	Measured	Points
SO 1	**Occupant Comfort**	Explanatory notes		4,9
SO 1.1	Daylighting	% of occupied spaces that are within distance 2H from window, where H is the height of the window or where there is good daylight from skylights	95	1,0
SO 1.2	Ventilation	% of occupied spaces have equivalent of opening window area equivalent to 10% of floor area or adequate mechanical system, with upolluted air source	100	1,0
SO 1.3	Noise	% of occupied spaces where external/internal/reverberation noise does not impinge on normal conversation (50dbA)	90	0,9
SO 1.5	Thermal comfort	Temprature of occupied space does not exceed 28 or go below 19oC for less than 5 days per year (100%)	100	1,0
SO 1.5	Views	% of occupied space that is 6m from an external window (not a skylight) with a view	100	1,0
SO 2	**Inclusive Environments**	Explanatory notes		4,0
SO 2.1	Public Transport	% of building (s) within 400m of disabled accessible (20%) and affordable (80%) public transport	80	0,8
SO 2.2	Information	Comprehensive signage provided (50%), Signage high contrast, clear print signage in appropriate locations and language(s) / use of understandable symbols / manned reception at all entrances (50%)	80	0,8
SO 2.3	Space	% of occupied spaces that are accessible to ambulant disabled / wheelchair users	80	0,8
SO 2.4	Toilets	% of occupied space with fully accessible toilets within 50m along easily accessible route	90	0,9
SO 2.5	Fittings & Furniture	% of commonly used furniture and fittings (reception desk, kitchenette, auditorium) fully accessible	70	0,7
SO 3	**Access to Facilities**	Explanatory notes		3,8
SO 3.1	Children	All users can walk (100%) / use public transport (50%) to get to their childrens' schools and creches	90	0,9
SO 3.2	Banking	All users can walk (100%) / use public transport (50%) to get to banking facilities	70	0,7
SO 3.3	Retail	All users can walk (100%) / use public transport (50%) to get to food retail	90	0,9
SO 3.4	Communication	All users can walk (100%) / use public transport (50%) to get to communication facilities (post/telephone/internet)	80	0,8
SO 3.5	Exercise	All users can walk (100%) / use public transport (50%) to get to recreation/excercise facilities	50	0,5
SO 4	**Participation & Control**	Explanatory notes		4,2
SO 4.1	Environmental control	% of occupied space able to control their thermal environment (adjacent to openable windows/thermal controls)	90	0,9
SO 4.2	Lighting control	% of occupied space able to control their light (adjacent to controllable blinds etc/local lighting control)	100	1,0
SO 4.3	Social spaces	Social informal meeting spaces (parks / staff canteens / cafes) provided locally (within 400m) (100%)	100	1,0
SO 4.4	Sharing facilties	5% or more of facilities shared with other users / organisations on a weekly basis (100%)	100	1,0
SO 4.5	User group	Users actively involved in the design process (50%) / Active and representative management user group (50%)	30	0,3
SO 5	**Education, Health & Saf**	Explanatory notes		3,7
SO 5.1	Education	Two percent or more space/facilities available for education (seminar rooms / reading / libraries) per occupied space (75%). Construction training provided on site (25%)	80	0,8
SO 5.2	Safety	All well used routes in and around building well lit (25%), all routes in and around buildings visually supervised (25%), secure perimeter and access control (50%), No crime (100%)	70	0,7
SO 5.3	Awareness	% of users who can access information on health & safety issues (ie HIV/AIDS), training and employment opportunities easily (posters/personnel/intranet site)	80	0,8
SO 5.4	Materials	All materials/components used have no negative effects on indoor air quality (100%)	100	1,0
SO 5.5	Accidents	Process in place for recording all occupational accidents and diseases and addressing these	40	0,4

Building Performance - Economic

	Criteria	Indicative performance measure	Measured	Points
EC 1	**Local economy**	Explanatory notes		4,7
EC 1.1	Local contractors	% value of the building constructed by local (within 50km) small (employees<20) contractors	100	1,0
EC 1.2	Local materials	% of materials (sand, bricks, blocks, roofing material) sourced from within 50km	100	1,0
EC 1.3	Local components	% of components (windows, doors etc) made locally (in the country)	100	1,0
EC 1.4	Local furniture/fittings	% of furniture and fittings made locally (in the country)	70	0,7
EC 1.5	Maintenance	% of maintenance and repairs by value that can, and are undertaken, by local contractors (within 50km)	100	1,0
EC 2	**Efficiency**	Explanatory notes		3,7
EC 2.1	Capacity	% capacity of building used on a daily basis (actual number of users / number of users at full capacity*100)	50	0,5
EC 2.2	Occupancy	% of time building is occupied and used (actual average number of hours used / all potential hours building could be used (24) *100)	50	0,5
EC 2.3	Space per occupant	Space provision per user not more than 10% above national average for building type (100%)	100	1,0
EC 2.4	Communication	Site/building has access to internet and telephone (100%), telephone only (50%)	100	1,0
EC 2.5	Material & Components	Building design coordinated with material / component sizes in order to minimise wastage. Walls (50%), Roof and floors (50%)	70	0,7
EC 3	**Adaptability**	Explanatory notes		3,8
EC 3.1	Vertical heights	% of spaces that have a floor to ceiling height of 3000mm or more	100	1,0
EC 3.2	External space	Design facilitates flexible external space use (100%)	100	1,0
EC 3.3	Internal partition	Non loadbearing internal partitions that can be easily adapted (loose partioning (100%), studwall (50%), masonary (25%)	25	0,3
EC 3.4	Modular planning	Building with modular stucture, envelope (fenestration) & services allowing easly internal adaptaptation (100%)	60	0,6
EC 3.5	Furniture	Modular, limited variety furniture - can be easily configured for different uses (100%)	90	0,9
EC 4	**Ongoing costs**	Explanatory notes		3,5
EC 4.1	Induction	All new users receive induction training on building systems (50%), Detailed building user manual (50%)	80	0,8
EC4.2	Consumption & waste	% of users exposed on a monthly basis to building performance figures (water (25%), electricity (25%), waste (25%), accidents (25%)	80	0,8
EC 4.2	Metering	Easily monitored localised metering system for water (50%) and energy (50%)	80	0,8
EC4.3	Maintenance & Cleaning	% of building that can be cleaned and maintained easily and safely using simple equipment and local non-hazardous materials	50	0,5
SO 4.5	Procurement	% of value of all materials/equipment used in the building on a daily basis supplied by local (within the country) manufacturers	60	0,6
EC 5	**Capital Costs**	Explanatory notes		3,2
EC 5.1	Local need	Five percent capital cost allocated to address urgent local issues (employment, training etc) during construction process (100%)	80	0,8
EC5.2	Procurement	Tender / construction packaged to ensure involvement of small local contractors/manufacturers (100%)	100	1,0
EC 5.3	Building costs	Capital cost not more than fifteen % above national average building costs for the building type (100%)	60	0,6
EC5.4	Technology	3% or more of capital costs allocated to new sustainable/indigenous technology (100%)	80	0,8
EC 5.5	Existing Buildings	Existing buildings reused (100%)	0	0,0