CATALYTIC NEXUS

Architecture as an interconnected resilience hub towards independence and self-efficiency in a complex socio-ecological landscape

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U16001380

PROJECT SUMMARY

DISSERTATION TITLE

Catalytic Nexus: Architecture as an interconnected resilience hub towards independence and self-efficiency in Melusi informal Settlement

SITE LOCATION

Melusi Informal Settlement, Abandoned quarry

PRIMARY PROGRAMME

Community food scheme and basic services

RESEARCH FILED OF STUDY

Urban Citizenship

CLIENT

City of Tshwane Municipality

YEAR CO-ORDINATORS

Prof. Arthur Baker, Ms Anika van Aswegen & Mr Johan Prinsloo

SUPERVISOR

Dr Jan Hugo

Co-supervisor: Dr. Carin Combrinck

KEYWORDS

Quarry, Informal settlement, Socio-ecological landscapes, biophilic architecture, co-design, participatory design

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 Master of Architecture (professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

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

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

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

Jua Greeff

Date

30-07-2021

Acknowledgements

I would like to thank my heavenly Father for blessing me with the talent to design space for giving me the strength, knowledge, insight, and endurance to complete this mini dissertation.

Thank you to my fiancé, JC for all your love and support throughout the year. Thank you for being my biggest fan and for all the much-needed coffee and ice-cream breaks. I appreciate you endlessly for keeping me positive by celebrating all the smaller milestones, throughout the year.

A very special thanks to my wonderful parents, Braam and Leanne for allowing me to follow my dream of becoming an Architect. Thanks for always being my cheerleader and cornerstone throughout my academic career. Thanks for all the prayers, love, and support, and the example that you set for me. I appreciate the valuable life lessons you taught me, that with hard work and dedication you can achieve anything.

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Abstract

Since independence in 1994, informal settlements in urban areas became a regular phenomenon with an exponential growth pattern and a lack of effective, proactive town planning. This phenomenon is described as an *Urban Crisis*. Informal settlements in South Africa are the result of spatial injustice and an imbalanced political atmosphere and therefore described as complex landscapes. Informal settlements exist most of the time on vacant land, inadequate for development such as abandoned post-industrial landscapes, wetlands, floodplains, and near rivers which are high-risk areas and contain environmental disadvantages which is the case with the Melusi informal settlement consisting of three post-industrial quarry holes.

Complex landscapes such as informal settlements ask for a shift in the mainstream architectural practices and due to the rapid urbanization, post-industrial abandoned landscapes have the potential of being rehabilitated and functioning as healthy public spaces especially in informal conditions.

The mini dissertation aims to develop a framework when working in informal conditions with layered complexities of socio and ecological nature. Through understanding the application of co-design and participative workshops this dissertation aims to apply architecture to find a (nexus) or mediation between the socio and ecological landscapes towards independent and self-functioning communities of growth, this dissertation aims to apply architecture to function as the backbone of the community and by using didactic methods will empower the community towards self-improvement. Due to the current alienation of the natural quarry hole the architecture aims to transform the quarry from object to resource in a vulnerable community towards independent from external resources.

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DEPARTURE POINT

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COVID-19 PANDEMIC TAUGHT ME AN IMPORTANT LIFE LESSON.

“You can’t wait until life isn’t hard anymore before you decide to be happy and do what you love”.

- Nightbirde

DEPARTURE POINT

CATALYST

(momentum)

"…urban areas suffering from stagnation or decline, we should place a high priority catalytic development that can cause more development." (Sternberg 2002:33)

NEXUS

(bridge)

"An important connection between the parts of a system or a group of things."

(Cambridge Dictionary n.d)

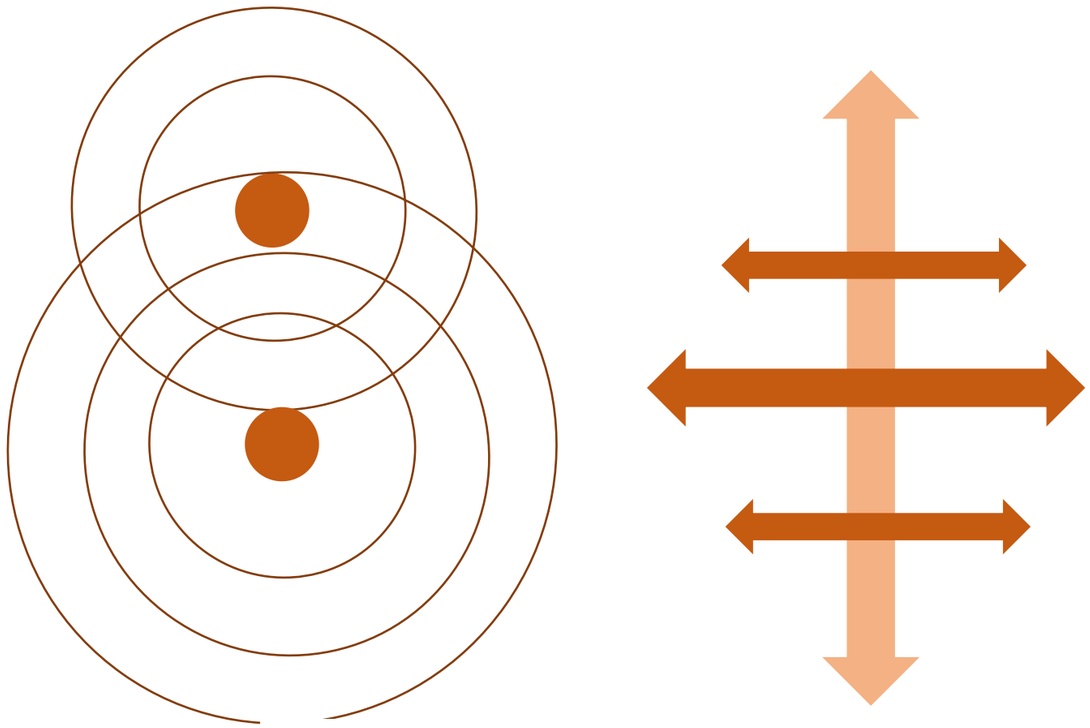


Figure i: Visual representation of Catalytic and Nexus (Author 2021).

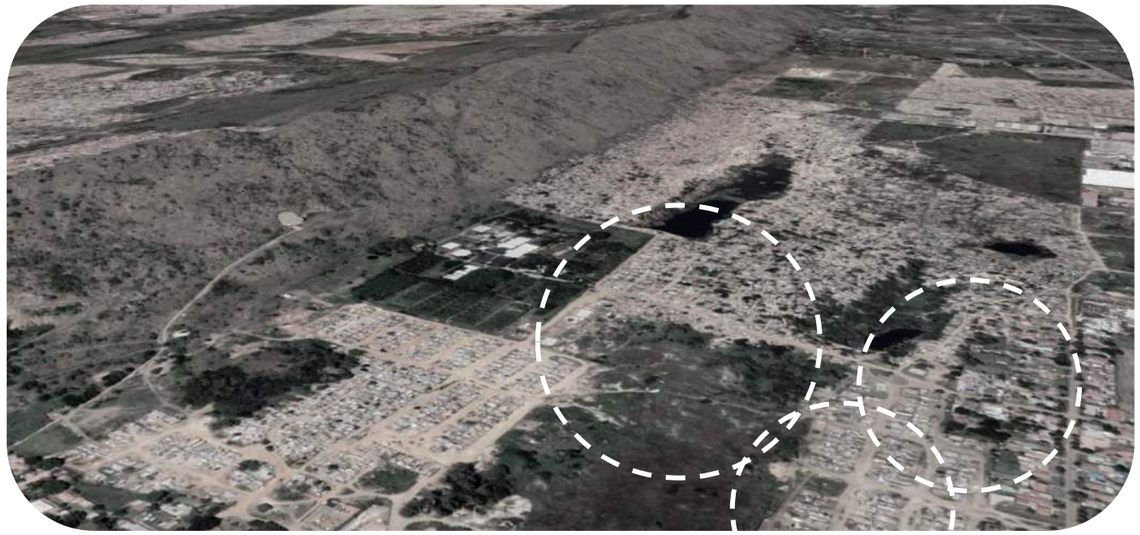


Figure ii: Google Earth image of Melusi and the three quarry holes on site (Google Earth 2021).

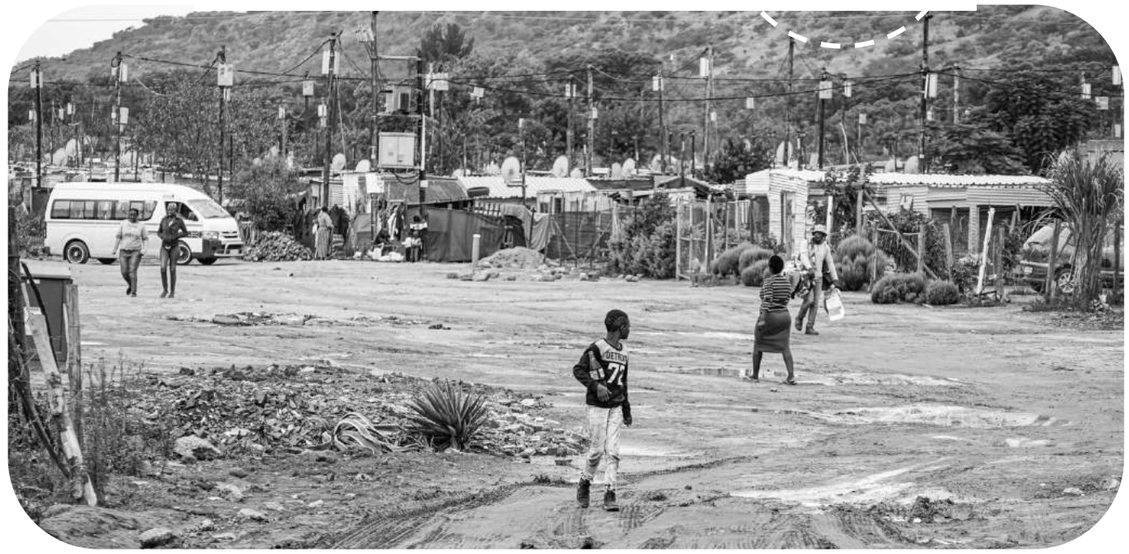


Figure iii: Landing images of Melusi informal settlement (Zorn 2021).

Figure iv: Landing images of Melusi informal settlement and a need for waste removal services (Zorn 2021).

VOICE OF MELUSI

CHAPTER 01

INTRODUCTION

Figure 1.1: Children of Melusi collecting building materials in the active street (Zorn 2021).

Complex landscapes such as informal settlements ask for a shift in the mainstream architectural practices. The author of the mini dissertation aims to investigate the design approach when dealing with layered complexities on site such as informal settlements situated on post-industrial abandoned landscapes. Informal settlements exist most of the time on vacant land and inadequate land for development such as abandoned post-industrial landscapes, wetlands, floodplains, and near rivers which are high-risk areas and contain environmental disadvantages (Adegun 2016:16). This mini dissertation aims to address the complexity of both the socio and ecological needs of a vulnerable community because of the connection and the relationship of the community with the natural ecosystems which can be problematic and cause hazards, but it also shows immense potential for sustainable solutions towards community independence and self-sufficiency (Adegun 2016:17).

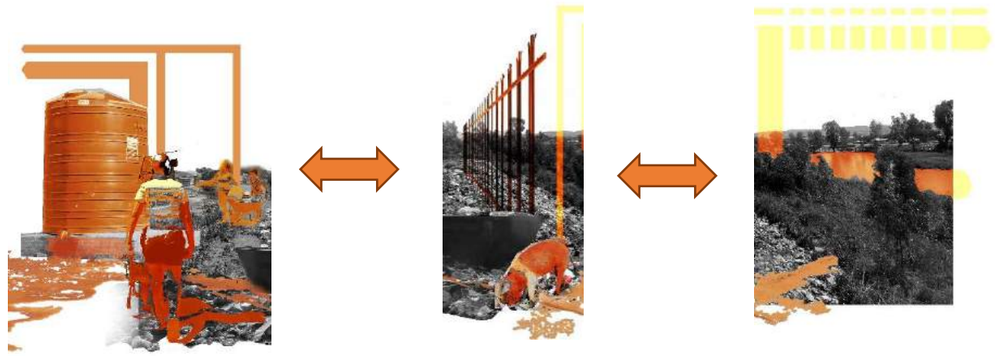
*"The relationship between human settlements and the natural environment or ecological system is **complex, iterative and continually changing**" - (Department of Forestry Fisheries and the Environment, n.d.)*

RESPONSE:

CATALYTIC NEXUS MEDIATOR

SOCIO COMPLEXITY

ECOLOGICAL COMPLEXITY



Phenomena of Informal settlements – Socio / human needs

Catalytic Nexus

Mini- dissertation intention

Phenomena of abandoned Ecological landscapes Environmental needs.

Figure 1.2: Intention of the mini dissertation (Author 2021).

MAIN PROBLEM

PHENOMENA OF INFORMAL SETTLMENTS

[complexity of socio needs]

Since independence in 1994, informal settlements in urban areas became a regular phenomenon with an exponential growth pattern and a lack of effective, proactive town planning (Pienaar 2002:5). This phenomenon is described by JM Pienaar (2002:5) as an *Urban Crisis*. Informal settlements in South Africa are the result of spatial injustice and an imbalanced political atmosphere. South Africa's cities will have to adjust to the current informality introduced organically. Normally informal settlements do not have any services available due to the authorities that generally refuse to provide them, as a result preventing the possibility of further expansion (Pienaar 2002:5). Through assessing the failures and shortfalls of previous upgrading schemes, the conclusion can be made that South Africa has not yet found a viable solution to the injustices in our urban contexts (Cirolia et al 2016). Upgrading informal settlements often implies a project-driven approach that has led to the downfall of informal upgrading schemes (Hamdi 2010). The main constraint experienced by the Government is how to upgrade informal settlements and not be financially obligated to sustain these interventions after practical completion. This mini dissertation will aim to find design solutions ensuring individuals and living spaces of continual growth towards co-evolution after practical completion (Jack 2014) and simultaneously improving the social and environmental needs of the landscape.

URBAN PROBLEM

1

PHENOMENA OF ABANDONED OR ECOLOGICAL LANDSCAPES

[complexity of ecological needs]

Informal settlements tend to develop on open, abandoned land or sometimes on land which consists of high ecological value where development is not allowed to preserve and protect these ecosystems or exists on least desirable or environmentally compromised areas such as flood lines, on dolomite land and next to mine dumps. These sites are often the only available sites in well-located or urban areas (*Department of Forestry Fisheries and the Environment, n.d)*. These human settlements' interaction with the environment causes more harm to the environment due to the excessive extraction of non-renewable natural resources (Department of Forestry Fisheries and the Environment, n.d).

2

CURRENT ARCHITECTURAL METHOD

Architects practicing in complex spatial problems tend to argue following a linear problem-solving approach, entering the challenge with preconceived solutions (Hamdi, 2010). Architecture is not just human shelter but space, which should cater for the complex form of human expression and spirituality which can't be analysed in a linear approach (Maslow, 1943). The human is a complex being with fluctuating needs and by understanding the layered complexity that one can no longer deal with spatial problems in isolation (Max-Neef 1991).

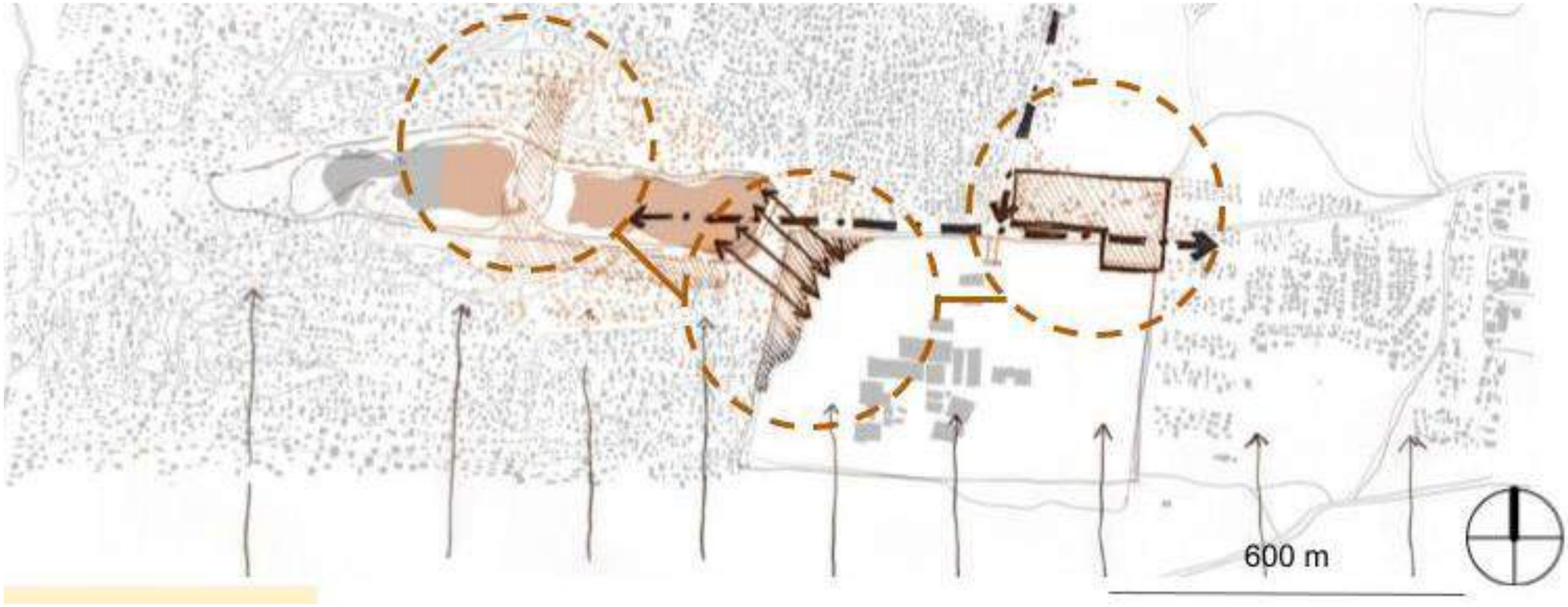


Figure 1.3: Site map showing proposed multiple strange attractors (Author 2021).

NORMATIVE POSITION

The proposed process of working in layered complexity spaces is to facilitated upgrading on a social and ecological level to ensure the successful transference of ownership but also to ensure for co-evolution to take place. Snowden (2011) suggested the following method of resolving physical complex phenomena is to Probe – Sense – Respond. Snowden suggests implementing multiple small, strange attractors or catalysts within a complex space which has the possibility to create smaller connection within the strange attractors. The concept is that the inhabitants interact with the attractors organically. The ideal would be for the strange attractors to function as OODA loops (figure 3.4), sustaining themselves by allocating people tasks and responsibility to maintain a functional strange attractor through Observe, Orient, Decide and Act. The OODA loop can only be successful if there was a transference of ownership towards the community using participatory design and co-design practices. When the OODA loop phenomena is evident within a space it will organically grow through internal connections into a co-evolutionary community towards co-evolution and community self-sufficiency. This mini dissertation aims to facilitate this socio and ecological emergence.

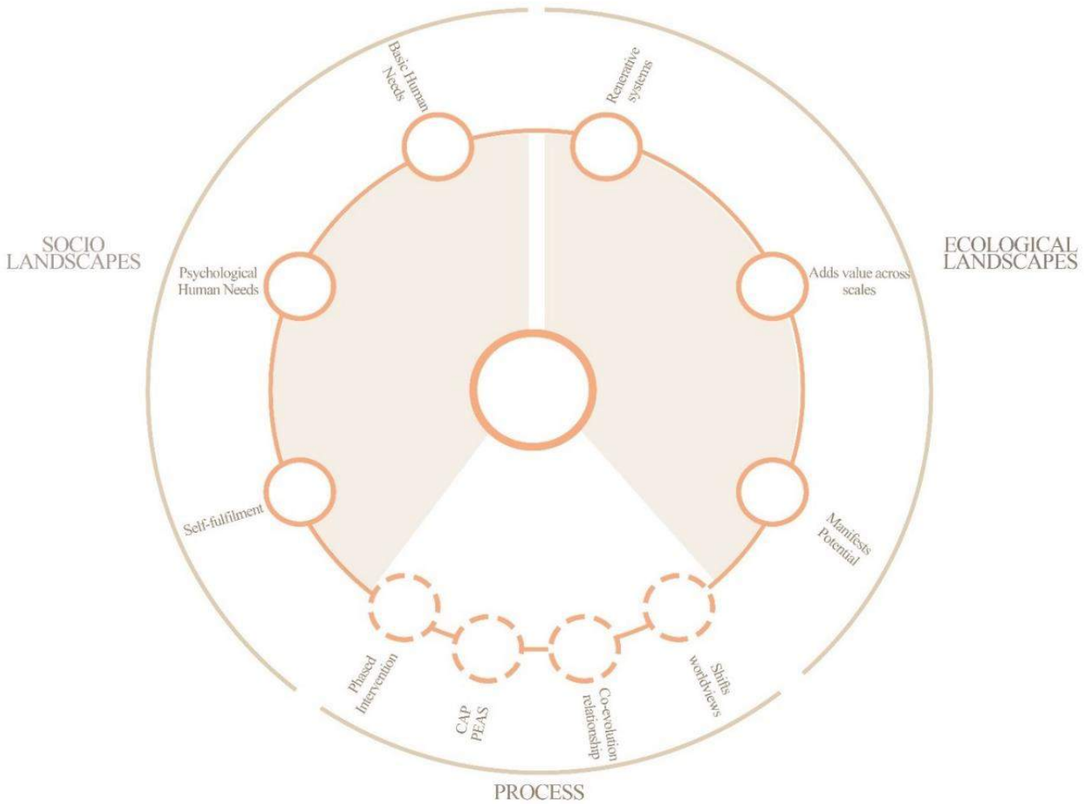


Figure 1.4: Developed framework (Author 2021).

By planting the seed of ownership, the architect opens the mind towards critical thinking and problem-solving skills which will have a sustainable effect on a community (Hamdi, 2010).

The author suggests that one should not only focus on one need in isolation but that a gradual intervention process is necessary for a project to be successful in addressing both the ecological and the social needs illustrated in figure 1.5.

In Chapter four a framework (figure 1.4) developed to address both the socio and ecological aspects in informal settlements upgrading projects is discussed in detail.

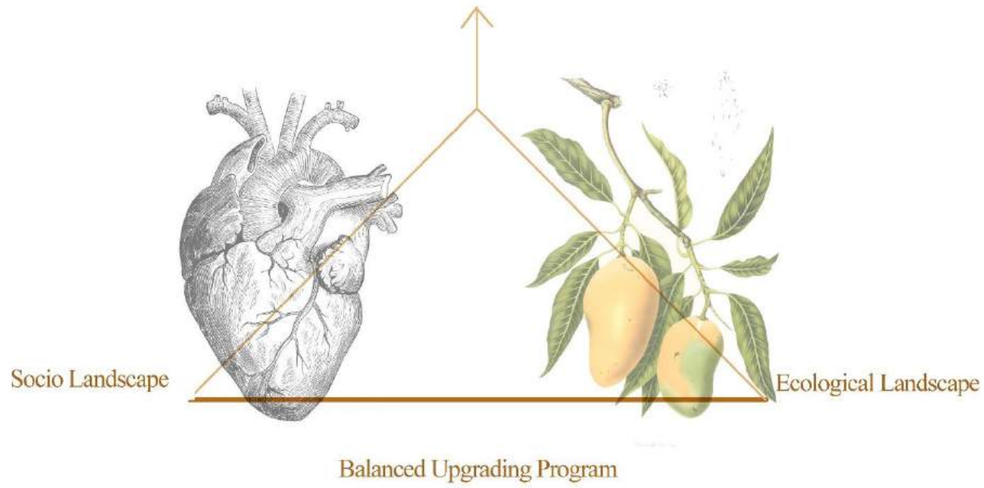


Figure 1.5: Illustrates the project intention which is to gain co-evolution towards self-efficiency (Author 2021).

PROPOSED SITE

SELECTED SITE

[Consists of both socio and ecological complexity]

The socio and ecological issues mentioned above are prominent in Melusi informal settlement and therefore the chosen site for this project. Melusi is an informal settlement West of Pretoria CBD near the Daspoort Tunnel (figure 1.6). The community shows exponential growth from 2008-2021 as indicated in figure 1.12. The land has been vacant for years before Melusi was established. Melusi consists out of three quarry holes and a natural wetland which made it difficult in the past for development to take place.

MACRO CONTEXT

Figure 1.6: Broader Context of Melusi. Original Orthophoto obtained from Google Earth (Climate adaptation studio 2020).

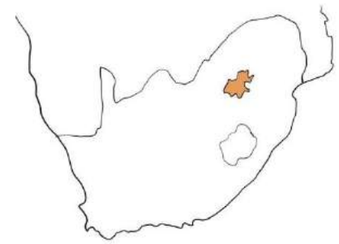


Figure 1.7: Melusi is situated in the City of Tshwane district in Gauteng province (Author 2021).

CHOSEN SITE

Quarry hole steep slope

Figure 1.8 & 1.9: Chosen site for intervention situated on the slope of the main quarry hole (Author 2021).

Figure 1.10: Selected site for the intervention- Repurpose the slope of the quarry hole making the edge a safer area (Author 2021).

Figure 1.11: Highlighted is the bridging island which will also be intervened on creating a link and bridge between the two parts of the community (Author 2021).

MELUSI GROWTH

Quarry hole steep slope

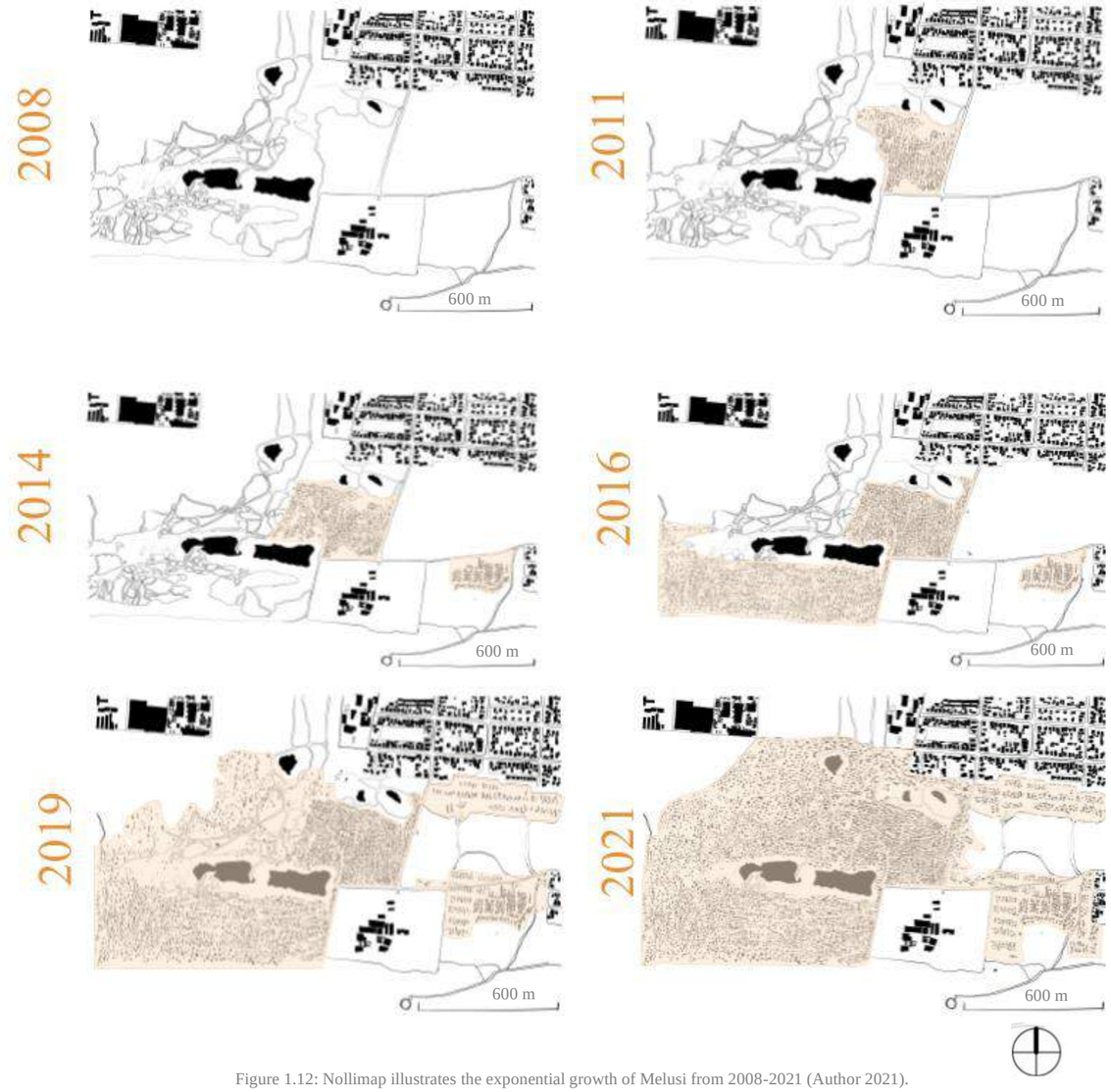


Figure 1.12: Nollimap illustrates the exponential growth of Melusi from 2008-2021 (Author 2021).

Figure 1.13: Site photo of the main street in Melusi and the need for safer pedestrian routes (Zorn 2021).

MELUSI SITE HISTORY

Because of the brief history documented about the site, the Author reached out to Rehan Opperman, which works at the Council for Geoscience on 19 August 2021 via an email.

According to the mineral deposit database Opperman (2021), mentioned that the site was mined for sand and clay of which the sand mining activities were already in progress at least in the year 1930. According to Opperman the Groenkloof Brick Works belonging to JJ Kirkness established a brick making plant in the late 1940's or early 1950's at the site of Melusi. Shortly before the Groenkloof plant shut down in 1950's the suburb *"Kirkney"*(name of a town in Scotland) next to the site was chosen as tribute to JJ Kirkness as the Scottish ancestry (Opperman 2021).

The site is underlain by the shales of the Silverton Formation. Weathering of the northwards dipping quartzites of the Daspoort Formation resulted in the formation and northwards transportation of the sand deposits. The sand deposits would generally be expected to overlie the shales. On the older aerial photographs, it seems as if the concentration of sand occurred from a poorly drained East-West channel Opperman 2021). The sand deposits are normally not very thick and suitable sand would have been stripped from extensive areas. According to Opperman there was not significant rehabilitation done on the site after excavations took place. It is expected for some areas to have little to no topsoil, which has negative implications such as soil fertility and drainage challenges (Opperman 2021).

By analysing the old aerial photographs Opperman made the following conclusions regarding the Quarry holes. The quarry holes are related to clay mining activities. It seems as if the weathered shales where mined and according to Opperman do not exceed 5-10 m in depth. The conclusions by Rehan Opperman are confirmed by Piet Vosloo (2018:46) as he mentions that there are numerous stone, clay and gravel quarries situate in and around the City of Tshwane region especially close to the ridges in Gauteng. There are around 12 potential quarry sites on the Magaliesberg and Daspoort ridges alone (Vosloo 2018:46).

1939

AERIAL PHOTOGRAPH

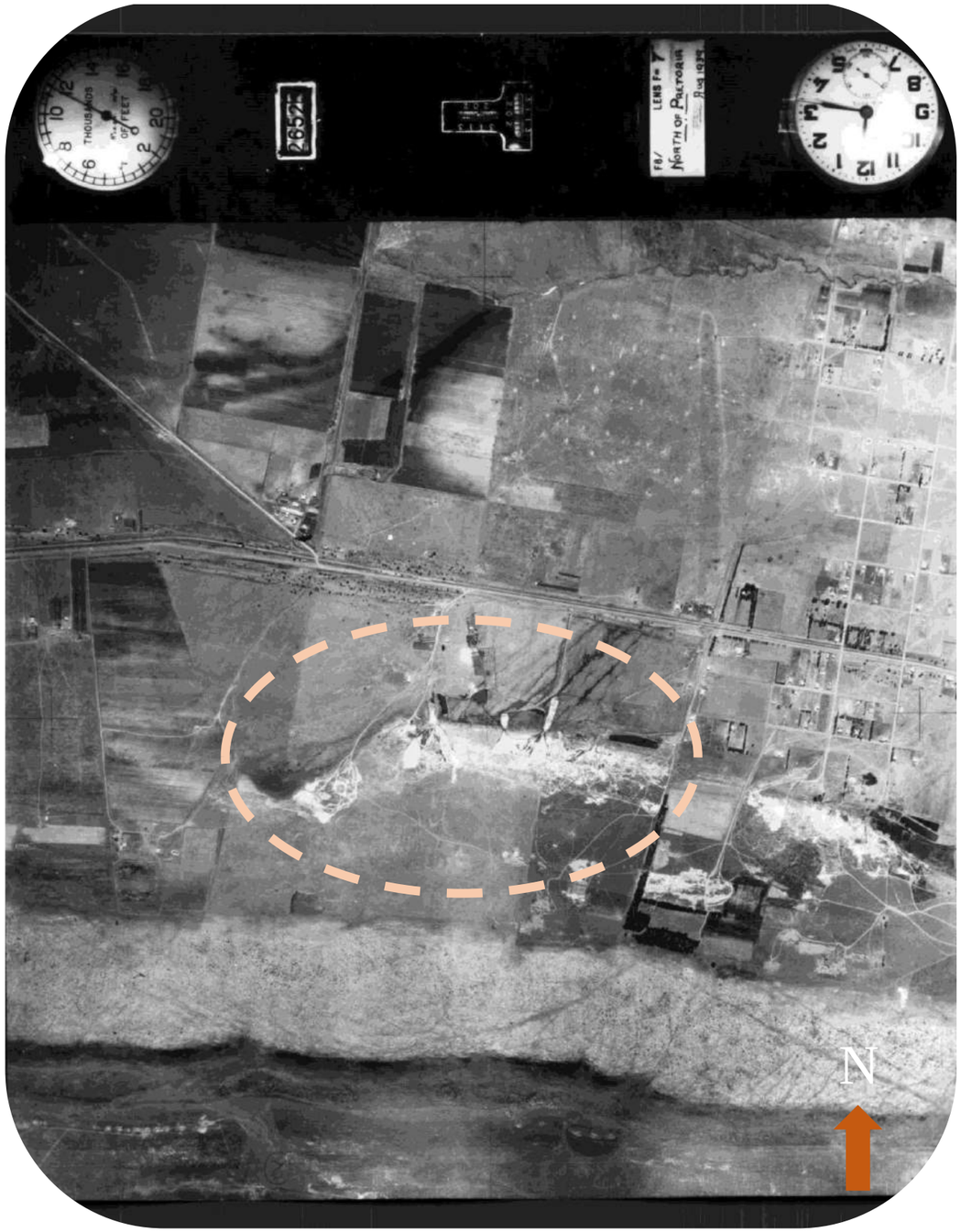


Figure 1.14: Arial photograph of Melusi site in 1939. Visible is only sand mine present (Opperman 2021).

1947

AERIAL PHOTOGRAPH

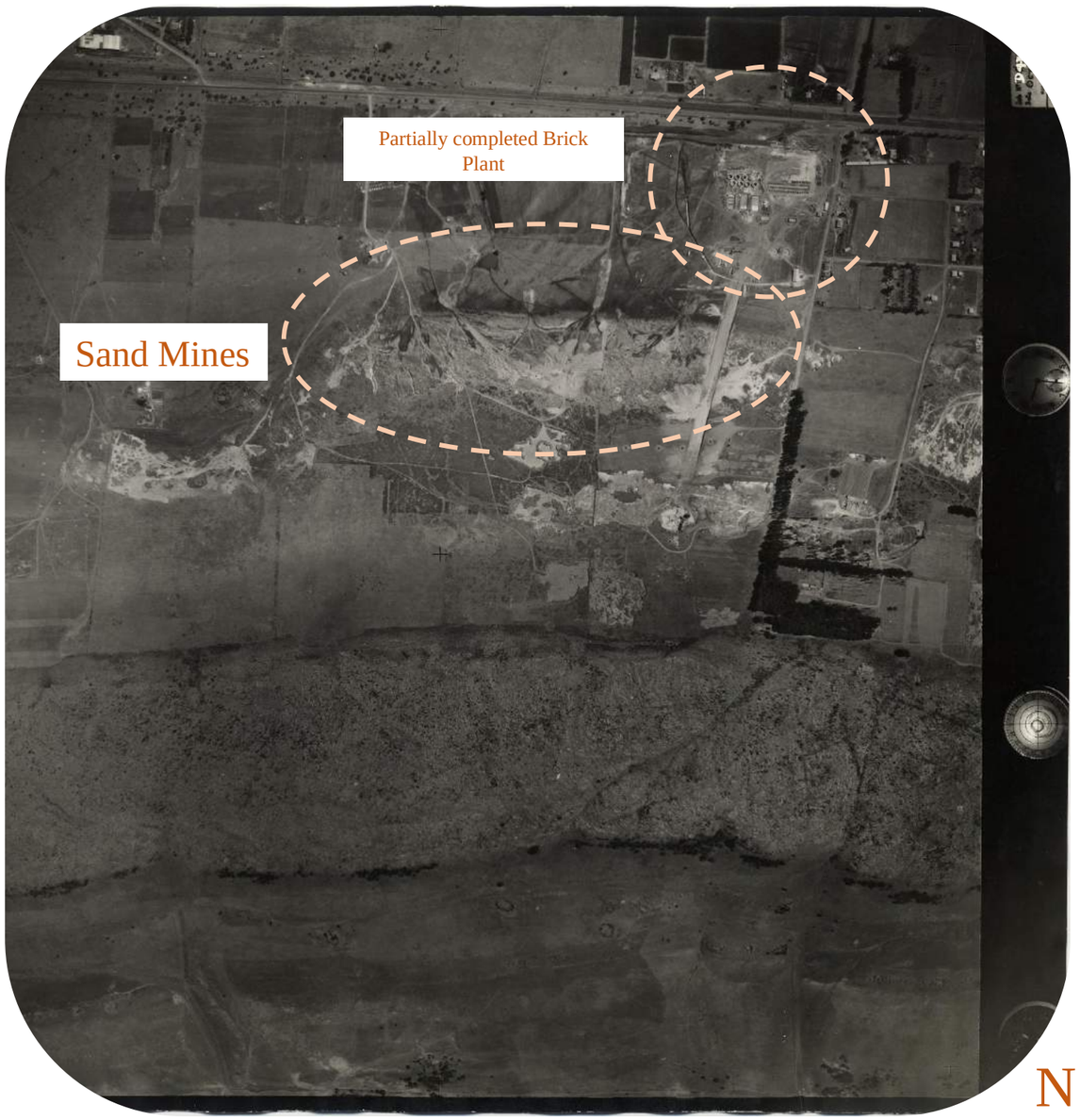


Figure 1.15: Arial photograph of Melusi site in 1947. Indicated is the partially completed brick plant visible near Van Der Hoffweg (Opperman 2021).

1980

AERIAL PHOTOGRAPH

Figure 1.16: Arial photograph of Melusi in 1980. Indicated is the three quarry holes currently situated in Melusi settlement (Opperman 2021).

ARCHITECTURAL PROBLEM

CURRENT QUARRY AND WATER RECOURCE AS BOUNDARY AND EXISTS IN ISOLATION

[Signs of Community have physical visual boundaries towards the Quarry]

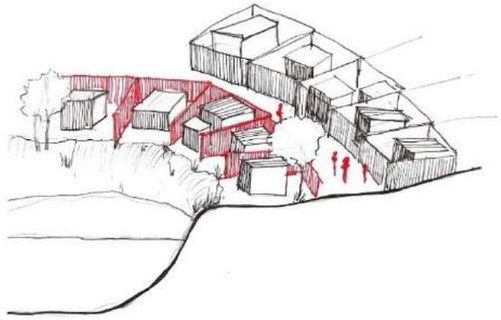


Figure 1.17: Illustrates the visual boundary and phenomena one where the Melusi community resides adjacent to the Quarry by using the quarry as a fourth boundary (Author 2021).

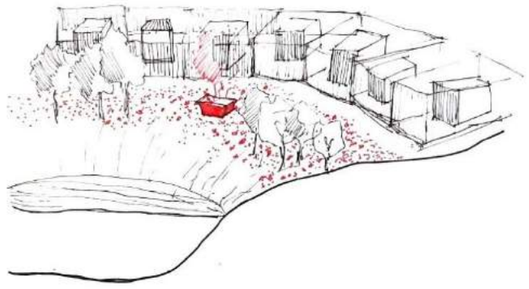


Figure 1.18: Illustrates the visual boundary and phenomena two where the Melusi community uses the slope of the quarry as a dumping site (Author 2021).

Through the data collection process (interviews), it became clear that there are multiple perspectives and perceptions of the existing quarry hole. The quarry is filled with water and resulted in a hazard for the community. The COPC researchers refer to the quarry as a health and physical hazard. The residents of the Melusi use the quarry as a fence or boundary indicated in the figure 1.17-1.20. The houses and household turn their back onto the water bodies and do not have any interaction with the quarry except as a dumping site as per figure 1.21-1.22.

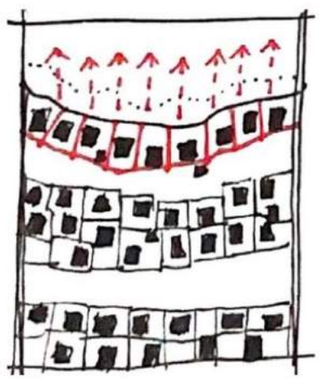


Figure 1.19: Plan view of visual phenomena one (Author 2021).

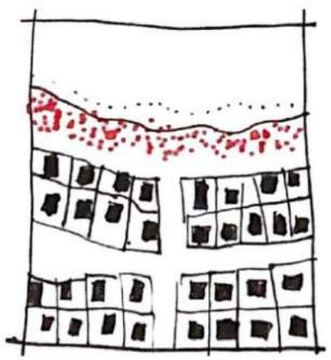


Figure 1.20: Plan view of visual phenomena two (Author 2021).

Figure 1.21: Observed Dumping sites in Melusi (Author 2021).

A

Figure 1.22: Waste on quarry edge (Author 2021).

B

Figure 1.23: Waste in the main street of Melusi (Zorn 2021).

C

Figure 1.24: Pigs on the duping sites at the natural wetland (Zorn 2021).

[Signs of Community have phycological invisible boundary towards the quarry]

The children gave us a glimpse of their fear for the “Dam” as they referred to the quarry in one of the water workshops we conducted on-site. The children believe that a monster exists in the quarry and to never goes near the water body. This mythical creature and story might be a safety mechanism the adults implemented to keep the children safe.

.

Children perspective

MYSTICAL
MONSTER
High Fear Level

Teachers perspective

PHYSICAL
HAZARD
Moderate Fear Level

COPC workers perspective

HEALTH
HAZARD
Concerned about the current state

Figure 1.25: Illustrates the different types of relationships and invisible boundaries the stakeholders have towards the quarry (Author 2021).

METHODOLOGY

On Site Data Collection Methodology

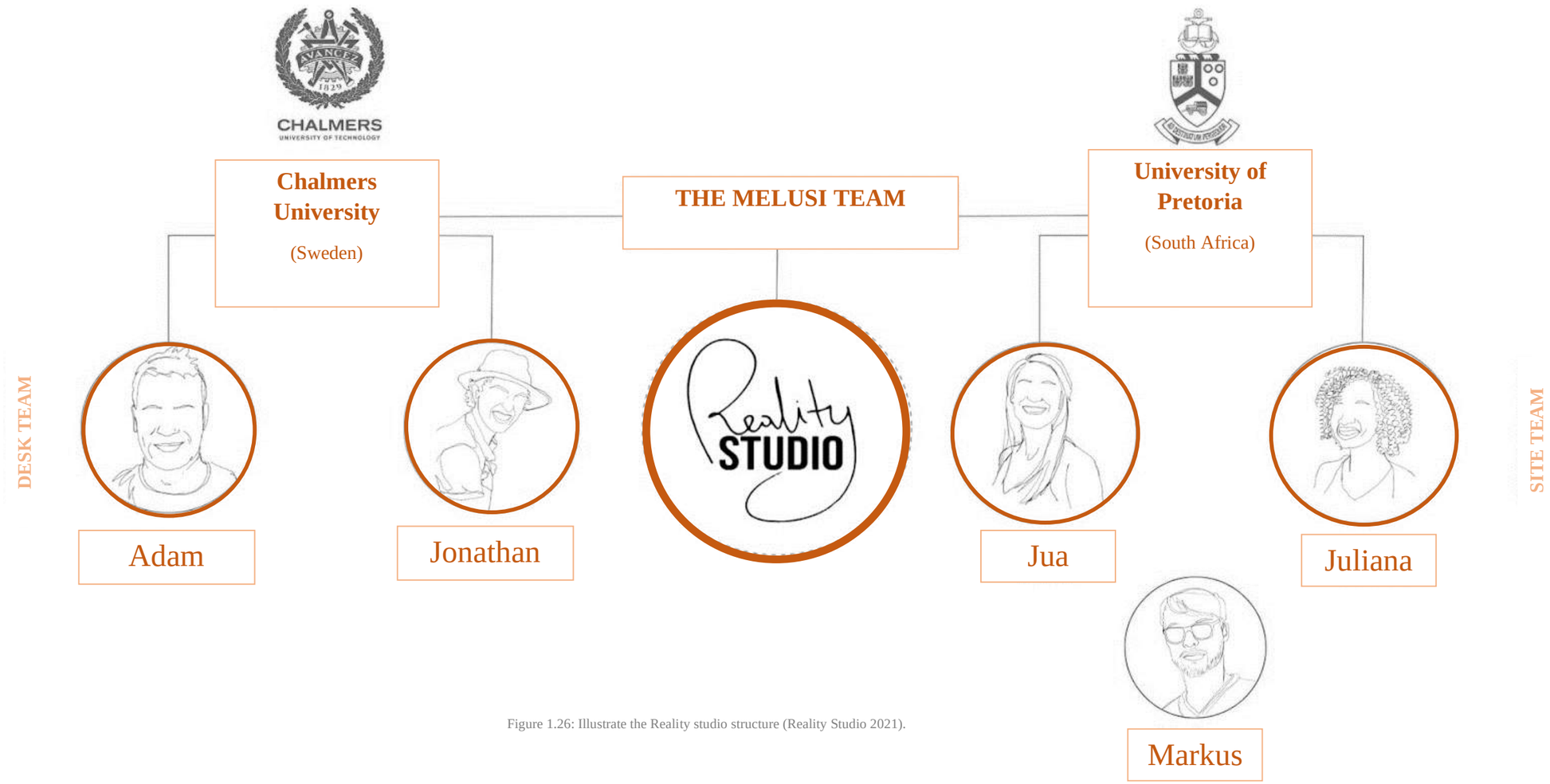


Figure 1.26: Illustrate the Reality studio structure (Reality Studio 2021).

This mini-dissertation formed part of - *The Urban Citizen Studios: Public Interest Design in South Africa*. This Studio collaborated with international students at Chalmers University in Sweden see figure 19. The current global pandemic (Covid-19) made it possible to collaborate internationally. The goal of this studio was to conduct a rigorous data collection and site analysis process in group format. The findings of the data collection process will be used to design an urban framework with a “Now” intervention (Hamdi 2010).

The project outcome of this mini dissertation will act as the “Soon” and “Later” intervention. Nabeel Hamdi (2010) suggested in the Community Action Planning (CAP) process to have multiple interventions that follow onto each other towards the successful transference of ownership. The importance of the “Now-Soon-Later” approach towards intervention is to introduce the Melusi community to the upgrading process, improving trust and relationships between stakeholders.

FIELDWORK TIMELINE

Reality Studio

Interviews and mapping exercises

Transect walks

Game Workshops

Play Africa Workshop

Understanding the Child Perspective

Figure 32: Illustrates the multiple methods used on site (Zorn 2021).

Figure 1.28: Mydo Youth centre sign in Melusi main street (Zorn 2021).

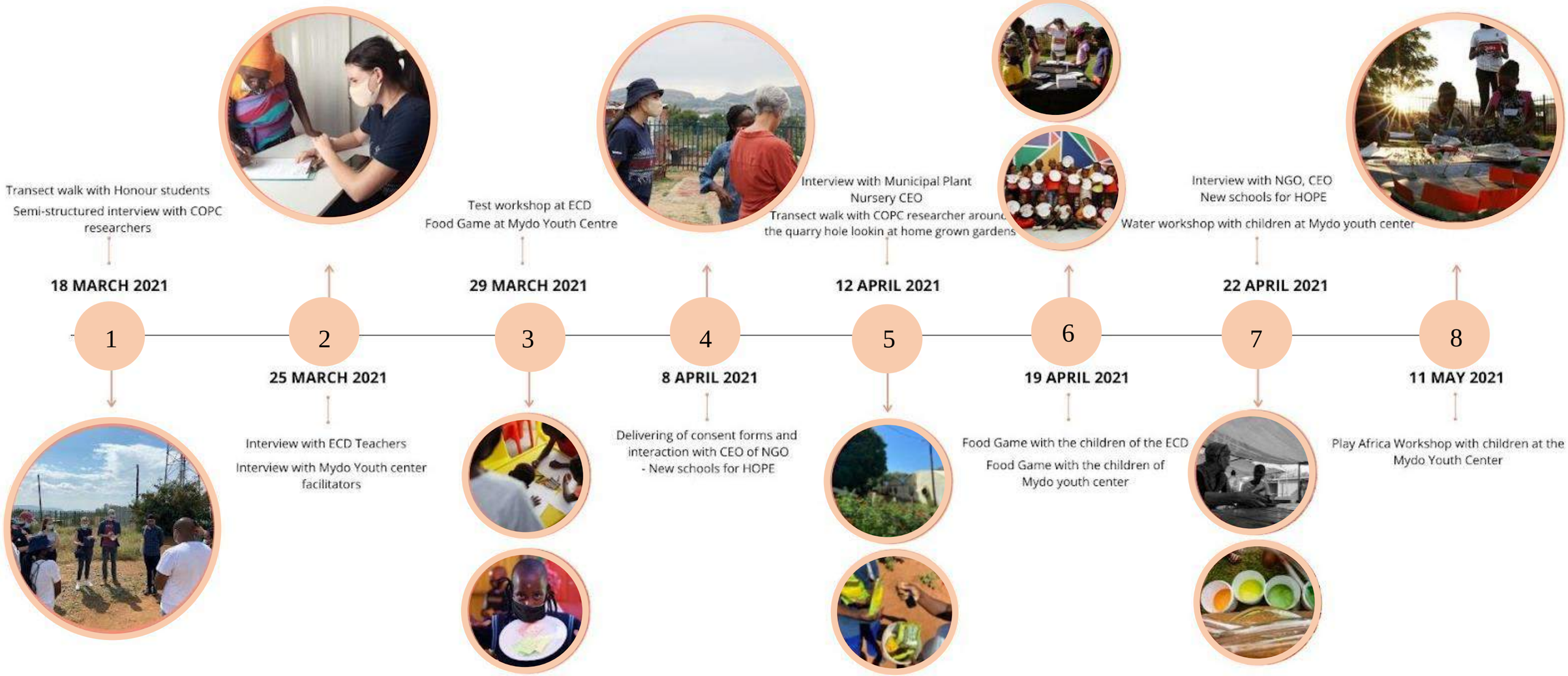


Figure 1.29: Illustrates the timeline and the community engagement the Reality Studio team conducted with the community (Zorn 2021).

CLIENT & USER

The Client of this project is the City of Tshwane and the Melusi community and the stakeholders identified is the following:

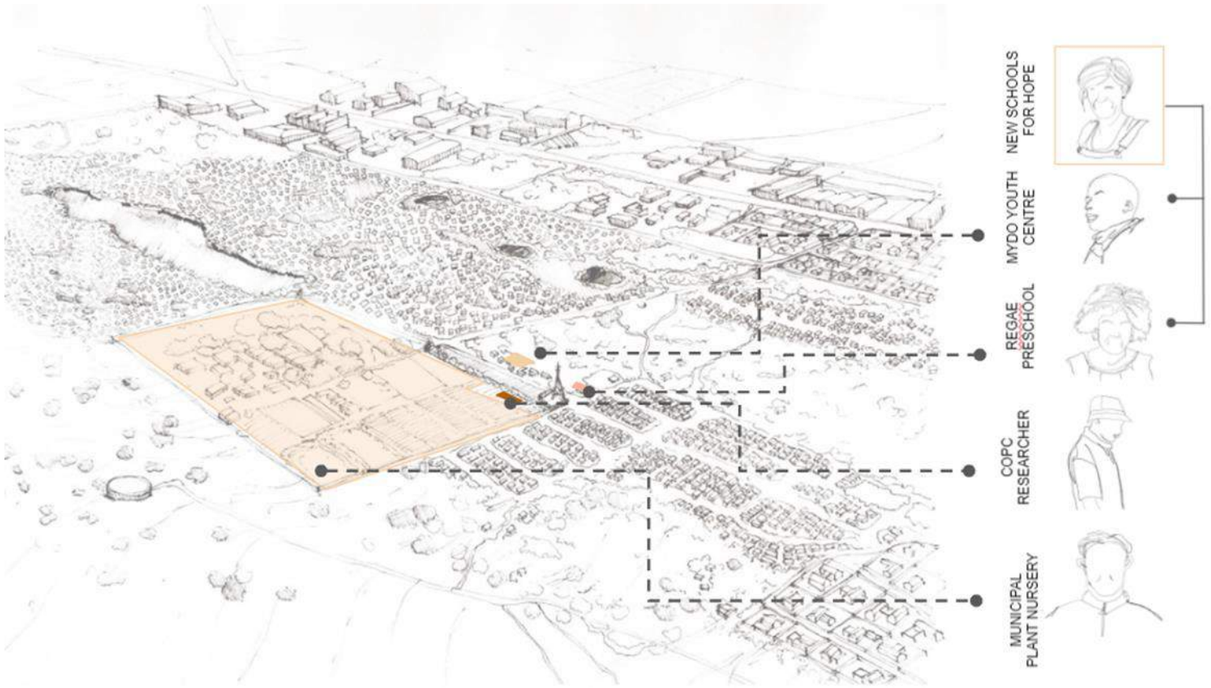


Figure 1.30: Illustrates the location of the stakeholders in Melusi (Climate adaptation studio 2020).

The Reality studio made use of the following methods to capture qualitative and quantitative data. The quantitative data were captured through transect walks where the group made use of photographs and Pic2Map to geolocate the photographs. The information was stored on a centralized Google drive. The team designed two games we played with the ECD- Regae preschool of Hope and the Mydo Youth Centre. The games were designed to be measurable to form part of the quantitative data collection. The qualitative data were captured through structured interviews and informal conversations with the stakeholders as in figure 1.31. The interviews were recorded and transcribed for analysis.

The educational system in Melusi is very well supported by multiple stakeholders outside of Melusi and saw this interface as a leverage point to gather information. We observed the need for a safe and healthy place for children to play.

The Reality Studio group worked with the Child perspective. Children are claimed to be the longest-term stakeholder in a community of society (Winters 2010:85) as well as sharing valuable information regarding their household conditions. It is important to include these vulnerable stakeholders in the design process because public space is for everyone especially for children (Danenberg et al 2018:20). Studies have shown that children are depending on healthy public space for emotional, cognitive, social, and physical development (Danenberg et al 2018:20).

> *"Children are the next generation who will face a range of global problems that our planet has never seen before. They will face immense challenges, eg, climate, population, migration. Therefore, the urge rises to prepare our children in becoming urban dwellers that are engaged and are encouraged with longevity to learn about and anticipate on external threats and challenges."- (Danrnberg et al 2018)*

Figure 1.31: Informal discussions with the children of the Mydo Youth Centre after a workshop have been completed (Zorn 2021).

Melusi Plate Game

Figure 1.32: Plate game workshop played with the children of the ECD in Melusi (Zorn 2021).

TWO GAMES PLAYED WITH CHILDREN IN MELUSI

MELUSI PLATE GAME

The Reality studio team realised that there is a nutrition problem in Melusi through the interviews with the teachers of the Regae ECD and the COPC health workers. The team worked with nutrition as a key theme and to investigate the household nutrition through the children. The games were developed to be suitable for both the ECD children (figure 1.33-1.34) and the Mydo youth centre (figure 1.35-1.36) children. It came to our attention that children from the ECD needed a lot more visual aid and a teacher's input to translate the exercise to the children.

ECD CHILDREN PLATE GAME

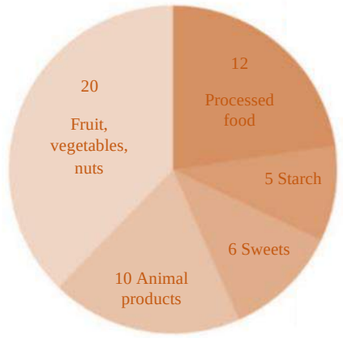
Figure 1.33-1.34: Melusi Plate game played with Regae Preschool of hope (Zorn 2021).

MYDO YOUTH CENTRE

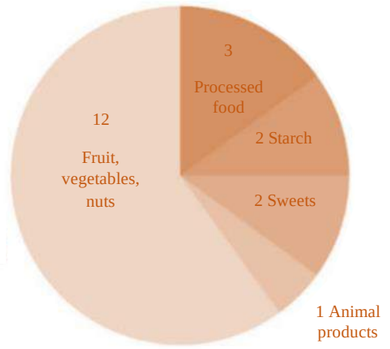
Figure 1.35-1.38: Melusi Plate game played with Mydo Youth Centre (Zorn 2021).

PLATE GAME RESULTS

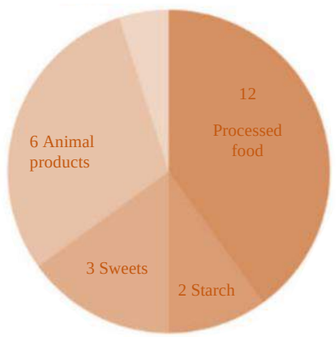
TOTAL GVEN FOOD



BOTTOM 20 FOOD



TOP 20 FOOD



TOTAL CHOSEN FOOD PER ITEM

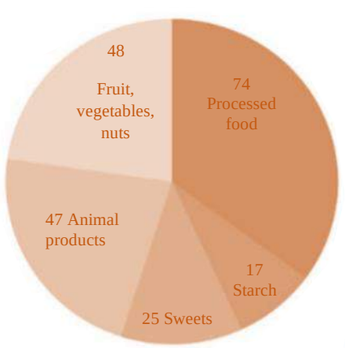


Figure 1.39: Findings of the plate game (Reality Studio 2021).

The results showed that the most popular foods were, processed foods as per figure 1.39. The reason for this is that the community members does not have fridges or freezers to keep fresh products. Most of the products consumed is can products (Reality Studio 2021).

**Please view Annexure B in conjunction with figure 1.39.*

Melusi Water Game

GAME

02

Figure 1.40: Illustrate the results of the Melusi water game (Zorn 2021).

MELUSI WATER GAME

Water is a very important resource in Melusi. Due to the information received in the interviews with the COPC researchers and the teachers it was evident that Melusi is dependent on Municipal water through refilling the JoJo tanks on site every day. Due to the limited safe water resources available on site the Reality Studio students tested the water knowledge of the children regarding water recycling for other purposes and how do they use water in their households. Due to the complexity of the concept “water recycling” the game was only suitable for older children and has only been conducted with the Mydo Youth Centre children.

Figure 1.41-1.43: Melusi water game played with the children of the Mydo Youth centre (Reality Studio 2021).

WATER GAME RESULTS

Figure 1.44: Drawings of water practises drawn by the children of the Mydo Youth Centre (Zorn 2021).

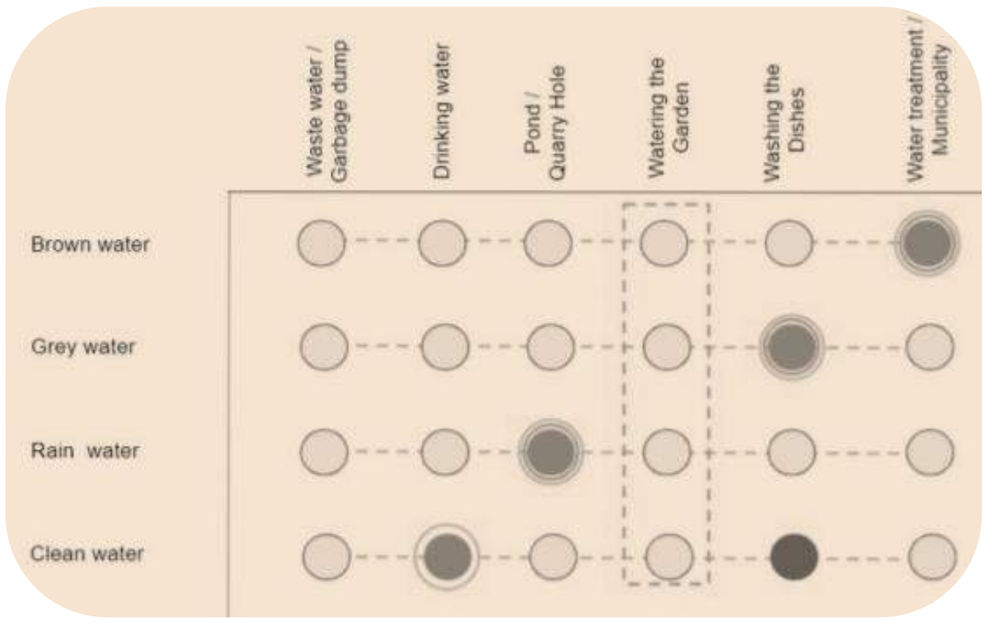


Figure 1.45: Findings of the Melusi Water game (Reality Studio 2021).

**Please view Annexure B in conjunction with figure 1.45.*

Play Africa Workshop

GAME

03

Figure 1.46: Play Africa Workshop with the Mydo Youth Centre and Co-design workshop (Zorn 2021).

DATA COLLECTION METHODOLOGY

Design Science

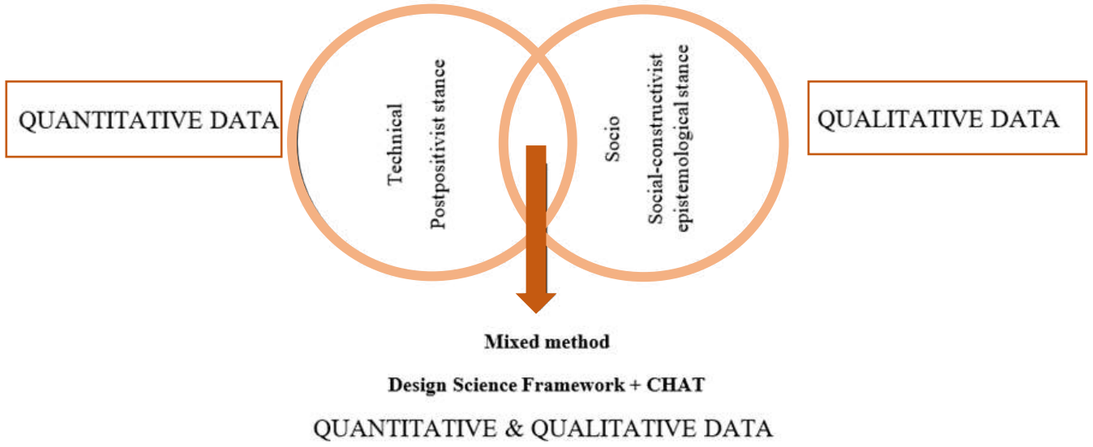


Figure 1.47: Author's understanding of Design Science framework (Author 2021).

A study done by Rana Aburamadan and Claudia Trillo (2020), suggests design science as a successful design method especially in complex socio-technical spaces. Design science is a user-centre design approach where professionals facilitate the design process through an iterative design cycle of data collection and analysis (Wieringa & Director 2013 ; Aburamadan &Trillo 2020:219). Design science process was used in the on-site workshops with the children focusing on the child's perspective that led to the design decisions made in the Reality Studio.

Due to the complexity and multi-layered nature of the site this project followed the Interpretivist paradigm which requires a holistic understanding of the environment, the circumstances, and vulnerabilities. These objectives can only be met with onsite informal interviews and focus groups with community stakeholders (Combrink 2015, Kivunja & Kuyini 2017). The Axiology of this study is subjective, and the data collection method is qualitative (Kivunja & Kuyini 2017).

CO-DESIGN WORKSHOP WITH PLAY AFRICA

After the games we played with the children the Reality Studio conducted a co-design workshop with the Mydo Youth centre students. The workshop was structured according to the design thinking method going through the phases of EMPATHIZE-DEFINE-IDEATE-PROTOTYPE-TEST-SHARE.

*Please view Annexure B in conjunction with figures 1.48-1.52.

PLAY AFRICA WORKSHOP

Figure 1.48-1.52: Play Africa Co-design workshop using the design thinking method (Zorn 2021).

PROBLEMS IDENTIFIED ON SITE

By analysing the qualitative and quantitative data collected on site the following problems were identified

01 Nutrition Especially Protein

02 Lack of safe and healthy public space

03 Ignored and isolated quarry hole

04 Lack of basic human needs sanitation (Dignity)

05 Isolation of Melusi with surrounding ccommunity

06 Low income and poverty

07 Health and physical hazard of the quarry hole

08 Community dependence on External resources

Figure 1.53: Main problems identified after the qualitative and quantitative date have been analysed (Author 2021).

PROJECT INTENTIONS

The project intentions listed on a scale from socio to ecological needs.

HUMAN | SOCIO

- Community independence from external resources.
- Supply Melusi's with basic human needs.
- Provide healthy and safe public space and the freedom to interact, socialize and play. To make the edges of the quarry hole safer.
- Add to the local economy providing work opportunities to sustain themselves.
- Challenge the perspective of the current quarry hole as being a hazardous place to a resourceful space in a sensitive manner.
- Re-appropriate the post-industrial quarry hole, adding value to the previously abandoned site and scarred landscape.

ENVIRONMENT | ECOLOGICAL

RESEARCH QUESTIONS

How can catalytic architecture mediate the socio and ecological needs of a complex landscape towards community independence and self-efficiency in a vulnerable community?

PROPOSED RESPONSE

RESOURCE INTEGRATION

[catalytic nexus mediator between the socio and ecological complexity]

Piet Vosloo (2018) identified the following aspects which could be used as a criterion to design a ‘New wilderness’ in an urban environment namely: aesthetic qualities, ecological benefits, and economic benefits. These aspects have a positive physical and psychological effect on human health and wellness. (Vosloo 2018). We can no longer think of land as a resource to be used for only one purpose, and because of our rapid urbanization, we must think of our open spaces as multifunctional (Bradshaw and Chadwick 1980:282-283).

According to Piet Vosloo (2018:44), post-industrial and abandoned quarry holes in urban areas are well suited to be transformed into open green public spaces. There is a need for public spaces in the urban context to foster a harmonious co-existence between humans and the environment in informal contexts (Vosloo 2018:44).

“*Provisions for leisure for the quality of life are as important as those for health and education.*”

- (Vosloo 2018:44)

The National Environmental Act 107 of 1998 states: “Everyone has the right to have the environment protected for the benefit of present and future generations.” (Burmeister 2014:2-3). Municipalities should intervene by supplying vulnerable communities with tools and resources to enable themselves through catalytic public spaces which create bridges (nexus) with the surrounding privileged suburbs.

Melusi community members do not have an interactive and positive relationship with the quarry and the wetland. These natural resources are currently in isolation or neglected dumping sites as the current practices are in dealing with quarries in vulnerable communities, even though this is illegal in terms of Section 26 of the NEMA Waste Act and results in more dangerous sites in terms of health and well-being (Vosloo 2018).

According to Karina Landman (2018:2), rapid urbanization not only surfaces many challenges but also opens opportunities for adaptation. Organic urbanization increases the pressure on city councils and municipalities to provide more services to all inhabitants. The pressure of supplying services influences the natural resources available negatively. Humanity is constantly confronted with this social and ecological imbalance which is detrimental to our landscapes- Socio needs before ecological needs. This mini dissertation aims to challenge this imbalance. *Invention’s ecology* advocated by Turner (1994:360) suggests to not only conserve natural resources but also natural ecosystems in the process towards restoration of a landscape. Resilience thinking is crucial in solving complex problems as it could integrate complex systems and contextual relationships in a single dynamic system-based approach (Peres 2015).

This mini dissertation will investigate the possibility for post-industrial landscapes to be transformed into valuable resources for vulnerable communities. These vacant and abandoned sites within our urban landscapes make excellent sites for legal informal settlements to exist with the support of the government to plan for informality as Kirkwood (2011:xiv) stated that these vacant land can be reintegrated through design to meet the needs of the surrounding communities in terms of food security, basic services and social inequality (Burnmeister 2014:2-3). The existing quarry hole in the community poses huge opportunities for the community concerning resources. Due to the opportunities the quarry hole poses, the site is considered a possible site for intervention.

The following theories and themes will inform the manifestation of the intervention:

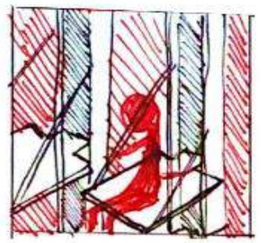
BIOPHILIC DESIGN PRINCIPLES

To achieve interactive architectural interventions, it is hypothesized that one will have to apply biophilic architectural principles to develop innovative and holistic thinking styles to develop problem-solving skills (Abdelaal & Soebarto, 2018). There exists disconnectedness (Lemmens & Zwart, 2004) to our natural environment that entails multiple detrimental effects on human health and wellbeing (Kaplan, 1995). Biophilic architecture intends to repair the reciprocity of man’s relationship with the natural environment, which is crucial for optimal human function and self-actualization (Bouberki, 2008). Biophilic design is necessary for the manifestation of the *Catalytic Nexus* where the architecture will act as the mediator between addressing the socio and ecological needs. Another informant that led to biophilic principles is the visible and invisible perceptions and actions towards the quarry hole. The adults implemented the story and safety measures of the mythical creature living in the quarry which should be respected in the design. *Prospect and Refuge,* a biophilic design principle will be used to inform the manifestation of spaces, contesting the individual towards the water but also creating spaces of refuge and safety as illustrated in figures 1.54-1.55 (Dosen & Ostwald 2013).

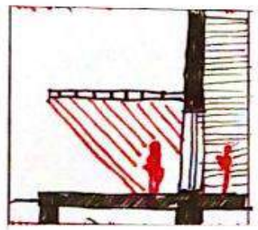
01 REFUGE - SPATIAL MANIFESTATION

Withdrawn fireplace

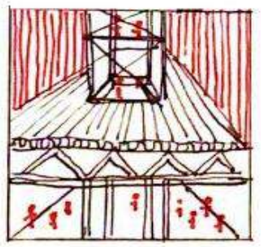
Low ceilings



Built-in seating and cabinetwork



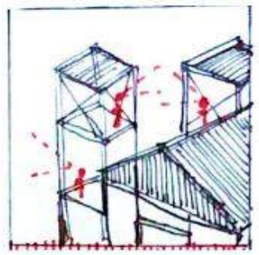
Deep overhanging eaves



Evident central chimney

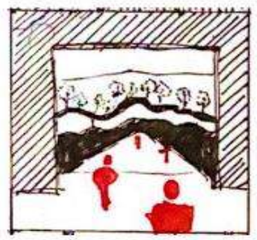
Figure 1.54: Biophilic design principle of refuge illustrated spatially (Author 2021).

02 PROSPECT - SPATIAL MANIFESTATION



Major spaces elevated

Ceiling sweeping upwards into roof

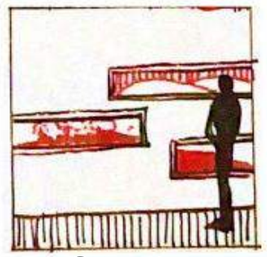


Interior views to contiguous spaces

Glass and glazed door

Generous elevated terrace

Deep overhangs



Connection to exterior and interior

Figure 1.55: Biophilic design principle of prospect illustrated spatially (Author 2021).

RESILIENCE THINKING

"A resilience-based approach focusses on learning how to respond, adapt to, and evolve with change and surprise, while avoiding changes that would move local and global socio-ecological systems closer. to tipping points that would threaten life-supporting and life-enhancing. capacity of these systems"- (du Plessis 2012:17)

Resilience thinking has the potential to break away from the existing linear thinking method towards public space adaptation to evolve into thriving socio-ecological systems. The main constraint experienced by the Government is to intervene in informal settlements and not be financially obligated to sustain these interventions. This is evident in Melusi where the community is dependent on the municipality to fill their JoJo water tanks. This project will strive to find design solutions ensuring individuals and living spaces of continual growth and independence after practical completion (Jack 2014) and simultaneously improving the social and environmental needs of the landscape.

Chapter one identified the problems and introduced the proposed framework to use in complex landscapes. The second chapter will focus on a precedent study testing the proposed framework as well as how the problems identified on site translates into programs (catalyst) and systems (nexus) towards a holistic intervention towards co-existence, self-efficiency, and community independence.

CHAPTER

02

SITE ANALYSIS

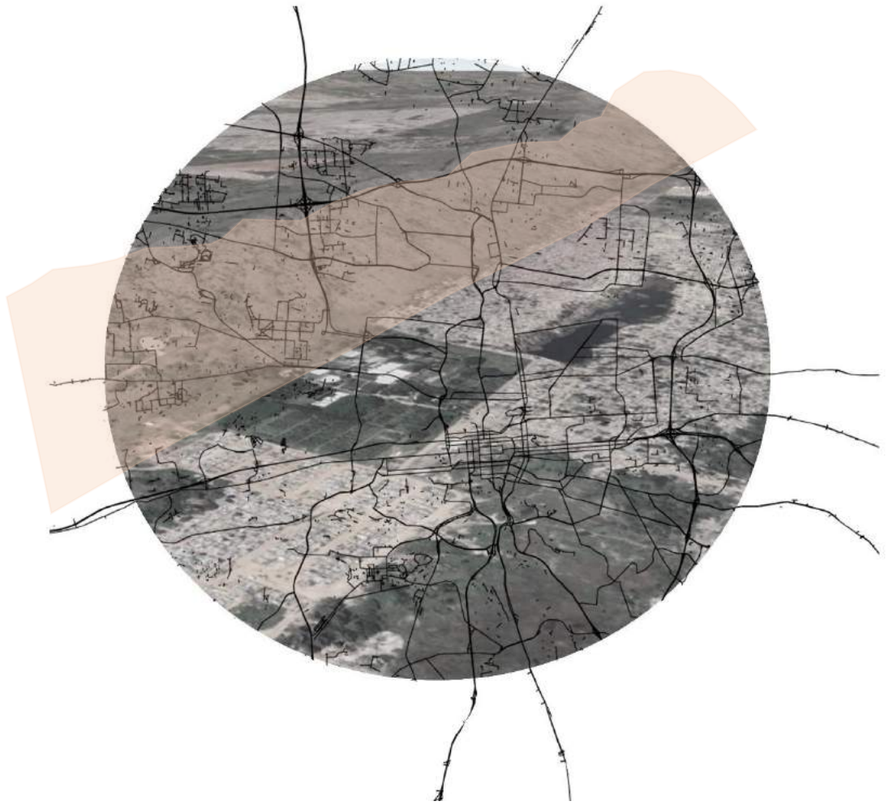


Figure 2.1: Macro site analysis of Melusi and the surrounding environment (Author 2021).

A Urban Analysis

B Daspoort climate

C Site selection of intervention

D Program selection

E Precedent studies

F Analogy

A

URBAN ANALYSIS

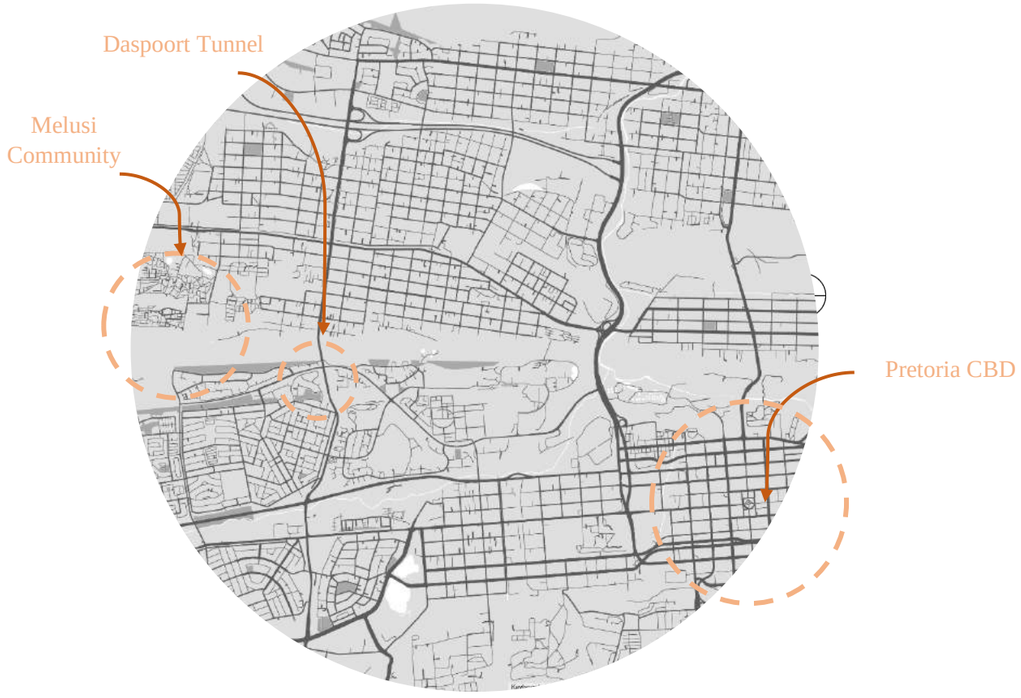


Figure 2.2: Melusi Settlement in relationship with Pretoria CBD (Author 2021).

MELUSI INFORMAL SETTLEMENT IN RELATION TO SURROUNDING INFORMAL SETTLEMENTS

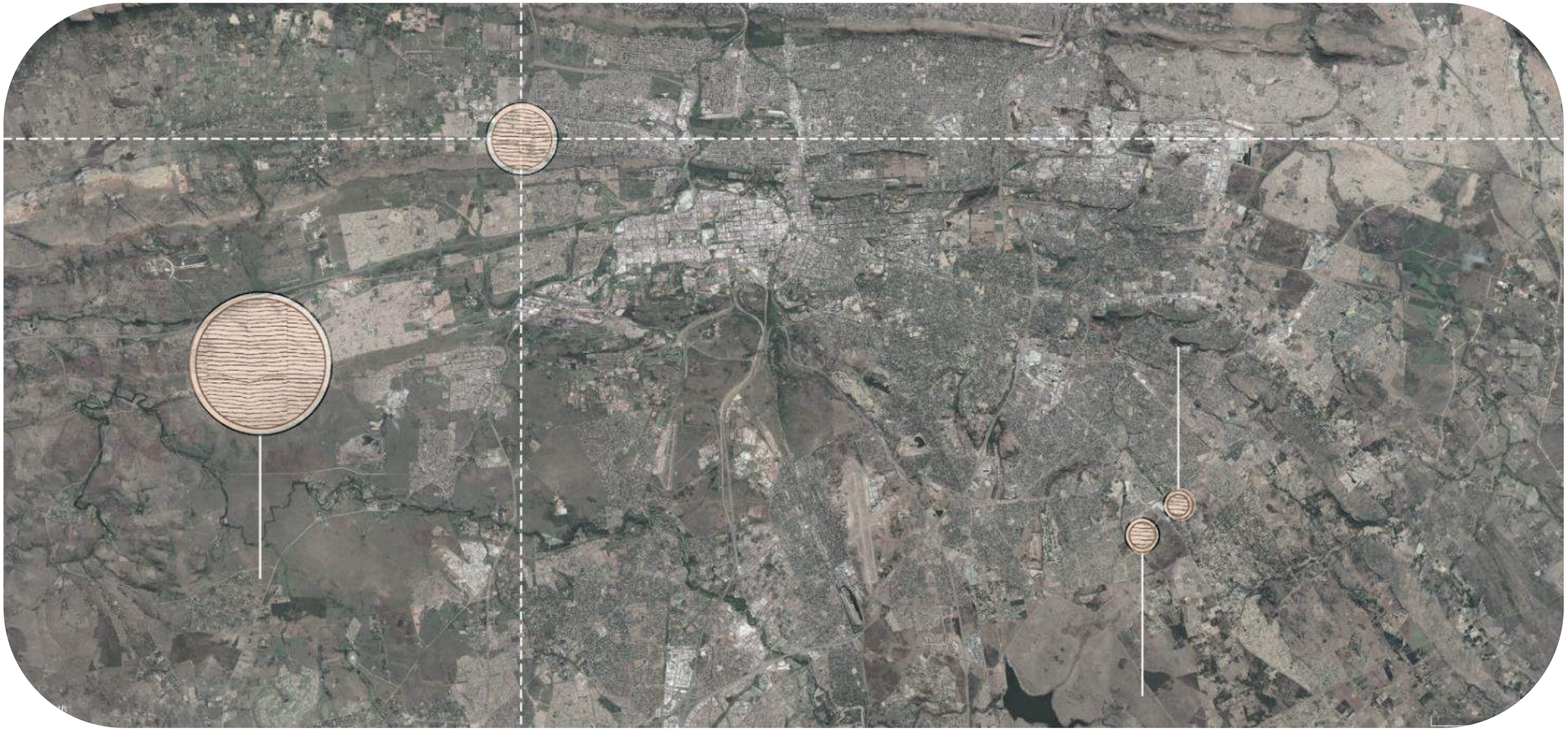


Figure 2.3: Broader Context of Melusi. Original Orthophoto obtained from Google Earth (Climate adaptation Studio 2020).

Figure 2.4: Illustrates the land ownership of which Melusi informal settlement is situated on (Author 2021).

The City of Tshwane GIS platform indicated plans for future development and infrastructure. Image 2.4 indicates the future infrastructure plans for the Zandfontein 317 farm. The proposal is to implement a western highway bypass west of the big quarry hole in Melusi see figure 2.5. This western bypass will require a tunnel through the Skurweberg ridge. The Author superimposed the Melusi Nolli map with the Tshwane GIS map to visualize the physical spatial implication of the proposed roads on the residents. The author has some critique regarding the realization of the future.

Figure 2.5: Google Earth Map illustrating the future proposed roads and the proposed western bypass as per Tshwane GIS (Author 2021).

Critique 1: The financial implication of building a western bypass highway together with a tunnel is financially an excessively big burden on the municipality especially in the current time of the Covid-19 pandemic.

Critique 2: City of Tshwane is formalizing Melusi 2 through supplying services and electricity to the community where the proposed routes are indicated.

In conclusion, it is visible that the community is formalizing because of all the Municipal interventions and formalization such as services and Erf layout which are taking place and therefore the proposed intervention (public space) is appropriate to add value to the community.

MELUSI SITE ANALYSIS

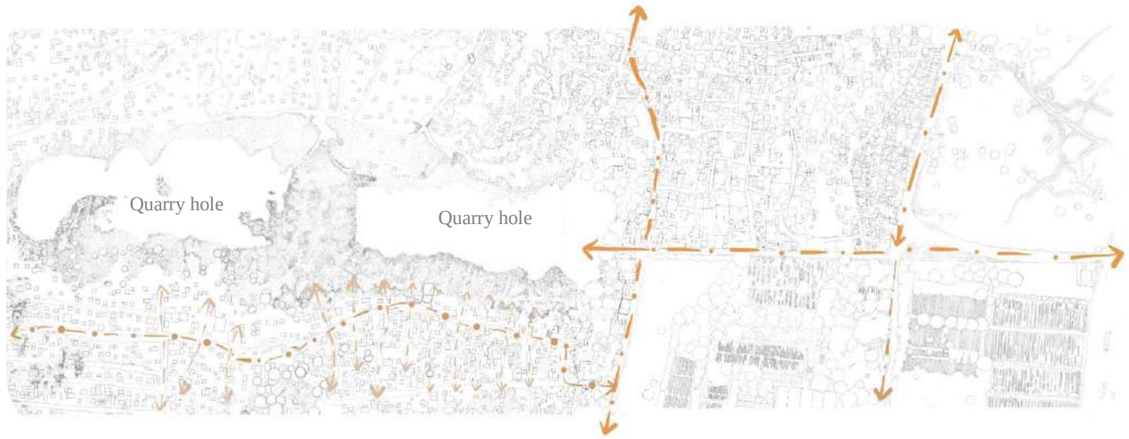


Figure 2.6: Main access roads (Author 2021).

Main access roads

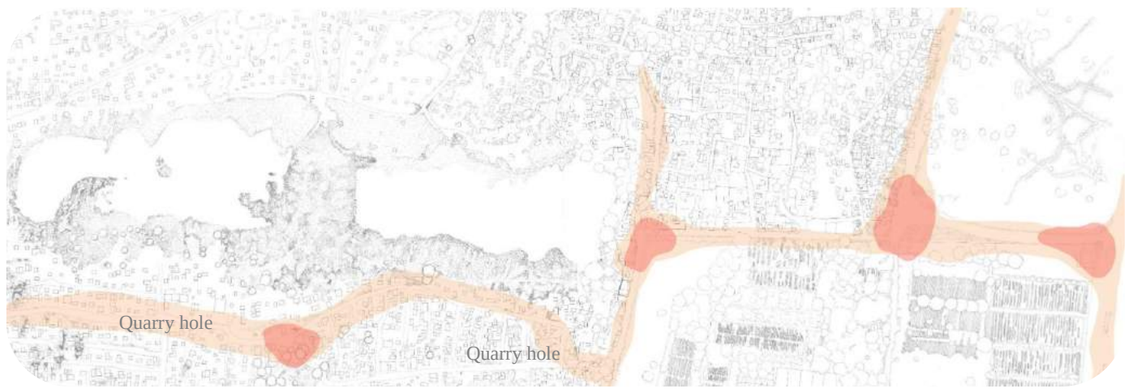


Figure 2.7: Busy intersections and main access roads (Author 2021).

Busy streets

Busy intersections

MELUSI SITE ANALYSIS

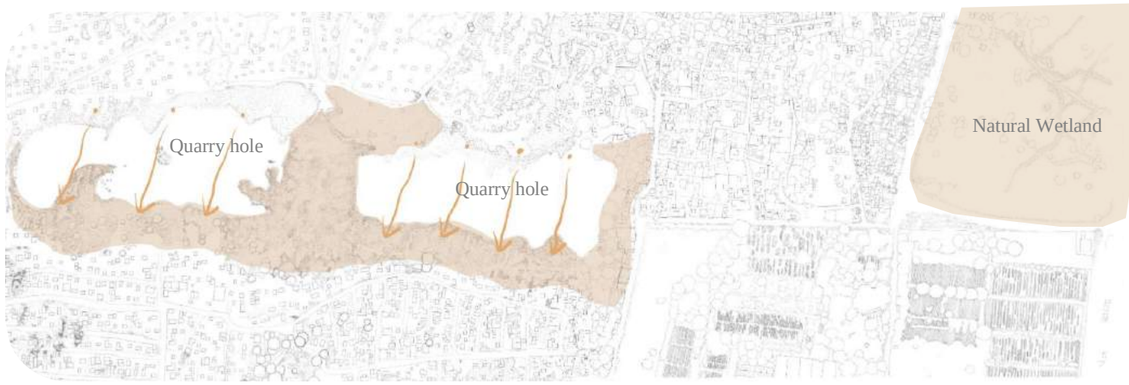


Figure 2.8: Open available public space (Author 2021).

Current available public space

North facing slope

Figure 2.9: Developing landscapes vs developed landscapes (Author 2021).

Residential

Municipal land

MELUSI SITE ANALYSIS

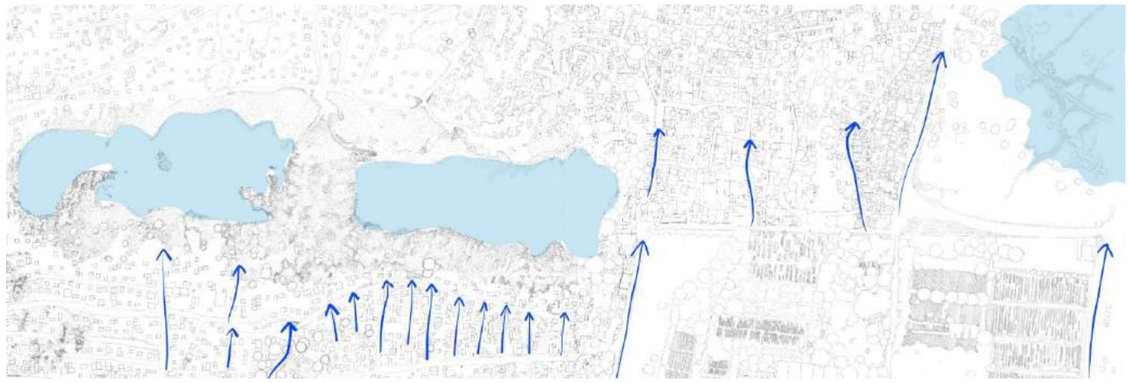


Figure 2.10: Water bodies and water run off (Author 2021).

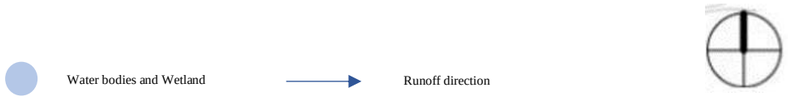


Figure 2.11-2.12: Google Earth image illustrating the Skurweberg on the Southern side of the settlement therefore the site slopes towards North (Author 2021).

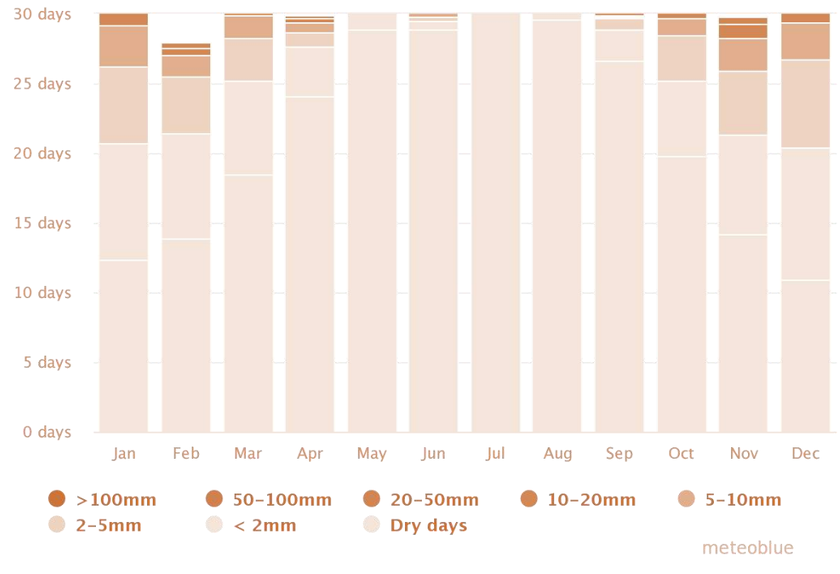


Figure 2.13: Daspoort's average precipitation (Meteoblue 2021).

B

DASPOORT CLIMATE

Figure 2.14: Melusi is situaged between Magalies ridges (Zorn 2021).

DASPOORT CLIMATE

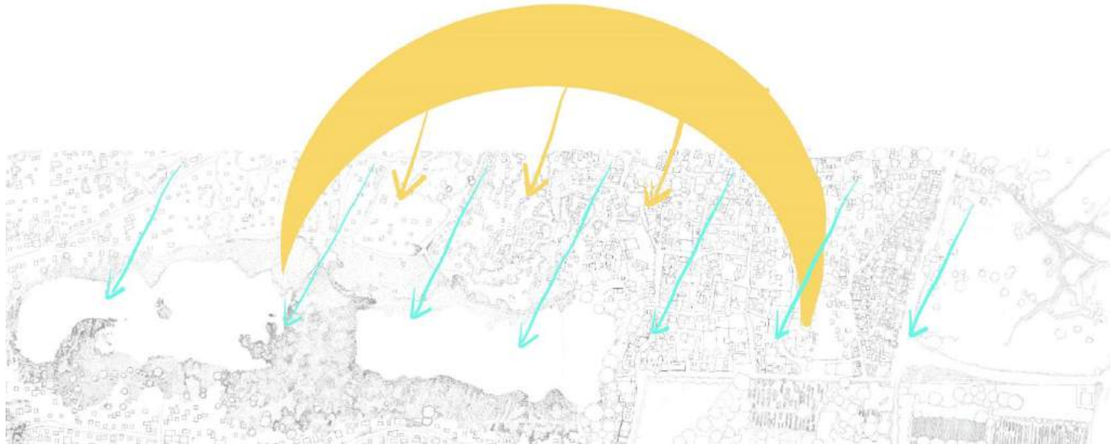


Figure 2.15: Wind direction and solar angel (Author 2021).

Solar Angle

Wind Angle

Daspoort is situated north-west from Pretoria CBD. Pretoria's temperature is classified for being warm (Climate-Data.org nd). According to the Köppen-Geiger climate classification map of 1980-2016 Pretoria is classified as a Cwa climate which is a Monsoon-influenced humid subtropical climate. Pretoria's average annual temperature is 18°C with an average precipitation of 661 mm per year (Climate-Data.org nd). The Subtropical climate of Pretoria with its warm temperatures, dry winters and warm summers is the perfect opportunity to implement an aquaponic farm as a program. Aquaponic farms have a low evaporation rate which is more water effective, especially in dry winters in Pretoria. Pretoria's winter temperatures do not reach temperatures under 0 degrees Celsius and therefore makes it possible to have a fish farm, such as an aquaponic farm. See figure 2.17.

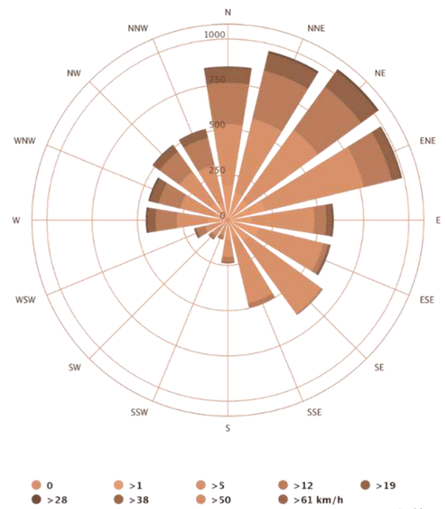


Figure 2.16: Daspoort's wind rose (Meteoblue 2021).

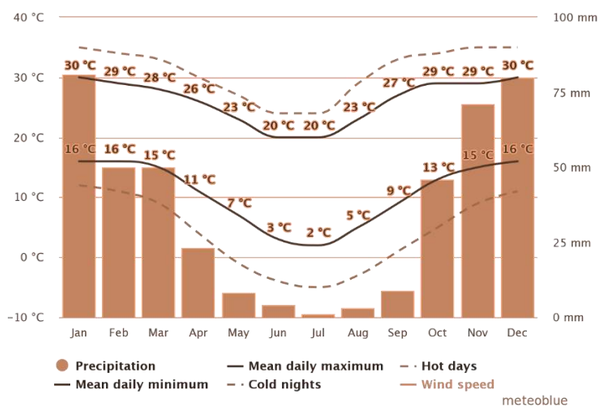


Figure 2.17: Daspoort's average temperatures throughout the year (Meteoblue 2021).

C

SITE SELECTION OF INTERVENTION

Figure 2.18: Chosen site situated on the southern edge of the quarry (Author 2021)

SITE SELECTION OF INTERVENTION

The Melusi field team developed an urban framework in collaboration with the Swedish students from Reality Studio, which will be implemented in multiple phases as proposed by Nabeel Hamdi (2010) as *Now-Soon* and *Later* interventions.

These phases will be discussed further in chapter 3. Visible in figure 2.19 is the phases indicated in the sequence it would be implemented. The first phase will be implemented in the street with all the active stakeholders.

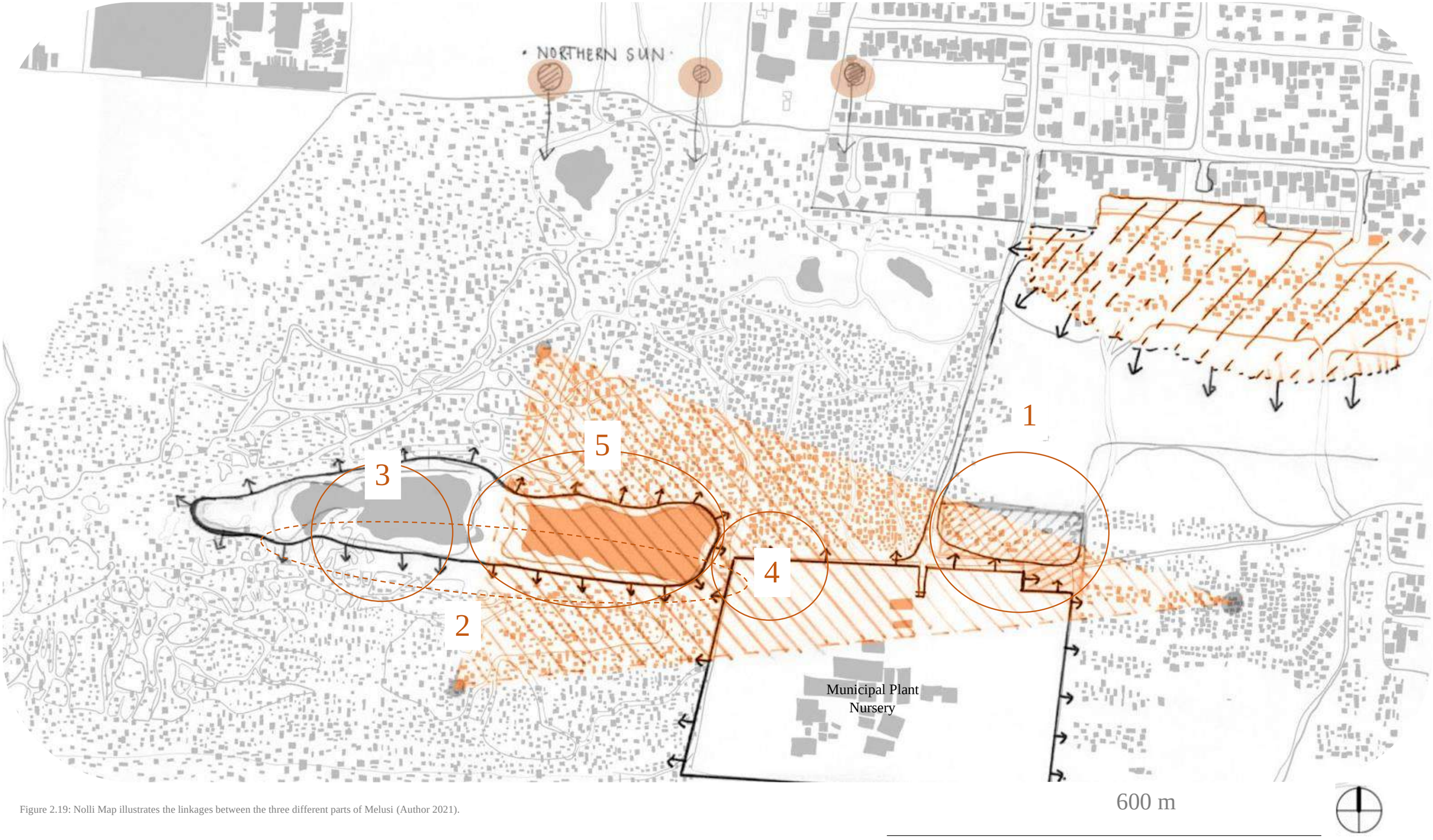


Figure 2.19: Nolli Map illustrates the linkages between the three different parts of Melusi (Author 2021).

Figure 2.20: Illustrates the main access in Melusi with the strong East-West access and a strong North-East access (Author 2021).

The ideal practice would be to create a strange attractor (catalyst) in the community on the east-west side of the community to create a possible connection between the two major strange attractors in the community, which is the Mydo Youth Centre and the ECD. This results in the opportunity for strange attractors to be linked through further development.

This mini dissertation will intervene on the southern edge of the quarry hole as well as bridging over the quarry using the existing island, separating the big quarry into two parts A and B in figure 2.20.

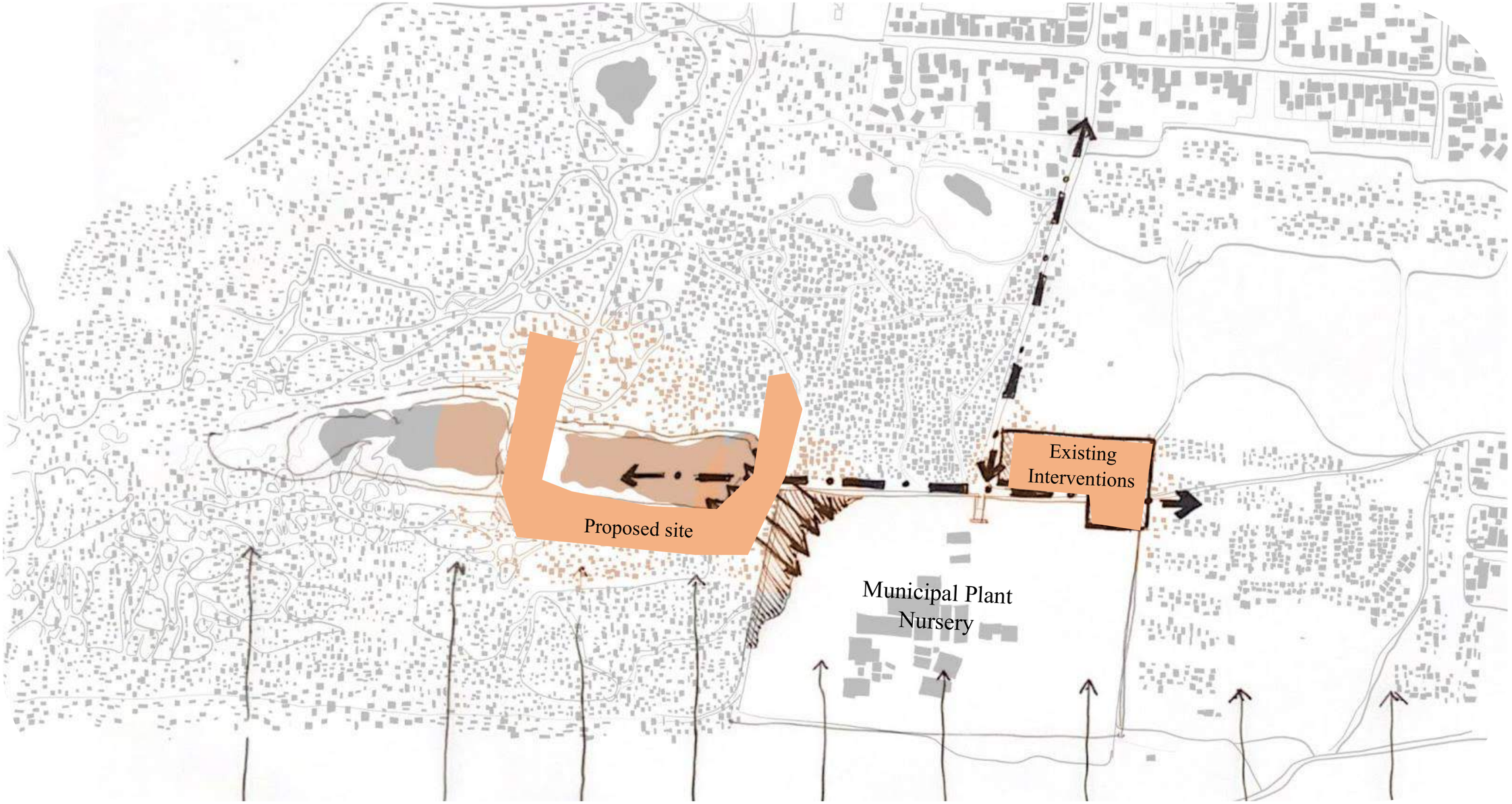


Figure 2.21: Illustrates the existing interventions currently implemented on the North-East side of the community (Author 2021).

D

PROGRAM SELECTION

Figure 2.22: Melusi water services are lacking and dependant on Municipal resources (Hugo 2020).

MAPPING THAT LED TO SPECIFIC PROGRAM DEVELOPMENT

Melusi consist out of three parts. Melusi one, two and three, as seen in figure 2.24. Poor sanitation and poor service deliver has been the most evident challenge identified. From transect walks and interviews led to the realization that alternative sanitation methods are currently used such as pit toilets, buckets, and chemical toilets. Figure 2.23 & 2.24 should be read in conjunction with each other.

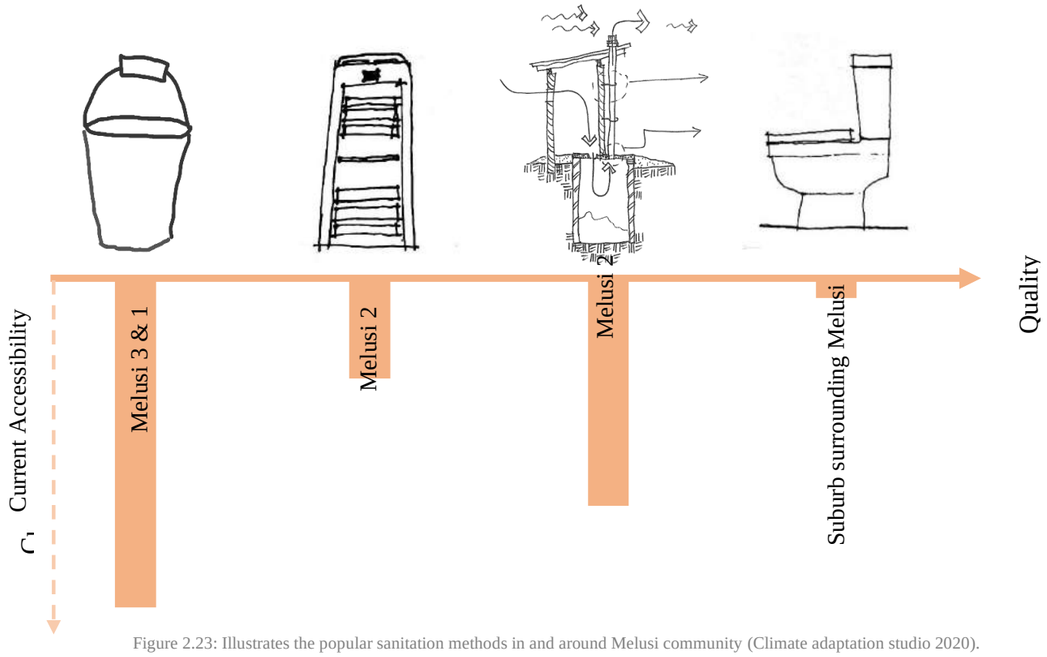


Figure 2.23: Illustrates the popular sanitation methods in and around Melusi community (Climate adaptation studio 2020).

Figure 2.24: Original Orthophoto obtained from Google Earth illustrates the three different parts of Melusi informal settlement (Climate adaptation studio 2020).

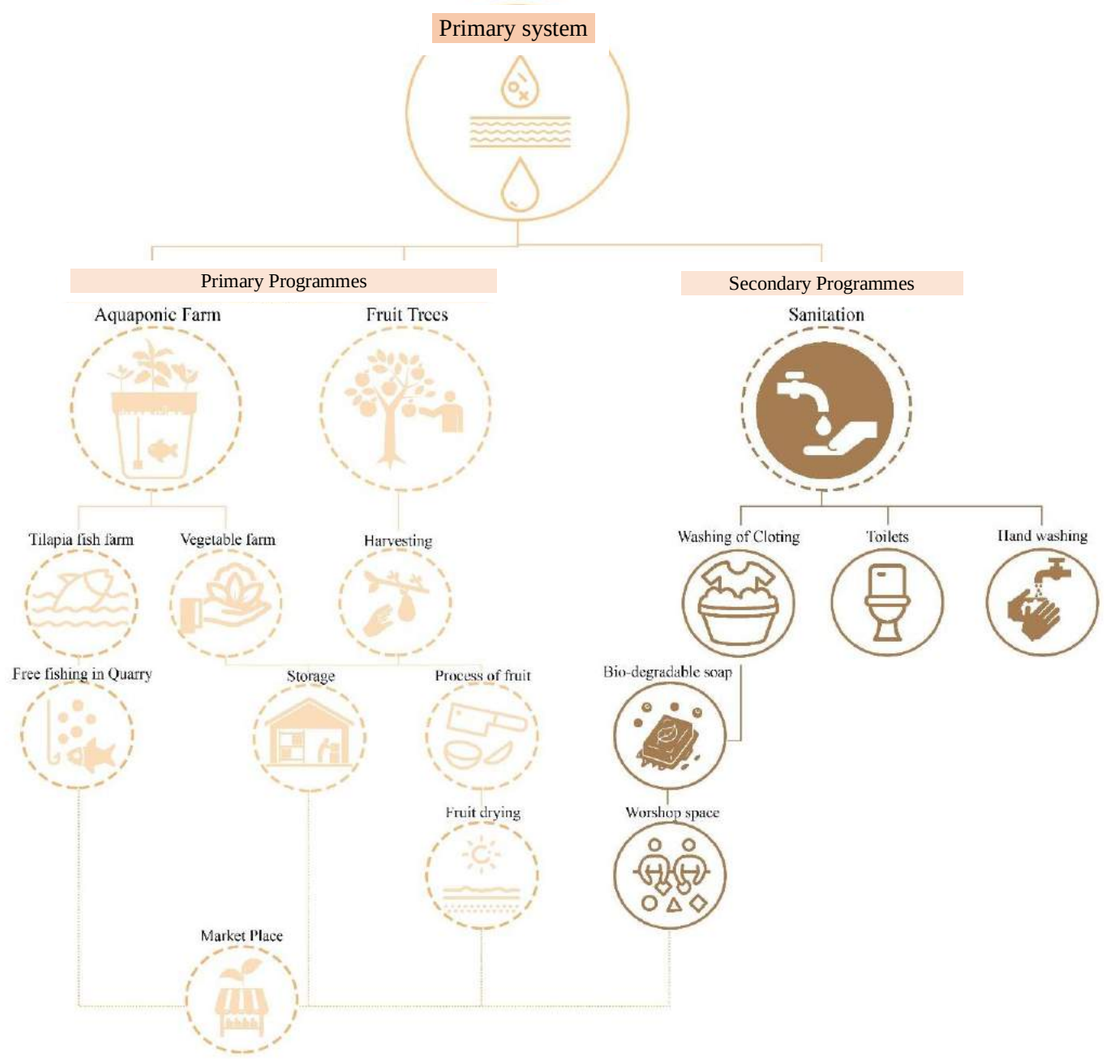


Figure 2.25: Illustration of the programs identified to be implemented in the intervention (Author 2021).

The primary system is identified to be the water filtration system. One of the main project objectives is to make the Melusi community more independent and self-sustaining, reducing Municipal resources. This program will put some relief on the municipal resources.

Primary programs are the Aquaponic system producing vegetables to the community through a rent a plot system where the community pays a monthly fee to use the facilities to farm their own vegetables to reduce travelling costs to Marabastad. This is especially problematic during the Covid-19 pandemic where public transport is a health risk.

The architecture will allow the community to also do informal fishing and use the fish from the aquaponic system as a source of protein which were identified through on-site interviews with teachers or the ECD and through the Melusi Plate Game it became evident that the children do not take in sufficient protein. The second secondary program will be the community fruit tree initiative which is open for all community members to eat and use the fruits produced reducing hunger in the community. The third secondary program will be basic sanitation, and water infrastructure improving community dignity and self-respect.

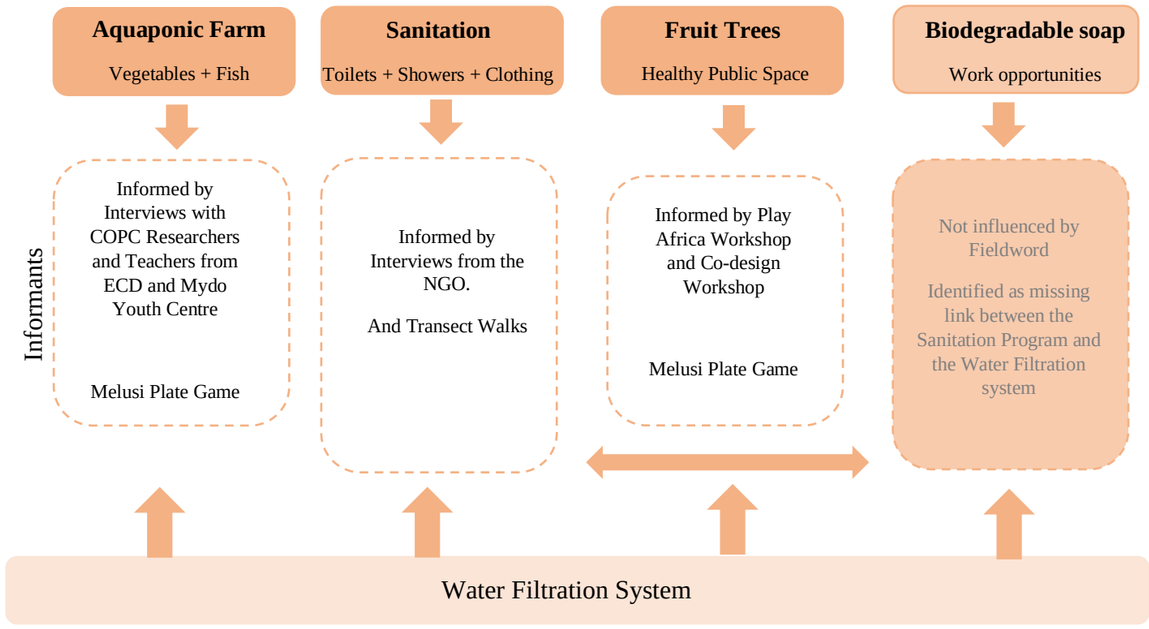


Figure 2.26: Diagram illustrate the informants led to the specific programs chosen (Author 2021).

E

PROGRAM SYSTEMS

Figure 2.27: Selected programs (Author 2021).

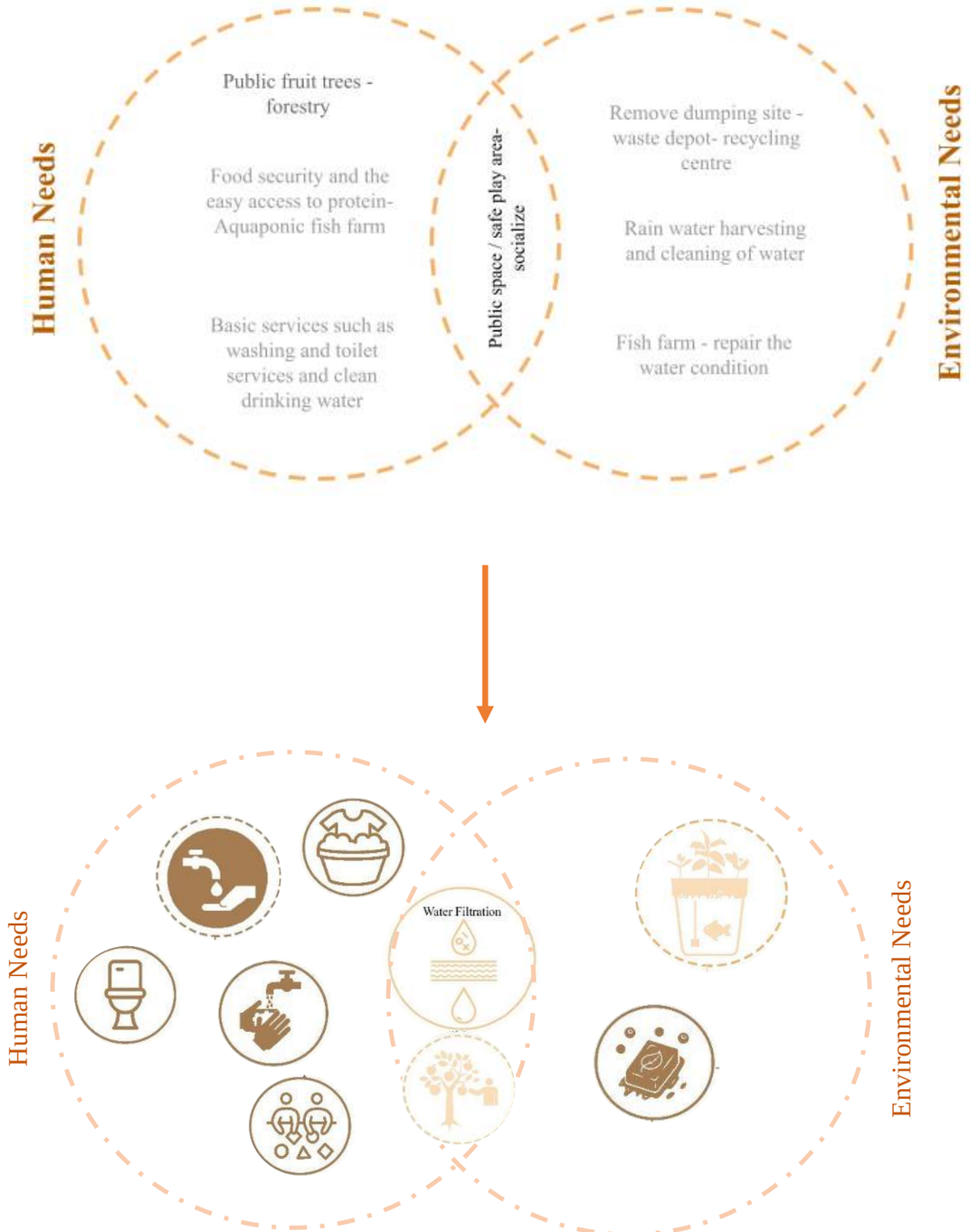
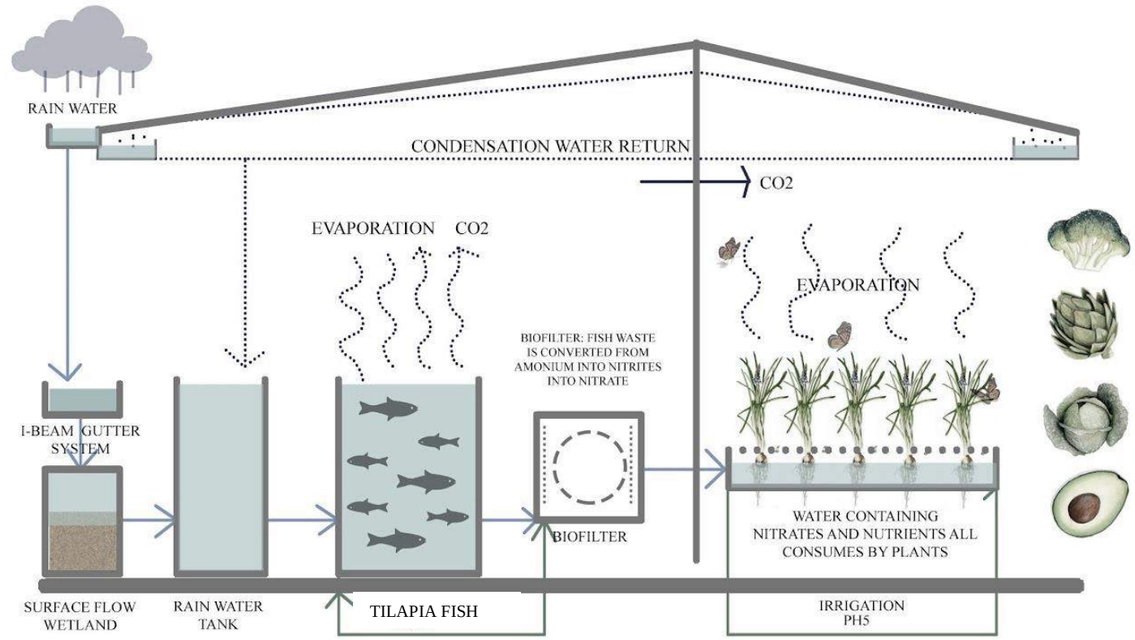


Figure 2.28: Diagram illustrates the programs chosen and how the programs address the socio and environmental needs (Author 2021).

PRIMARY PROGRAM

Aquaponic Farm

Figure 2.29: Aquaponic farm at Karoo Kafee in Pretoria and the produce for sale (Author 2021).



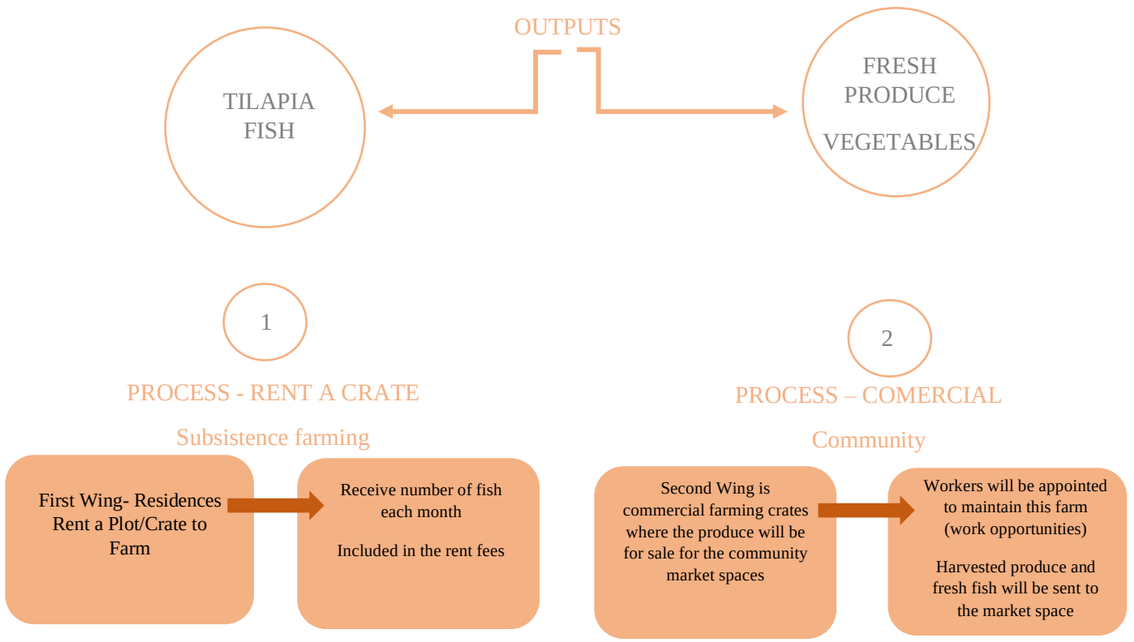


Figure 2.30: Aquaponic farm system (Author 2021).

PRIMARY PROGRAM

Public space and Fruit Trees

Figure 2.31: Fruit trees (Author 2021).

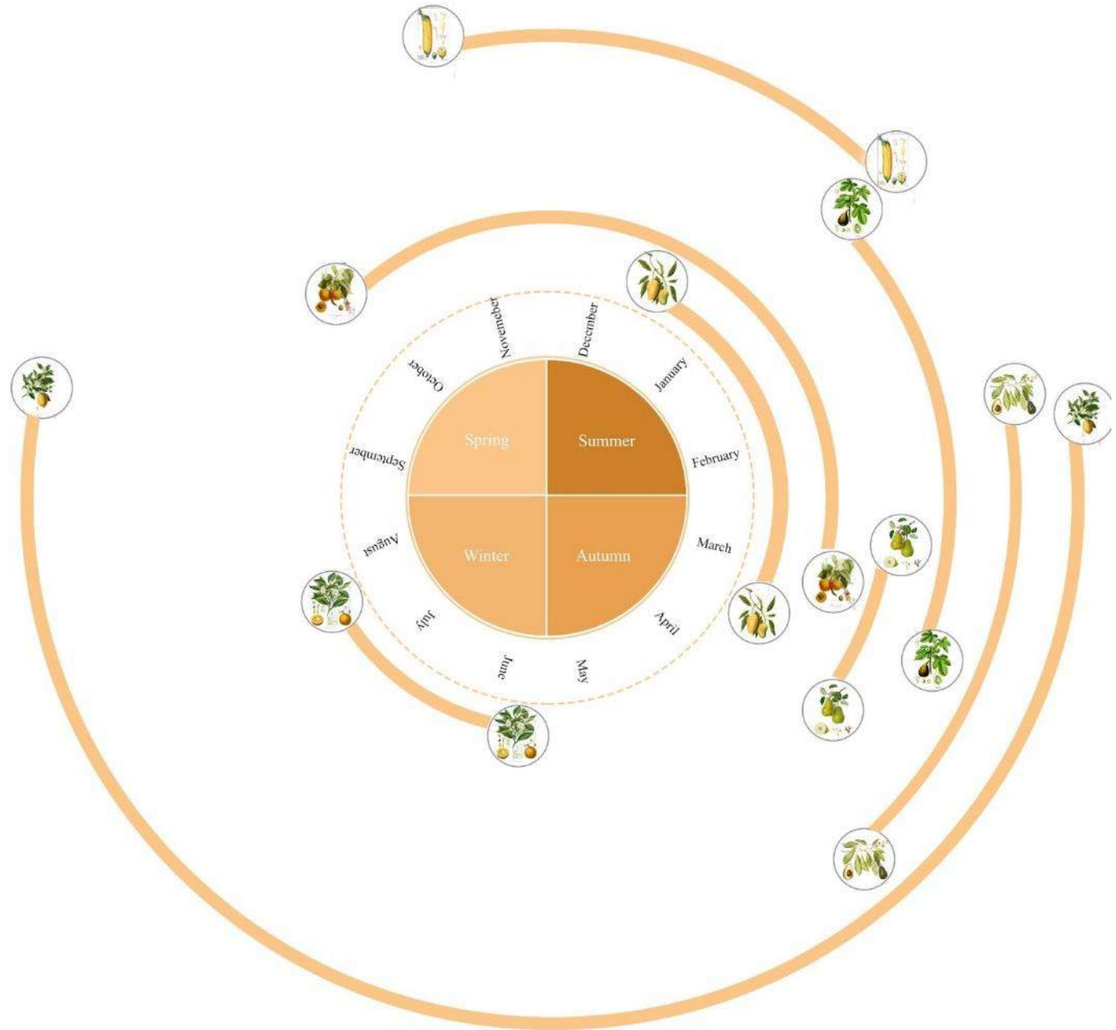


Figure 2.32: Diagram illustrates the different fruit trees and the harvesting season (Author 2021).

SECONDARY PROGRAM

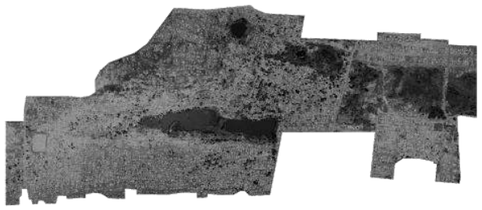
Sanitation, Laundry Facility and Biodegradable soap factory

1
Sanitation Facility

2
Laundry Facility

3
Biodegradable Soap Factory

Figure 2.33: Secondary programs (Author 2021).



1 710 000 m²

9240 Units

185 m²

= 26 813

= 9 240

2.9 / Unit

Figure 2.34: Melusi area and household size (Climate Adaptation Studio 2020).

SANITATION FACILITIES

Only Biodegradable soap will be used in the facility

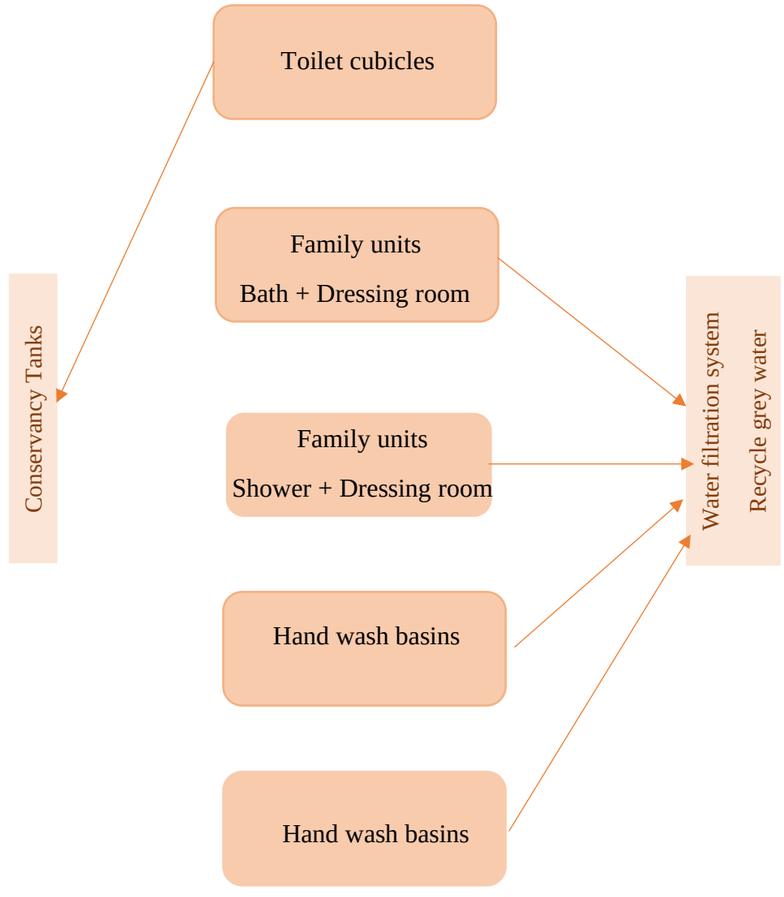


Figure 2.35: Sanitation facilities and how it functions (Author 2021).

LAUNDRY FACILITY

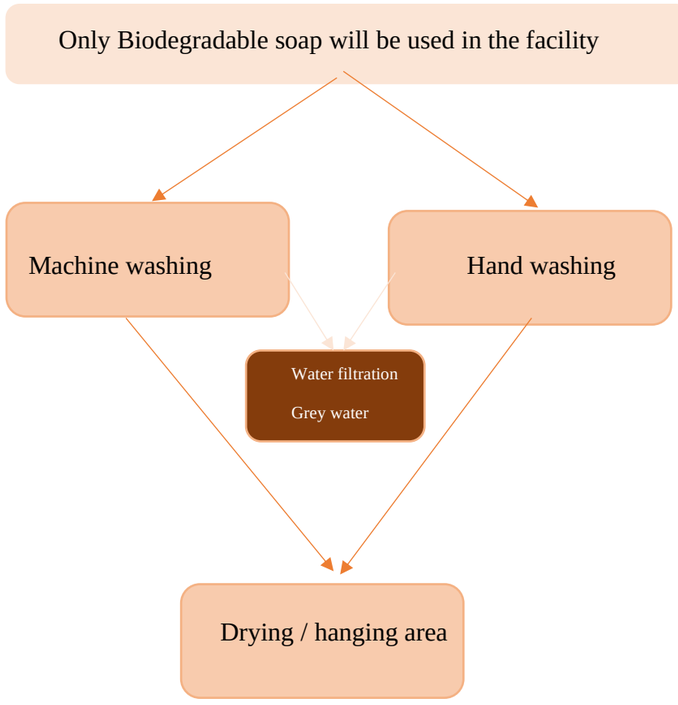


Figure 2.36: Laundry facility process (Auntor 2021).

BIODEGRADABLE SOAP FACTORY

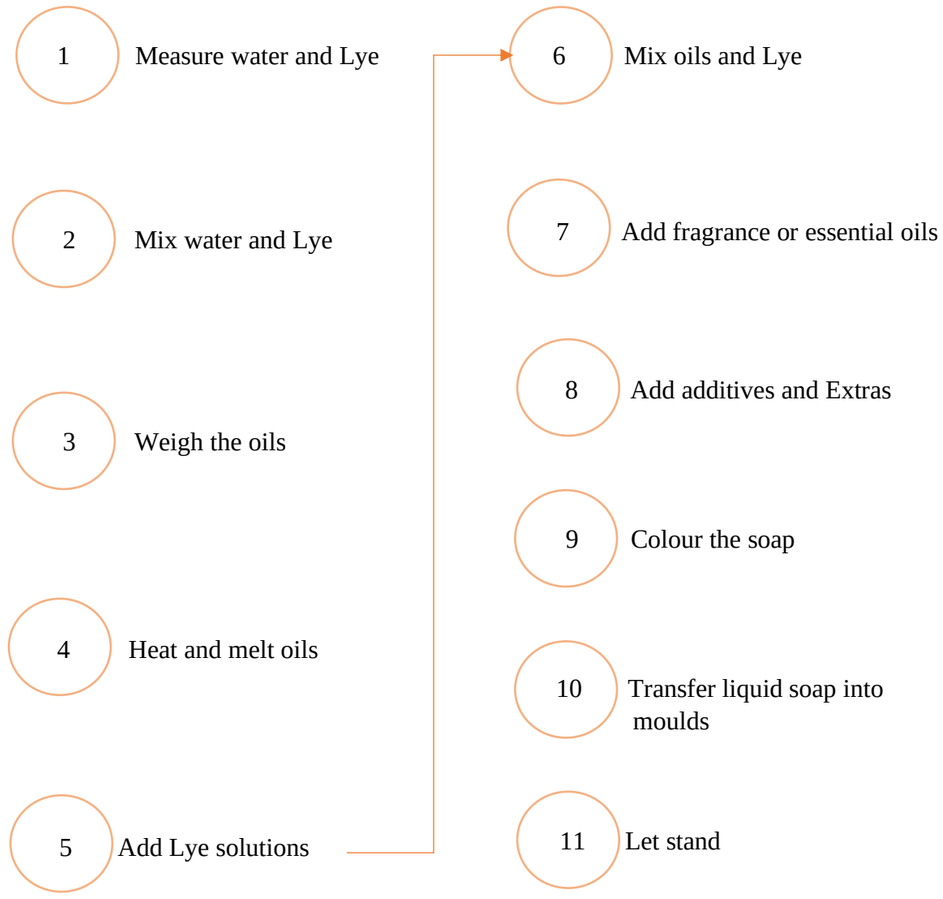


Figure 2.37: How to make biodegradable soap (Fisher 2020).

F

ANALOGY OF CARDIOVASCULAR SYSTEM

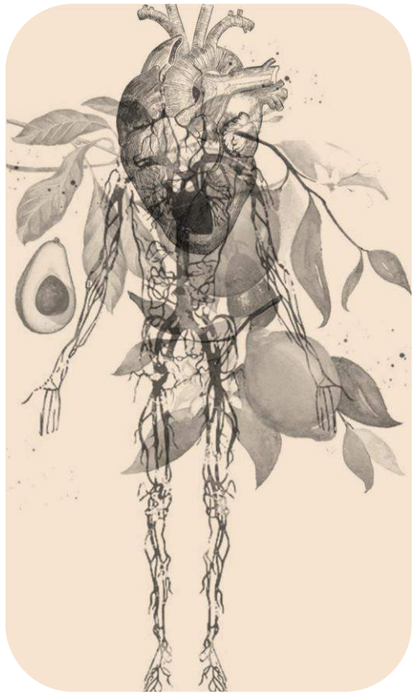


Figure 2.38: Analogy of the water filtration system (Author 2021).

Due to the high complexity in- Melusi dealing with socio and ecological challenges which consist of both complex systems, one should look at the most complex, wondrous, and holistic workable system in the universe; - the cardiovascular system.

An analogy has been drawn to the cardiovascular system, which is a complex arrangement of hydraulic, yet living components (Swain 2000:43). This analogy will act as an informant on how a hydraulic system works spatially and conceptually.

The layout of programs will be allocated along the flow of the water filtration system and will inform the location of certain programs. The water filtration system will relate to secondary water systems connected to the main line of water flow as per figure 2.40.

Analogous of the cardiovascular systems	Main Water filtration System.
Heart	The Quarry hole
Aorta	Surface Flow Wetlands
Arteries	Pipes supplying water to all the multiple programs

Figure 2.39: Table comparing the analogy of the water filtration system (Author 2021).

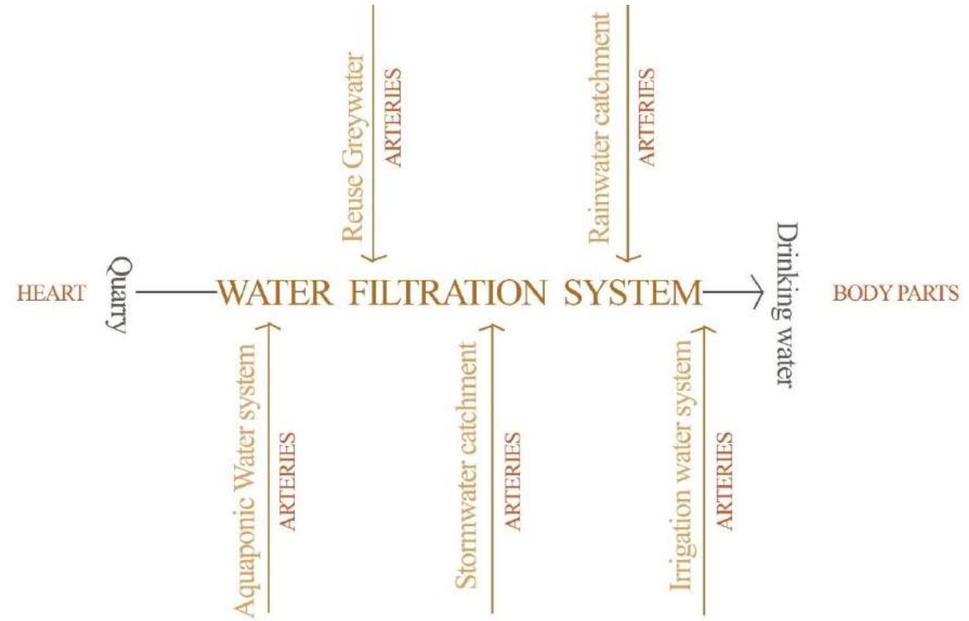


Figure 2.40: Illustrates that the water filtration concept and how the water feeds the programs (Author 2021).

CHAPTER

03

DESIGN PROCESS

Figure 3.1: Design progress collage (Author 2021).

A Urban Vision + Stakeholder Evolution

B Phase 1 – 5 Small Changes

C Phase 4

D Phase 5

A

REALITY STUDIO URBAN VISION

Figure 3.2: Reality studio collaborating with the student from Chalmers University using Google Meets in Melusi (Zorn 2021).

The Reality Studio group developed 5 phases of development in group format to ensure co-evolution to take place between inhabitants and the environment. The phased intervention approach is informed by Nabeel Hamdi (2010), Now- Soon and Later approach to spatial design. Due to the scale of Melusi being and constantly expanding community, it is decided to create multiple strange attractors (catalysts) in a space to activate participation and responsibilities. Snowden (2011) suggested the following method of resolving physical complex phenomena is to Probe – Sense – Respond. Solving of complex challenges calls for an emergent practice (Snowden 2011). Snowden suggests having multiple small, strange attractors (spaces of interaction, services, and production) within a complex space; the idea is that the inhabitants interact with the attractors organically. The ideal outcome would be if the strange attractors function as OODA loops, sustaining itself by allocating people tasks and responsibility to maintain a functional strange attractor through: Observe, Orient, Decide and Act. The OODA loop can only be successful if there was a successful transference of ownership towards the community using participatory design, co- design practices and if the architect takes in the role of facilitator (Hamdi 2010).

Figure 3.3: Reality studio collaborative meeting (Zorn 2021).

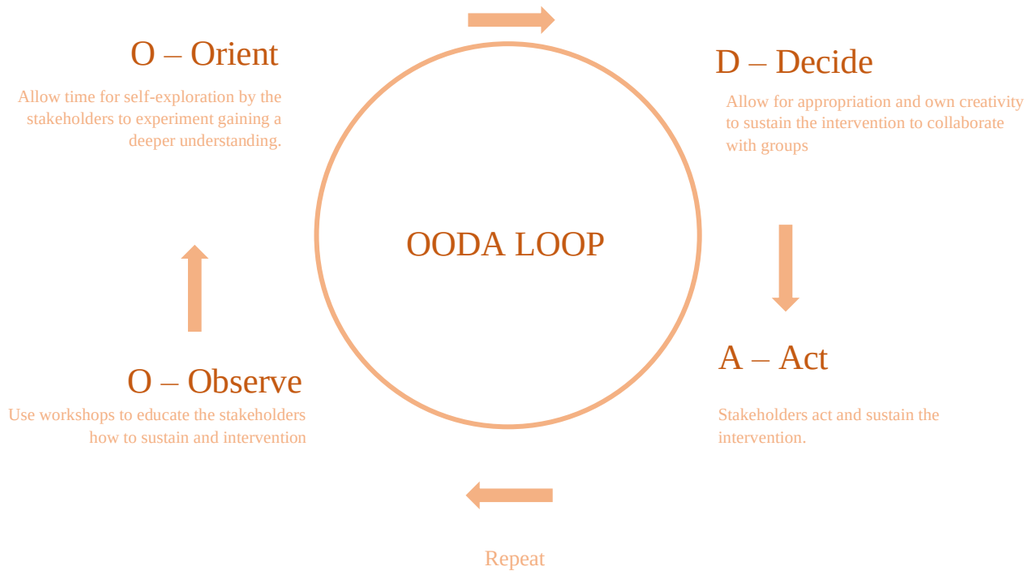


Figure 3.4: Illustrate the concept of the OODA LOOP (Snowden 2011).

The Reality Studio group developed a stakeholder diagram to understand the current relationships and connections between all the stakeholders. The second intention of the phased intervention approach is to strengthen and improve current relationships within the community. The initial relationship stakeholder structure has been identified as the following:

CURRENT STAKEHOLDER RELATIONSHIP BEFORE INTERVENTION

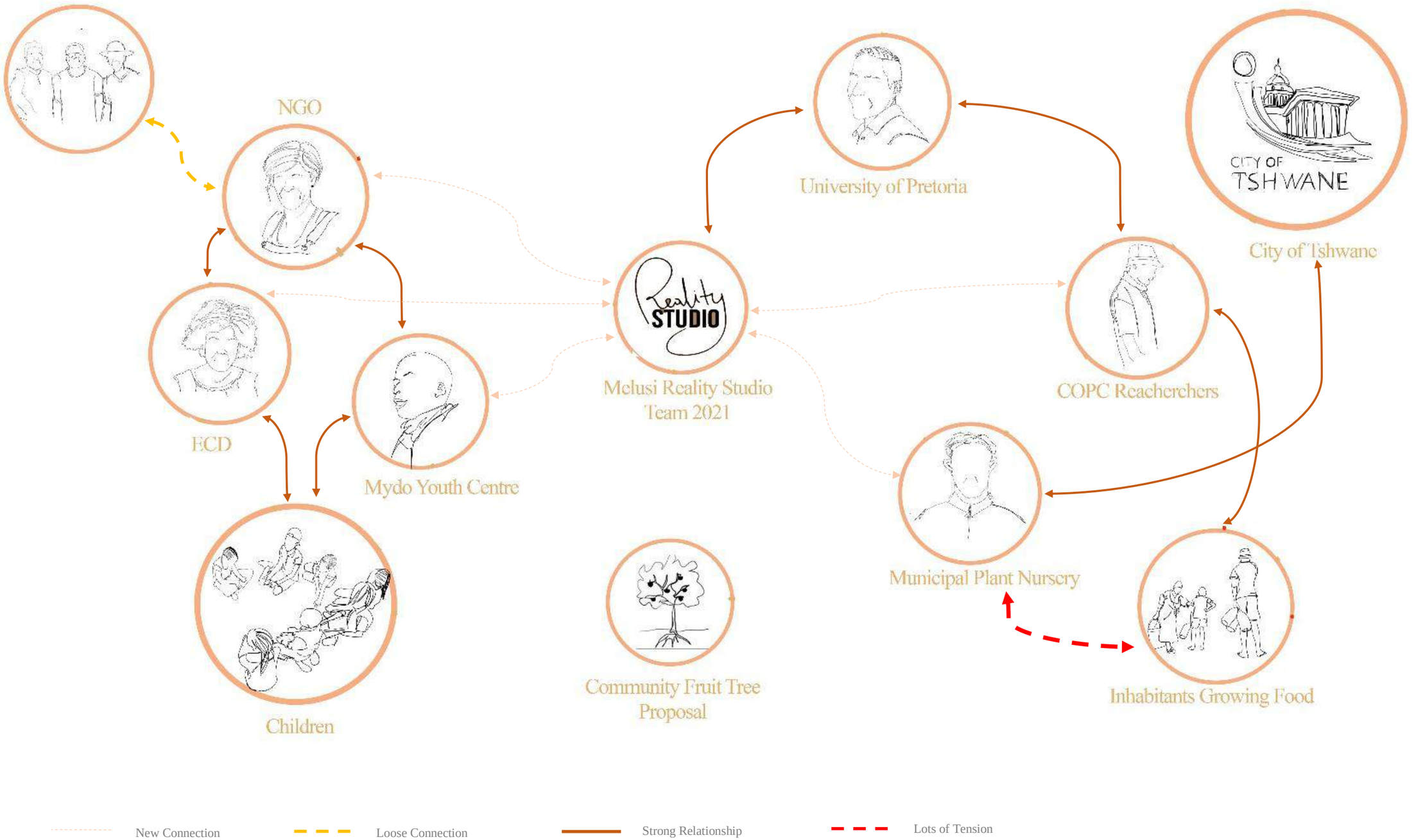


Figure 3.5: Illustrates the current stakeholder relationships and connections before intervention (Reality Studio 2021).

URBAN VISON PROPOSAL PHASE 1-5

Figure X.

Figure 3.6: Illustrates the big urban vision from phase one to phase five developed by the Reality Studio (2021).

INTENTIONS OF THE FIVE PHASES

The main drivers for the five phases are to create strange attractors (catalysts) on the main access road in Melusi. Currently, all the new developments are happening on the Eastern side of the community. The intention is to pull further development to the western side of the community to ensure the entire community benefit from the upgrading process. Every phase will operate according to the OODA LOOP principle of complexity theory as explained in figure 3.4 above. Phase one will be situated in the busy street where most of the stakeholders are situated in (Mydo Youth Centre, ECD and COPC researchers) see figure 3.7.

The second phase will consist of a service and access road together with a fruit tree aisle. The third phase would be Juliana Achi's master's project, also situated on the Southern edge of the Quarry hole. Juliana Achi was part of the Reality Studio team. Jua Greeff and Juliana Achi consisted of the fieldworkers where Adam Elinder and Jonathan Naraine were part of the sky team see figure 1.26 chapter one. Phase four is proposed to open the current palisade corner of the Municipal plant nursery and have a more permeable street edge with the community.

PHASE 1

Phase 1 – Situated in the current activated street due to the multiple stakeholders

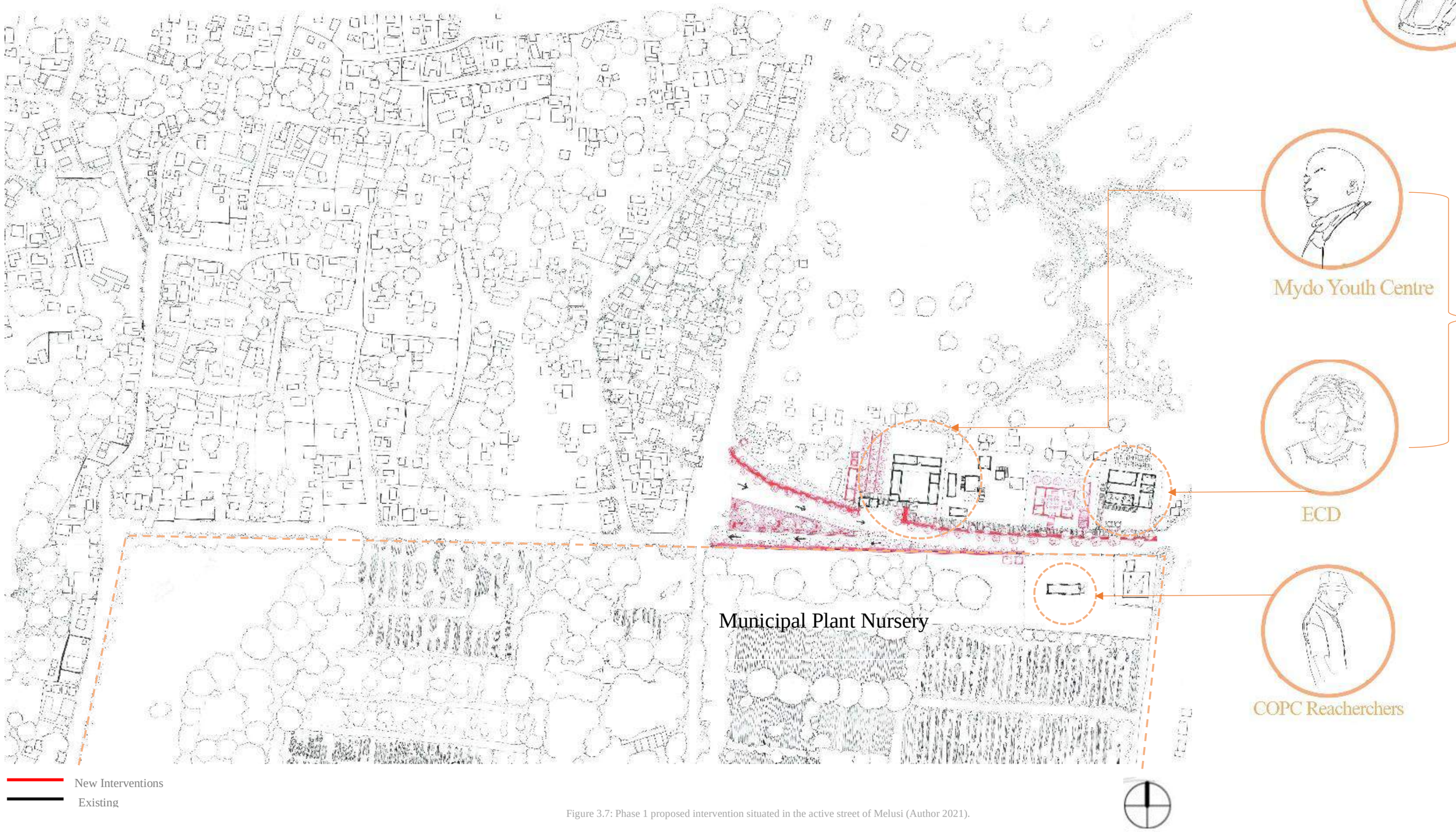


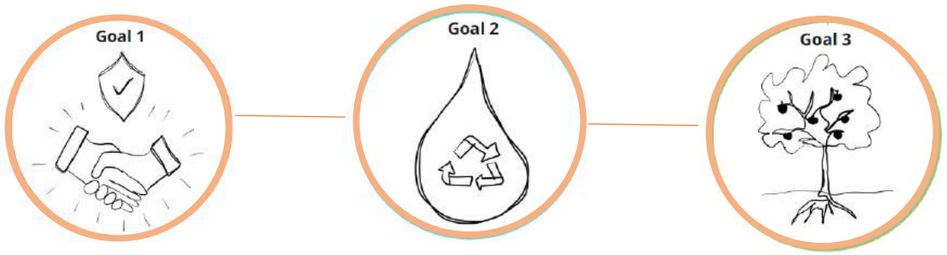
Figure 3.7: Phase 1 proposed intervention situated in the active street of Melusi (Author 2021).

The first phase consists of five small changes which will address the three goals set out by the Reality Studio (2021) to be addressed in the now intervention. The five small changes will act a one ecosystem and are efficient in areas lacking earlier architecture or planning (Hamdi 2004). Each small change will allow the next small change to follow.

"In the language of emergence, it is better to build a densely interconnected system with simple elements and let the more sophisticated behaviour trickle up. In this respect good development practice facilitates emergence, it builds on what we've got and with it goes to scale."

– Nabeel Hamdi

DEFINED GOALS



SAFETY & TRUST

Increase safety alongside the street and build a social capital and trust between the Municipal plant nursery and the community.

Informants: Play Africa Workshop

GREY WATER RECYCLING

Increasing awareness around greywater reuse practices.

Informants: Water game with Mydo Youth Centre

FOOD SOVEREIGNTY

Increasing production of food in Melusi where inhabitants have ownership in process from seed to plate

Informants: Melusi Plate game and interviews with teachers and COPC researchers.

Figure 3.8: Defined goals set out by Reality studio (2021).

B

PHASE 1 – 5 SMALL CHANGES

Figure 3.9: Google Earth image of the active street where phase one will take place (Author 2021).

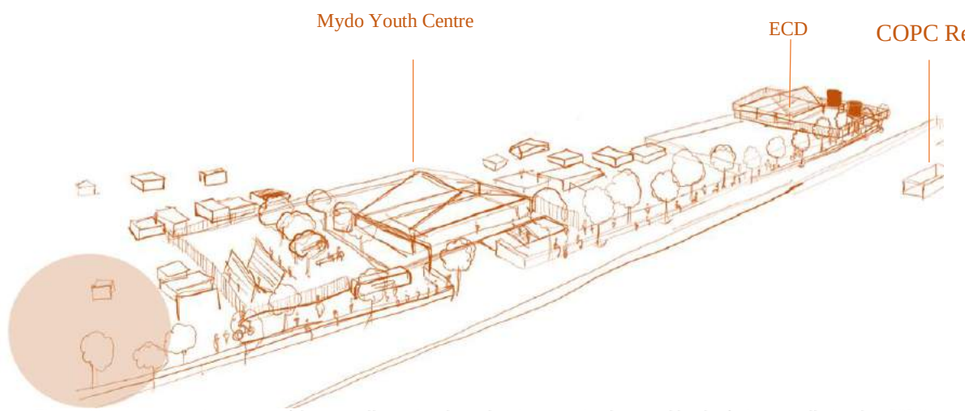


Figure 3.10: Axonometric concept of the street illustrating the pedestrian route implemented by the fruit tree wells (Author 2021).

5 SMALL CHANGES

RECYCLING WORKSHOP

Proposed to be situated at the Mydo Youth centre. This facility was chosen due to the large number of children attending the youth centre. It is a communal area where community members collect their children which is ideal for a recycling depot.

ECO BRICKS WORKSHOP

Upcycling Melusi

Ecobricks will be produced by the youth at the Mydo Youth Centre. The Youth Centre will sell the bricks to the community. This will allow Mydo to expand and grow buying food for the food kitchens and study material. This intervention will make the Youth Centre independent and self-efficient form external resources

WATER REUSE

The water reuse channel will span from the ECD towards the Mydo Youth centre creating a barrier between the vehicle road and the pedestrian walkway. The proposal proposed that the channel will collect rainwater from the roofs of the ECD and the Mydo Youth centre. The idea is to supply the fruit trees with the rainwater gathered from the roofs.

TREE WELLS

Along the street next to the water channel the tree wells will be situated. The tree wells will be constructed with eco-bricks to capture storm water in the busy street. The tree wells will prevent erosion and indirectly also make the street safer.

FRUIT TREES

Fruit trees will be planted in the tree wells for the community to use. This will create a cooler pedestrian road in summer and a source of food for anyone in the community. The fruit trees will be watered with the rainwater collected from the roofs.

Figure 3.11: Illustrate the five small changes in sequence developed by the Reality studio (2021).

SMALL CHANGE 2

Recycling workshop

1

Collect clean and dry plastic waste polystyrene, wrappers, packets, cling wrap, paper, film, plastic packaging.

2

Compress waste into plastic 2L bottle with a stick

3

Pack tightly throughout the process to ensure that it's unsquishable

4

Squish with one hand to measure if the bottle is full enough. (squish < 10% = complete)

5

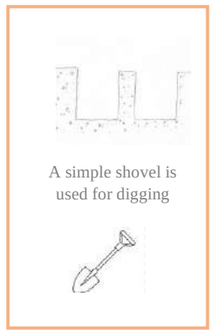
Celebrate! Your Eco Brick is ready to be built with!

Figure 3.12: Illustrates the process of an eco-brick (Reality Studio 2021).

SMALL CHANGE 3

Water reuse

1



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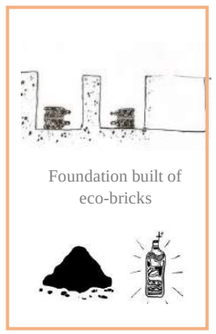

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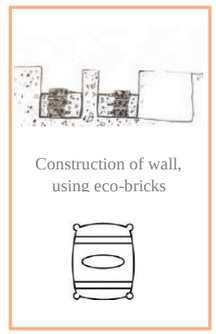

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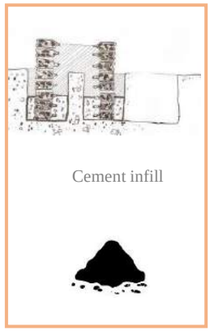

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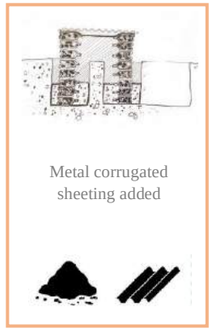

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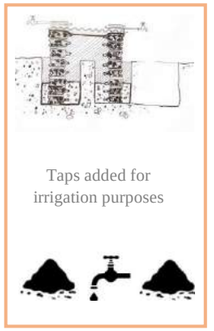
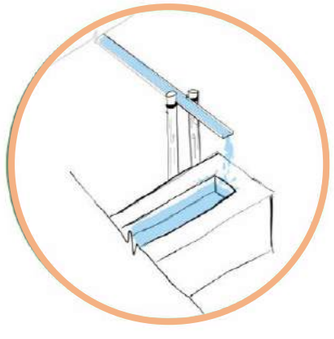


9

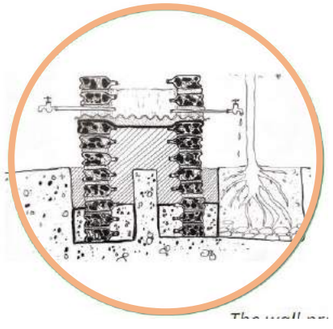
10

Figure 3.13: Diagrams illustrates the process to build the eco-brick water channel and the materials needed (Reality Studio 2021).

Figure 3.14: Concept diagram illustrating the rpinciple of the water channels becoming a barrier between the pedestrian road and the vehicles (Reality Studio 2021).



DETAIL 1



DETAIL 2

Figure 3.15: Detail 1 and 2 illustrates the details of the concept figure 113 (Reality Studio 2021).

SMALL CHANGE 4

Tree wells

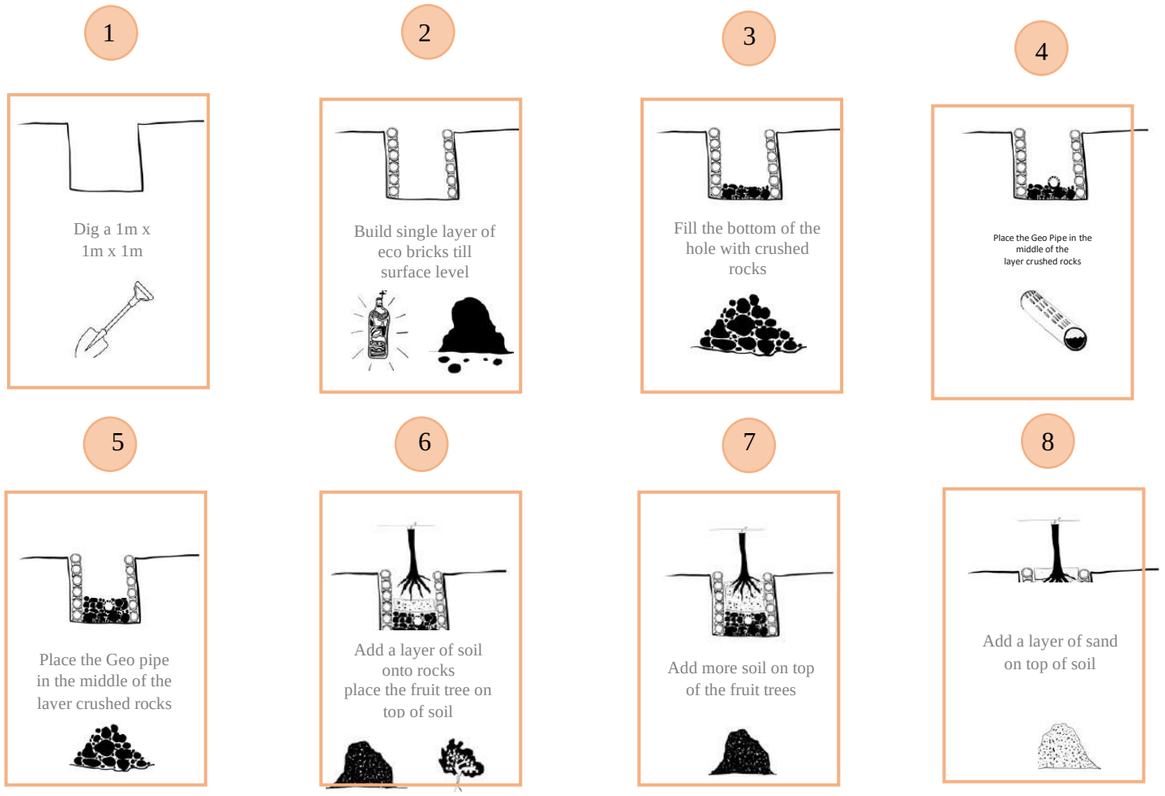


Figure 3.16: Diagrams illustrates the construction process of the tree wells (Reality Studio 2021).

SMALL CHANGE 4

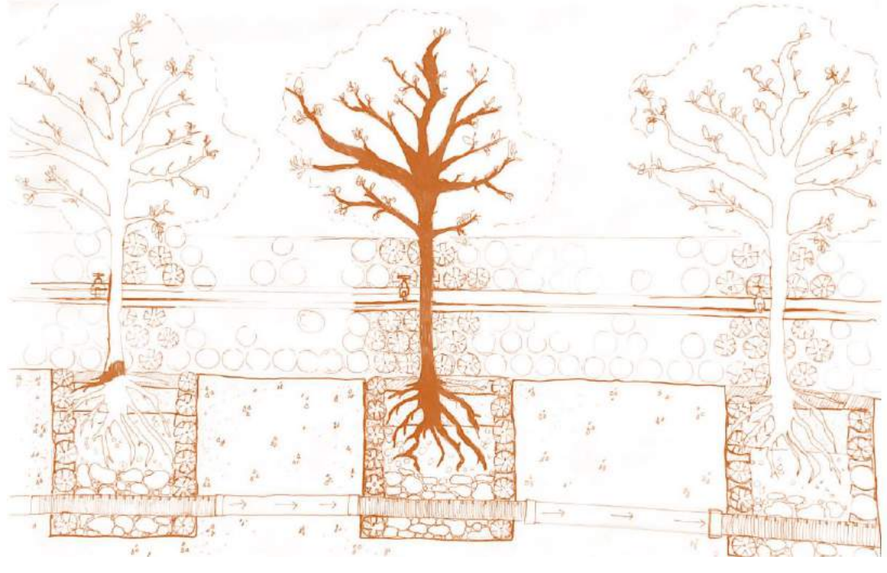


Figure 3.17: Concept diagram of tree wells and how the geo-pipe will remove of the excess stormwater (Reality Studio 2021).

During the first phase of the community upgrading program the community establishes stronger relationships with stakeholders. The reality studio and the University of Pretoria becomes the facilitator (nexus) between stakeholders as seen in figure 3.18.

STAKEHOLDER RELATIONSHIP DURING INTERVENTIONS / PHASES

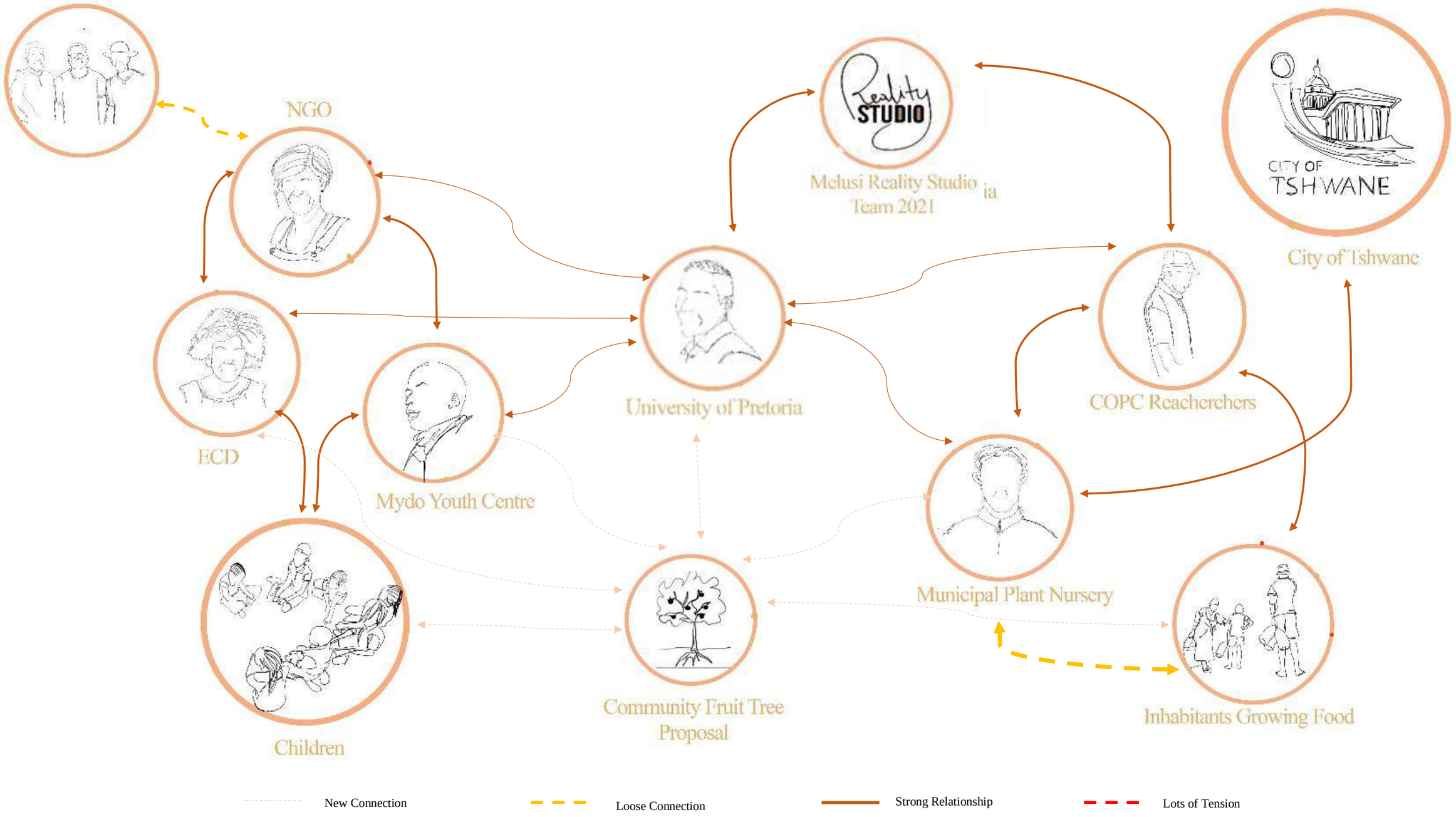


Figure 3.18: Illustrated the stakeholder evolution and relationships growing during the interventions (Reality Studio 2021).

C

PHASE 4

Opening of the Municipal Plant Nursery

Figure 3.19: Google Earth photo of the corner of the Municipal Plant Nursery, illustrating possible open public space (Author 2021).

Figure 3.20: On ground views of the plant nursery corner (Author 2021).

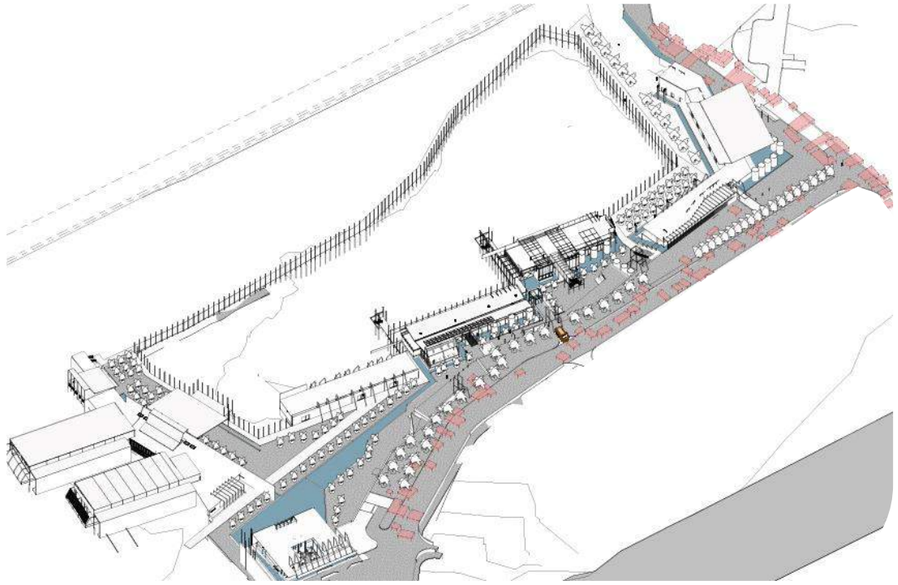


Figure 3.21: Axonometric view highlighting the residences which will have to be relocated to the allocated areas (Author 2021).

The corner of the municipal plant nursery has been identified as a possible site for intervention. This site is not in use and is vacant land. The intention is to transform the currently enclosed plant nursery (figure3.20) into a resource for the community by breaking the harsh boundaries. It is also proposed to move the current dwellers residing on the edge of the quarry (figure 3.21) to the corner of the plant nursery (figure 3.23). The intention is to assist with the relocation process by assisting to supply building materials such as eco-bricks for the new residences.

Figure 3.23: Proposed plan of transforming the plant nursery corner to a more permeable integration with the Melusi community (Author 2021).

D

PHASE 5

Jua Greeff Master's Architecture Project

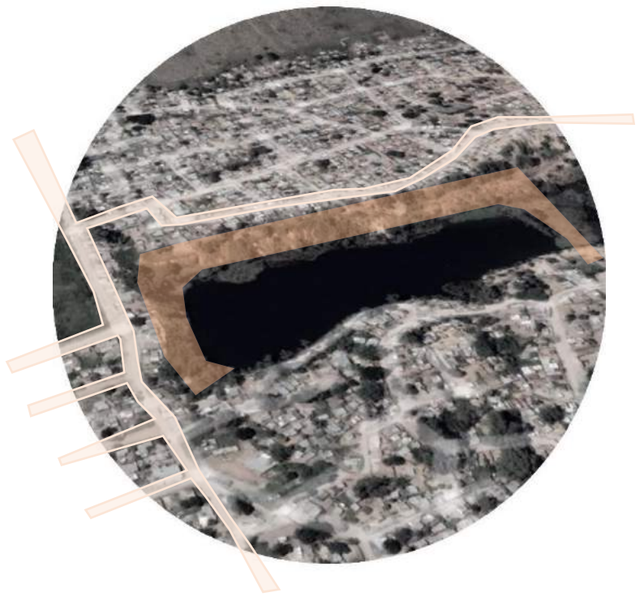


Figure 3.24: Google Earth 3D representation, illustrating the phase 5 location on the southern edge of the existing quarry hole (Author 2021).

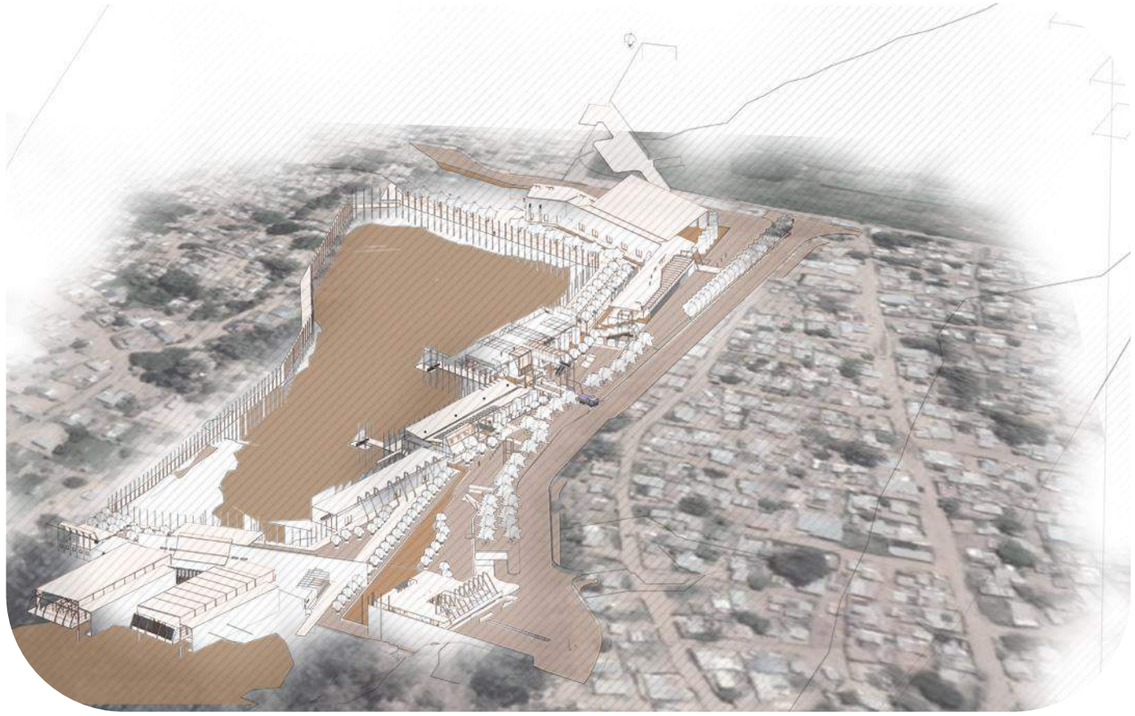


Figure 3.25: Axonometric of proposed intervention for phase 5 in relation with existing context (Author 2021).

Figure 3.26: Illustrating the nexus the intervention relates with the surrounding environment (Author 2021).

STAKEHOLDER RELATIONSHIP AFTER THE INTERVENTION

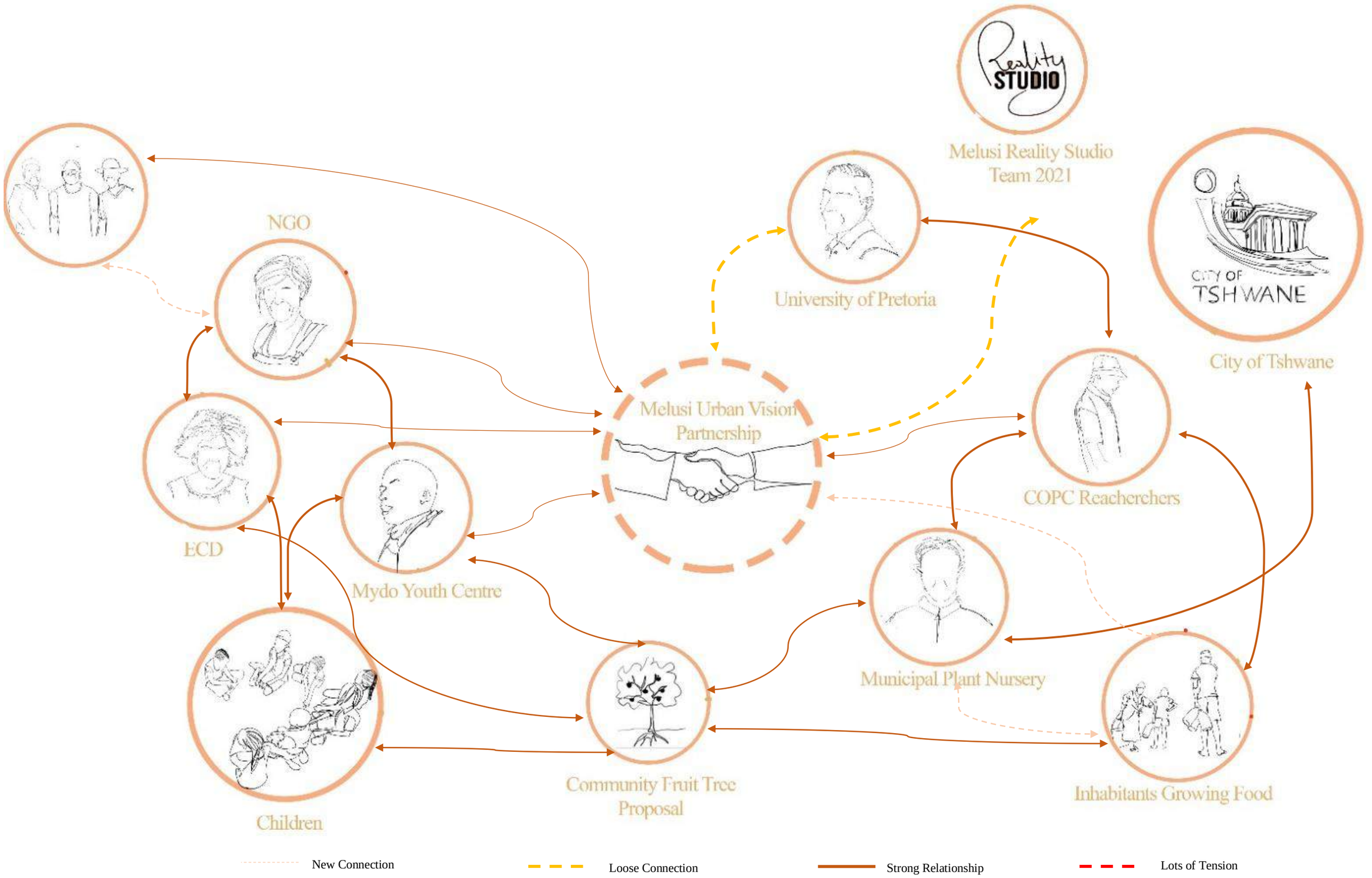


Figure 3.27: Illustrated the stakeholder evolution and relationships after the interventions. In the diagram it is visible that the University and Reality studio became the bridge (Nexus) between stakeholders (Reality Studio 2021).

CONCLUSION

In conclusion it is visible that the proposed interventions will have a social and physical growth as a result and in essence the phased interventions allow for the Melusi community to adapt and take part in the community upgrading process.

During this process new skills will be transferred to the community members supplying Melusi with skills of alternative material usages and smart water management and practices. Phase 4 allows for the community members living on the edge of the quarry to move to a safer portion of land to secure the dangerous edge.

Chapter four will focus on the theoretical framework developed to measure balanced upgrading programs and how to approach informal settlements in a sustainable manner towards community co-evolution and self-efficiency.

CHAPTER

04

THEORETICAL ANALYSIS

Figure 4.1: Site condition of dumping sites (Zorn 2021).

Chapter four aims to find a framework for community upgrading programs towards co-evolution between ecological and social landscapes. The framework will be set out by learning from previous projects and by analysing the shortcomings in the process followed, how successful the ecological aspects have been addressed as well as the social aspects. A theoretical framework will form the criteria the project will follow towards community independence and co-evolution.

Understanding Complexity in space

Although nature presents itself as chaos there is natural laws behind the chaos which in fact is in total order (Otto 2021). However, complex dynamic systems occur in man-made (socio) as well as natural (ecological) systems (Sala 2004:35). Melusi, as informal settlements entail multiple complexities on multiple scales. One of the biggest challenges was when working in informal settlements such as Melusi were to find order in the chaos and that is exactly what George Birkhoff defined. A mathematician, George Birkhoff proposed a measurement for beauty in 1930. Birkhoff (2004) identified complexity as the "edge of chaos" which is related to geometry which can then inspire the aesthetic sense (Sala 2004:36). The equation is as follows:

$$M = \frac{O}{C}$$

M stands for aesthetic measure or beauty, O is for order, and C is for complexity. The equation therefore reflects means that through chaos and complexity is beauty. Strange attractors aim to address this equation in space. A strange attractor in space tends to contain elements of stability and processes which are stable – order- and the outcomes such as growth patterns and human movement – complexity- (Sala 2004:37).

The author proposes a framework which can be used to analyse and critique future projects to ensure the upgrading programme or intervention in informal settlements happens though co-evolution and harmony towards community independence and further growth as described by Maslow's hierarchy of needs (1943) as to reach self-actualization.

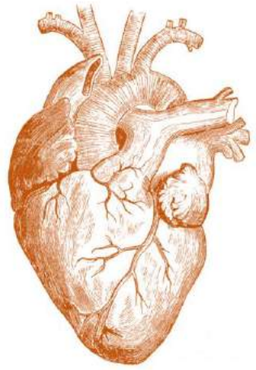
ECOLOGICAL FRAMEWORK INTRODUCTION

Architectural design is where human behaviours and culture meets the earth's processes to create form (Minnaar 2017:30). When architects intervene in informal settlement environments the focus is primarily on the residents' needs and not the great deterioration of the natural resources in an environment (Lyle 1994:4). Haggard, Reed and Mang (2006:1) believe that instead of causing mass destruction to our natural environment, all development and especially development in vulnerable communities such as Melusi should promote ecological health towards harmonious co-existence and resilience.

Linear, one-way flows of systems implemented on a landscape are a degenerative system (Haggard et al 2006:1). This one-way system is evident currently in Melusi where the City of Tshwane Municipality supply's the community of water through Jojo tanks distributed over the settlement. John Tillman Lyle (1994) defined regenerative design as a replacement of linear systems making use of circular processes, energy, and operation towards community self-efficiency.

Robert Rodale was the pioneer of regenerative thinking when he stated the need for continuing organic renewal of complex living systems (Mang & Reed n.d:6). Regenerative development principles are proposed to address the ecological needs of a landscape as regenerative principles mediates the design gap between sustainability and ecology (Barakat et al 2018:5).

"Regenerative development is poised to become the major force in the transformation of social-ecological systems towards sustainability."- (Barakat et al 2018:6)

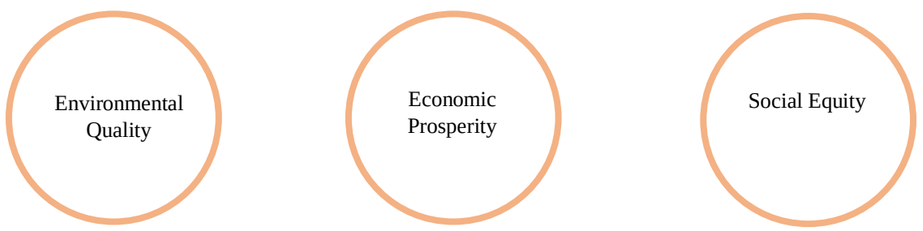


SOCIAL FRAMEWORK INTRODUCTION

Maslow's classical hierarchy of needs can be compared to the basic configuration to a building or structure. By focusing on the basic human needs in an informal settlement lay down the foundation for Melusi community to grow towards self-efficiency and sustainable livlihoods. Sustainable livelihoods became a developing concept in the early 1990'to understand the world crisis of food insecurity in the 1980's in Africa (Alfiky nd:2). The slow economic growth, sluggish agricultural performances coupled with rapid rates in population increased the need of food resources (McCarthy 1986:58). Maslow's Hierarchy of needs is used to understand the socio-aspects of a community and that one's need cannot be fulfilled if the basic needs defined my Mslow (1943) are not fulfilled and that a community cannot grow if certain aspects are not in placed (Alfiky n.d:3). This concept of building the foundations for a community to grow from is also the concept and outlook of the NGO- New Schools for HOPE and their philosophy in life is to counteract poverty with education. The CEO of the NGO also mentioned in the interview that the community cannot move forward without the foundation that gives us dignity and value (Fourie 2021).

In conclusion it is visible that one needs to address both the socio and ecological landscapes in upgrading programmes for co-evolution to take place. The following pillars define the intentions of the framework and divides the framework into three categories:

The sustainability pillars (Alfiky nd)



- Environmental quality: is the practice how humans design with the natural environment without affecting it negatively.
- Economic Prosperity: to ensure the landscape and environment have the resources and knowledge to have some prospects of economic growth.
- Social equity: Provide the community with the basic needs to function in a holistic manner.

The *Sustainable livelihoods* concept aims to counteract poverty by creating opportunities through architecture for the community to grow and to have access to more resources (Alfiky nd). This idea is also supported by the Cynefin and the OODA loop framework (Kurtz & Snowden 2003). The OODA loop is a decision-making process which is used in non-linear thinking processes to solve complex problems which cannot be solved in a linear thinking method. Cynefin is a Welsh word that means *"Habitat"* or *"Place fails to do it justice"* (Kurtz & Snowden 2003:467).

In conclusion by providing people with the basic human needs does not necessarily means that the project is successful. The human basic needs should be addressed together with opportunities to gain financially and to grow financially. For communities to be self-efficient and sustainable community members needs responsibilities to maintain. This will allow for ownership to establish. These responsibilities to maintain certain structures, businesses, etc, should function on the OODA loop principle towards self-efficiency and co-evolution for constant growth (Snowden 2003).

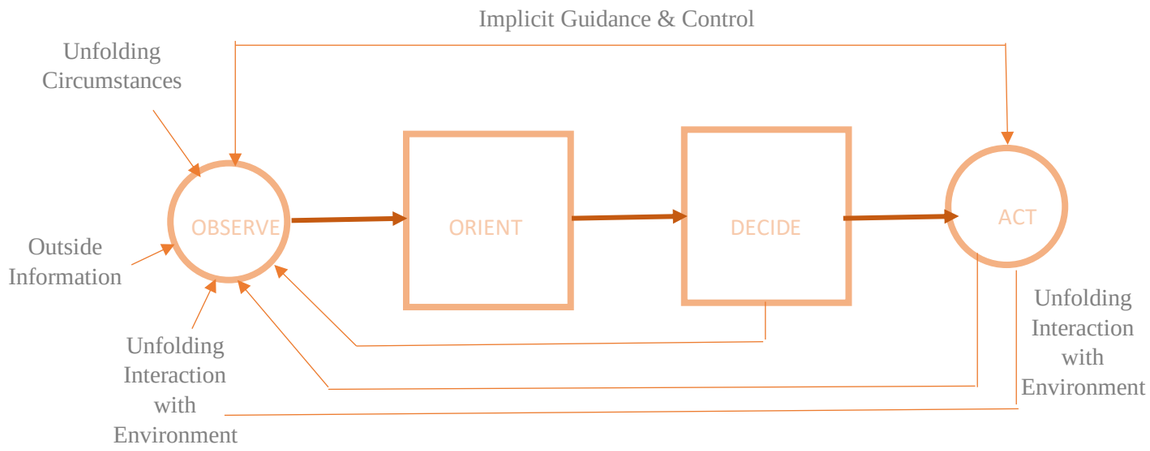
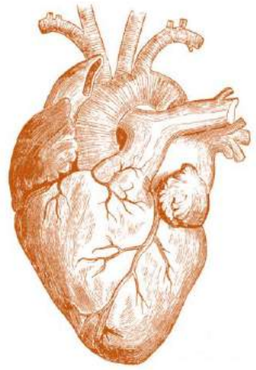


Figure 4.2: The OODA loop decision making framework which acts in a non-linear manner (AGLX 2019).

"Informal communities, which may range from public to secret in their profile, provide a rich and fertile source of knowledge and learning"- (Kurtz & Snowden 2003: 477).

Figure 4.3: Diagram showcasing the desired balance towards co-evolution and self -efficiency (Author 2021).

Once a Sustainable livelihood is evident the community can progress and focus on self-improvement towards self-actualization. This way of providing for vulnerable communities involve a more community centred approach because the community is no longer marginalized their basic needs are met which is directly or intricately connected with human dignity (Gasper 2005:269).



SOCIAL CRITERION INTRODUCTION

Based on the basic Huma Needs addressed by Maslow (1943).

A

Basic Human Needs: Physiological - & Safety Needs (Maslow 1943)

Refers to what people require to be able to achieve a level of functioning that satisfies a certain ethnical conception for example, dignity (Gasper 2005:269). The basic human needs include the physiological and safety needs. These needs are crucial for a human survival, Maslow (1943), refers to these needs as most important as all other needs becomes secondary until these needs are met (McLeod 2020).

B

Psychological Needs: Esteem- & Belongingness Needs (Maslow 1943)

The Psychological needs includes belongingness, love, and esteem needs. Belongingness refers to human emotional need for interpersonal relationships, affiliating, connectedness and being part of a group (McLeod 2020). Esteem needs are the fourth level of needs. which includes accomplishment and respect. Maslow classified the Esteem needs into two categories (McLeod 2020).

1-Esteem for oneself (independence, achievement, dignity).
2-Desire respect from others (status, prestige).

C

Self-fulfilment: Self-actualization Needs (Maslow 1943)

Self-fulfilment is the highest tier of Maslow's hierarchy which refers to the level of personal realization of one's personal potential and self-fulfillment, this level includes when people search for personal growth and accomplishment. This level is also known for when individuals become more creative and inventive to reach certain goals (McLeod 2020).

Process

1

Phased Intervention- Now-soon-Later: Configuration in a landscape using the strange attractor model.

According to Nabeel Hamdi (2010:67) it is important to implement interventions in a Now-Soon-Later approach. This way of implementing interventions allows for scaling up an intervention on a later stage once a community is operating and took ownership of a Now intervention once can propose improvement and expansion (Hamdi 2010:73).

2

Community Action planning- Transference of ownership through co-design and participatory action.

Consist of PEAS (Hamdi 2010:148)

Co-design workshops is necessary when working in communities by using maps, models and collaborative design workshops to break the boundary between "them and us" and builds a sense of ownership in the earliest design phases (Hamdi 2010:74).

ECOLOGICAL CRITERION

Based on the Regenerative Development Framework (Barakat et al 2018:6)

A — Manifests Potential

Refers to an increase of health and the positive outcomes to all members of a system through health, well-being, and happiness (Barakat et al 2018:6).

B — Shifts worldviews

Deepens and strengthens the relationships of stakeholders such as inhabitants of a site, practitioners in a collaborative and co-creative process. This shifts the normal practice where architects and practitioners are seen as professionals and experts in their specific field. The shift in the mainstream discourse is where the professionals in a working community intervene by becoming the facilitator and mediator. The aim of this approach is to nurture thriving living systems and existing systems currently evident on site.

C — Creates mutually beneficial co-evolving relationships

Forms intrinsic relationships between the ecological and the sociocultural components of systems that evolve through time.

3 — Adds value across scales

Regenerative development works across scales this means that it seeks to add integral, life-conductive value systems.

"Smaller scale efforts are coordinated within larger scale efforts and are leverages to catalyse transformation towards sustainability throughout the living system." (Barakat et al 2018:6)

Process

4 — Regenerative Systems in entire systems

The holistic approach to regenerative development entails that the entire living system is included within the project and is not focused on in isolated fragments. The holistic approach calls apron a development as a living and functioning organism which results in evolutionary capacity throughout the multiple sociocultural and ecological landscapes.

"We should recognise that each phase of our work should make a tangible difference from the start, building progressively a sesnse of belonging and ownership parallel with fixing things up and making it all work." – (Hamdi 2010:78)

The ideal outcome would be if all the principles are selected in the circles which will illustrate a balanced sphere. This framework (figure 4.4) will be used to analyse the following three precedents.

FRAMEWORK DIAGRAM (CLEAR)

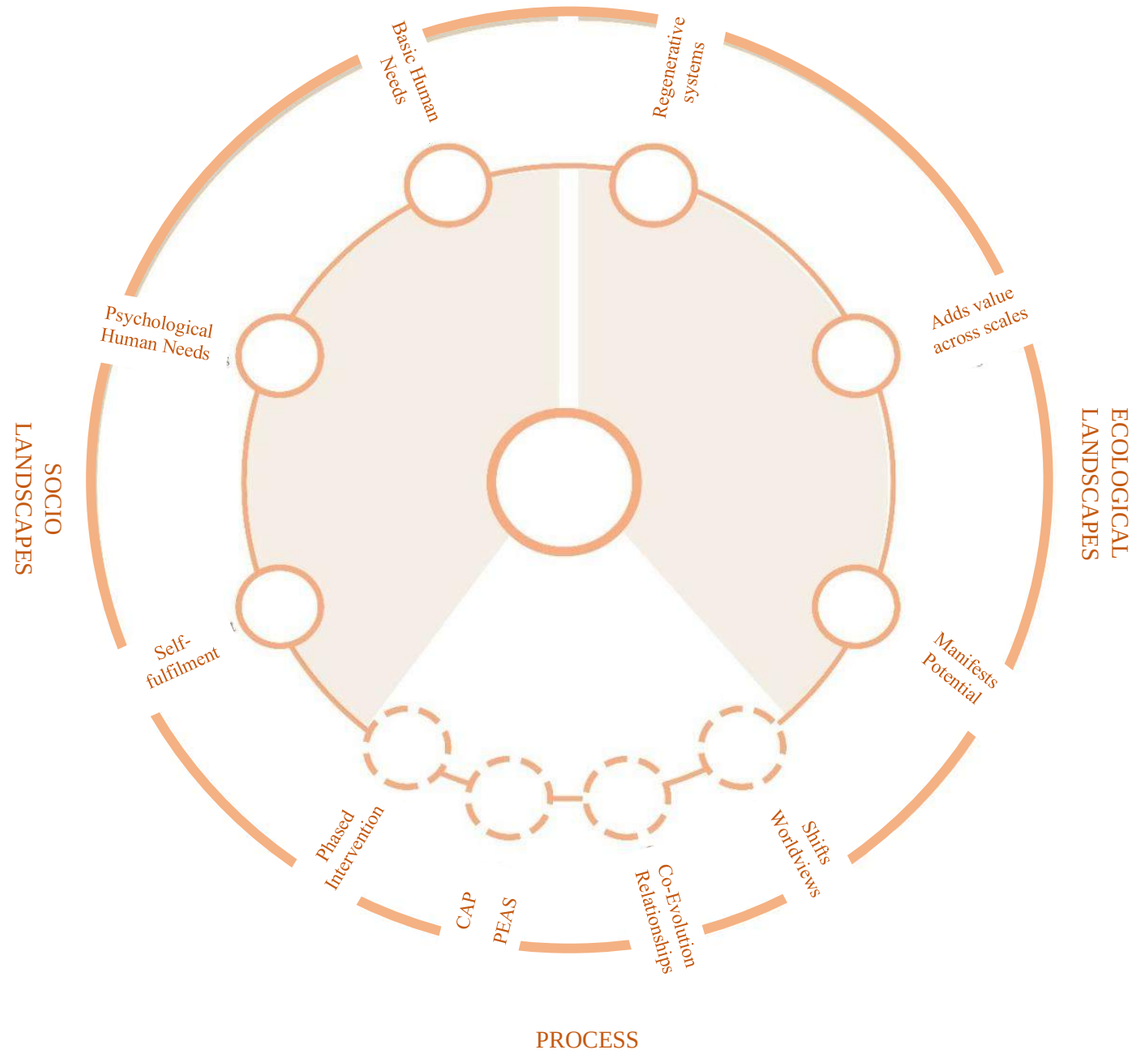


Figure 4.4: Author's visual framework which will be used to analyse precedent studies (Author 2021).

B

PRECEDENT STUDIES

Figure 4.5: The three precedent studies to follow (Author 2021).

1

INTERNATIONAL

NEXUS PRECEDENT

GOTONG TOYONG: UNITY AND RESILLIENCE IN MAKASSARS INFORMAL SETTLMENT AMID A PANDEMIC

Figure 4.6: Illustrates the bamboo rafts and walkways to cope with the floods in Batua in Makassar Indonisia (Burge et al 2020).

This RISE community project took place in Batua neighbourhood of Makassar, Indonesia during the Covid-19 pandemic. RISE is a co-design principle that enables community members towards resilience. RISE help with supplying the community with the necessary infrastructure which addresses the current needs of the community. The infrastructure includes constructed wetlands, biofilters combined with traditional grey water systems (Burge et al 2020). The project is funded by Urban Climate Change Resilience Trust Fund (UCCRTF) which focusses on improving the most vulnerable' s living quality and addresses their basic needs as a community which improves their dignity.

The project also uses existing networks and structures evident in the community towards implementation and maintenance. RISE also make use of participatory and co-design methods to fully understand the needs in the community through workshops, interviews, and co-design workshops.

The main problem identified in this community was the water floods and a need for proper sanitation which falls under the basic human needs on the hierarchy of Maslow's needs focusing on strengthening the foundation of the community towards improvement.

"Gotong royong" is a respected Indonesian society that lives in informal settlements where intimate relationships and networks are crucial for overcoming obstacles. It also refers to a spirit of – *"Whatever the challenge as long as it is done together, it will feel lighter and possible" (*Burge et al 2020*).* This community spirit was especially evident when the Covid-19 pandemic lockdown procedures lead to job opportunities which have been lost.

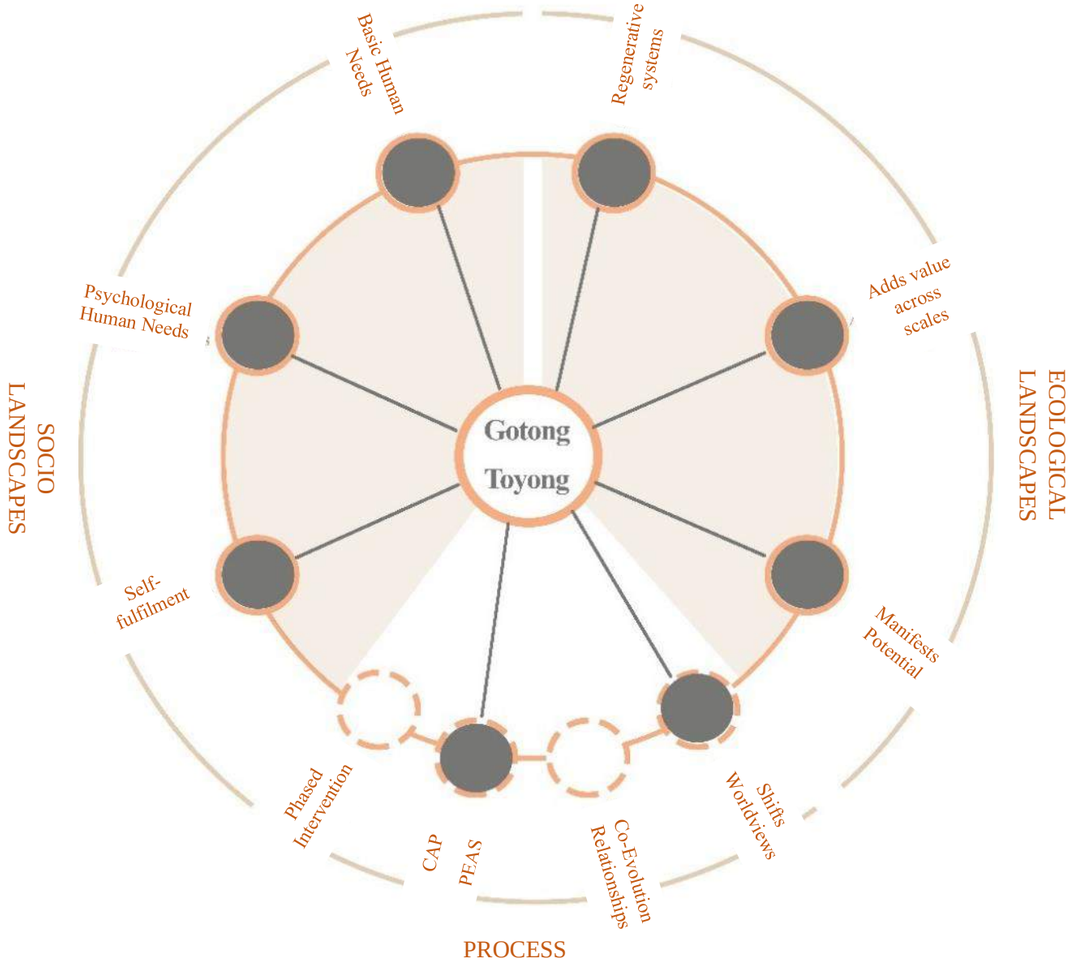


Figure 4.7: Using the author's framework it is evident that the Gotong Toyong is a balanced project focussing on the social and the ecological landscapes equally and therefore have the possibility to grow into a self-sustaining community (Author 2021).

Figure 4.8: Tallo residents participating in a co-design workshop of how to upgrade the water and sanitation challenges experienced in the community (Burge et al 2020).

Figure 4.9: The figure illustrates the co-evolution of the socio and ecological landscapes (Author 2021).

CLONCLUSION

The lessons learned from this precedent was that it showcases a balanced project addressing the process, socio, and ecological landscapes but the process lacks some of the principles such as phased interventions and co-evolution during relationships is not as visible. However, is a balanced project with the potential to sustain itself after practical completion becoming an independent community.

2

SOUTH AFRICAN

STRUCTURE PRECEDENT

THE REFILWE TOWNSHIP NDPG PRECINCT MASTER PLAN AND IMPLEMENTATION FRAMEWORK

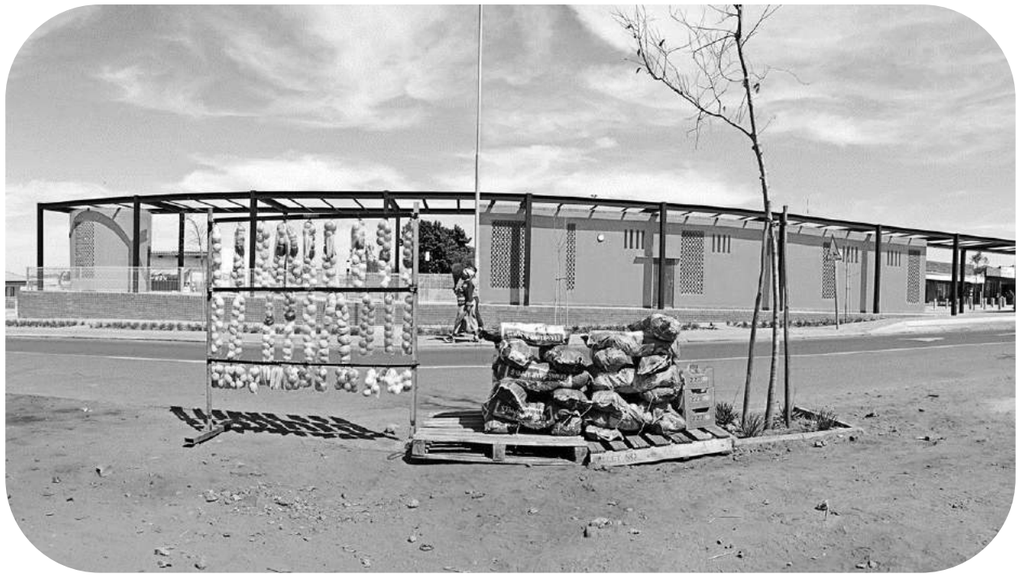


Figure 4.10: Illustrating the isolation of the Refilwe Business Node with the community. The community does not interact with the structure as intended by the designers. This photograph shows the alienation of the business node (Feat 2014).

Figure 4.11-4.12: Refilwe Business Node illustrating its relationship with the street allowing the pedestrians to circulate (Feat 2014).

The Refliwe Business Node is designed and developed by Holmjordaan, Insite Landscape architects and town planners, Bigen Africa. The project was completed in 2014. The idea and concept behind the project are according to the theory of Nabeel Hamdi in the book *Small Change* (2004), where Hamdi suggests that small interventions in a community have significant impact. The intention of this building is to interconnect and link with existing networks. However, the open-ended structure that is open for impromptu and improvision is less successful because there are no guidelines to what the spaces can become. There is a lack of professional guidance and introduction to the structure, no responsibilities have been transferred to the community. The current programs of the structure are sheltered roof, ablution, seating, and access to water which serves the user's basic need according to Maslow's hierarchy of needs. The user is not introduced by the possibilities of other programs and can be argued that the professional team worked form a top-down approach and not a bottom-up approach. The methodology is unclear of the site analysis process and community engagements with inhabitants and community leaders.

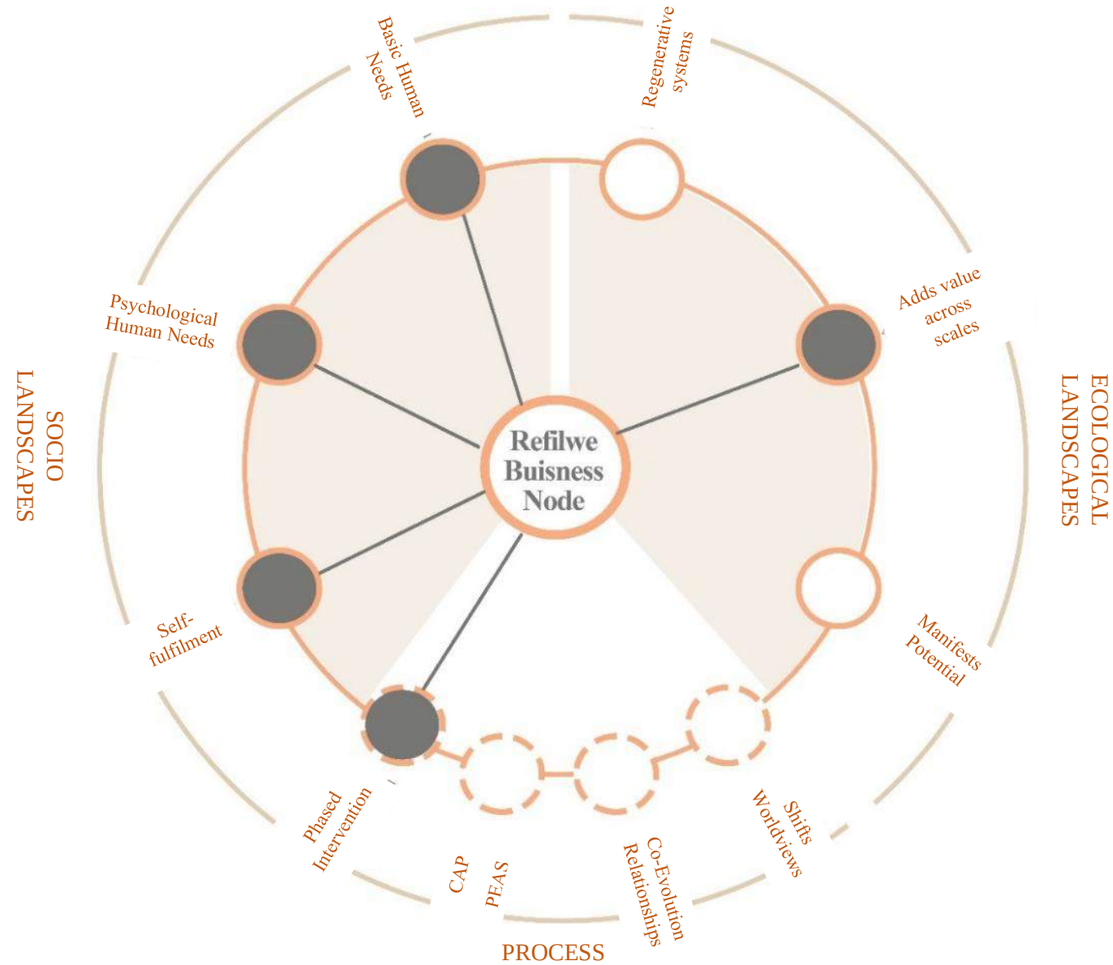


Figure 4.13: Author's analysis according to the criteria (Author 2021).

The project is unbalanced by analysing the criteria only focusing on the socio landscape and not on the ecological landscape. The process towards allocating the specific programs is unknown and not incorporating the community through the design process. The project has good user intentions, but the process followed could be more integrated following the community action plan and co-design process. The transference of ownership was also not successful due to the isolation of the intervention. However, during the xenophobic attacks in 2016-2017 many buildings were affected except for the Refilwe Business Node which shows some community pride towards the intervention.

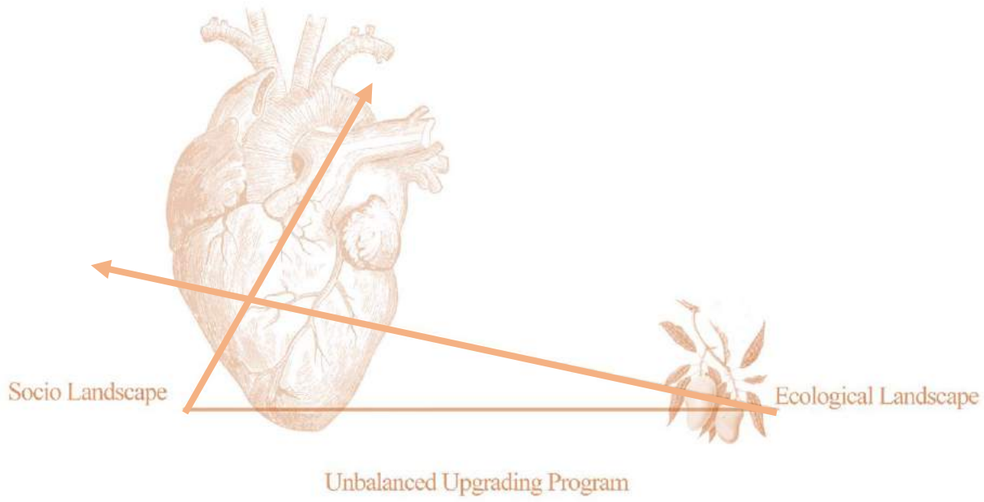


Figure 4.14: Illustrates the unbalanced approach to community upgrading (Author 2021).

3

SOUTH AFRICAN

CATALYTIC PRECEDENT

VIOLENCE PREVENTION THROUGH URBAN UPGRADING IN KHAYELITSHA, CAPE TOWN, SOUTH AFRICA

The Urban Upgrading program in Khayelitsha, Cape Town ethos and approach is how socio-economic improvements in vulnerable communities can be improved. The on-site research and surveys indicated that robbery, murder, rape, and break ins are the top four crime categories. The idea of creating ‘safe nodes’ or spaza shops is vital to create a safer public space for woman to circulate in the community (Hamzadiab 2015).

Figure 4.15-4.16: Illustrates the active public spaces created by the VPUU (Hamzadiab 2015).

The VPUU calls this strange attractor approach to public design- *Active Box*. The programs identified to these structures were mixed-use spaces but what the VPUU did differently was that they allocated specific programs to specific spaces as what the Refilwe business node did not allocate any specific programs to the structure and left it open for interpretation.

The VPUU also incorporated opportunities for economic growth which will also repair the current poverty challenge. The VPUU addressed not the symptoms but the core root of the problem which is also identified by Nabeel Hamdi (2010) in the Community Action Planning guide towards building sustainable communities.

Figure 4.17: Indicates the multiple interventions in the community previously identified as hotspot crime areas. A series of strange attractors were introduced in a community (Hamzadiad 2015).

In conclusion by reviewing the tree precedents one can clearly see the effect of a balanced community upgrading program than an unbalanced upgrading program. A balanced upgrading program has the potential to sustain itself beyond practical completion which allows the community to gain independence. These principles learned will be applied in the proposed project in Melusi.

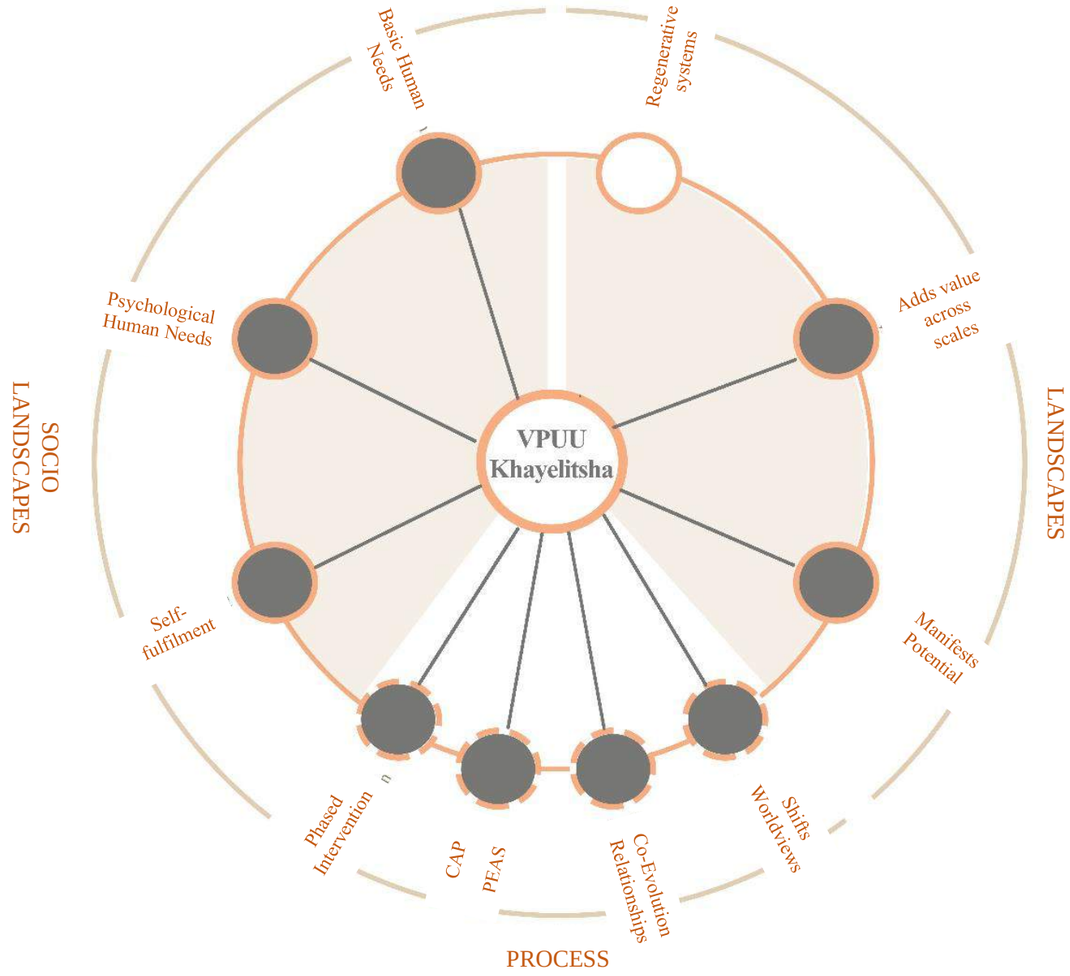


Figure 4.18: Author's own framework analysing the success of the project (Author 2021).

Figure 4.19: The diagram indicates the semi-balanced upgrading program (Author 2021).

C

DESIGN DEVELOPMENT & PROCESS

Figure 4.20: First maquette built (Author 2021).

DESIGN INTENTIONS

Figure 4.21: First maquette built (Author 2021).

01

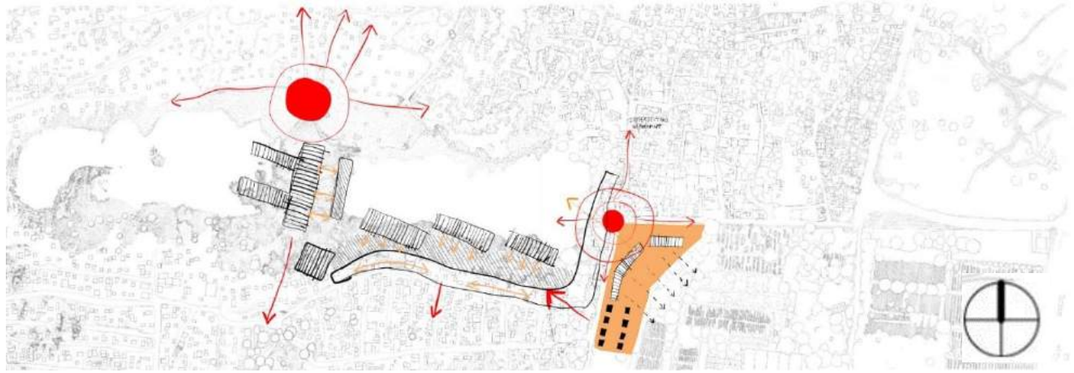


Figure 4.22: Concept sketch illustrating the intention of making the edge safer (Author 2021).

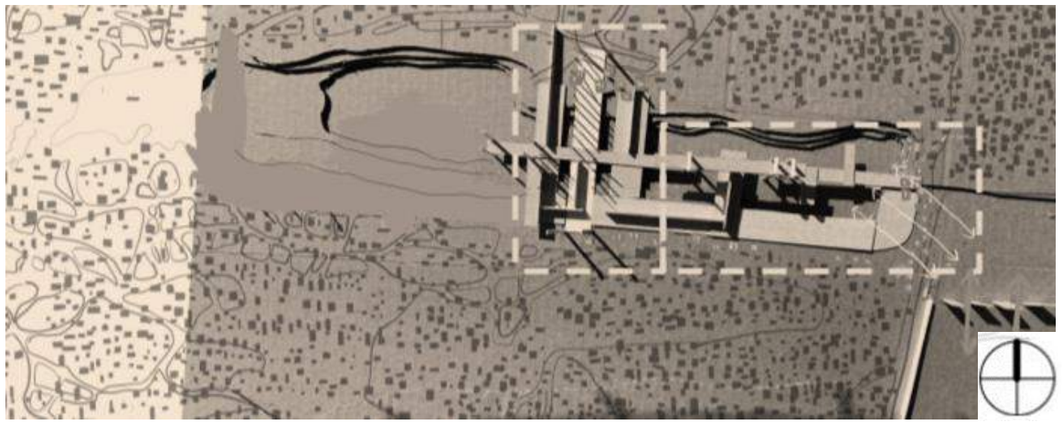
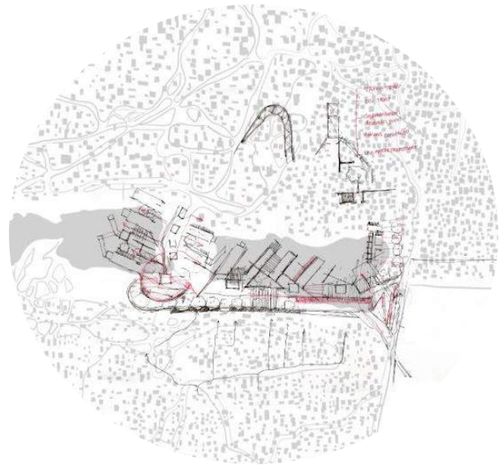


Figure 4.23: Concept model indicating the bridges over the quarry hole (Author 2021).

The critique however of this design was that the structure dominated the water body and needed to minimize structure in the water to cantilevering structures from the edges.

02

Orientation of the pockets cantilevering over the water body is orientated in the wrong direction for optimal solar radiation see figure.4.24.



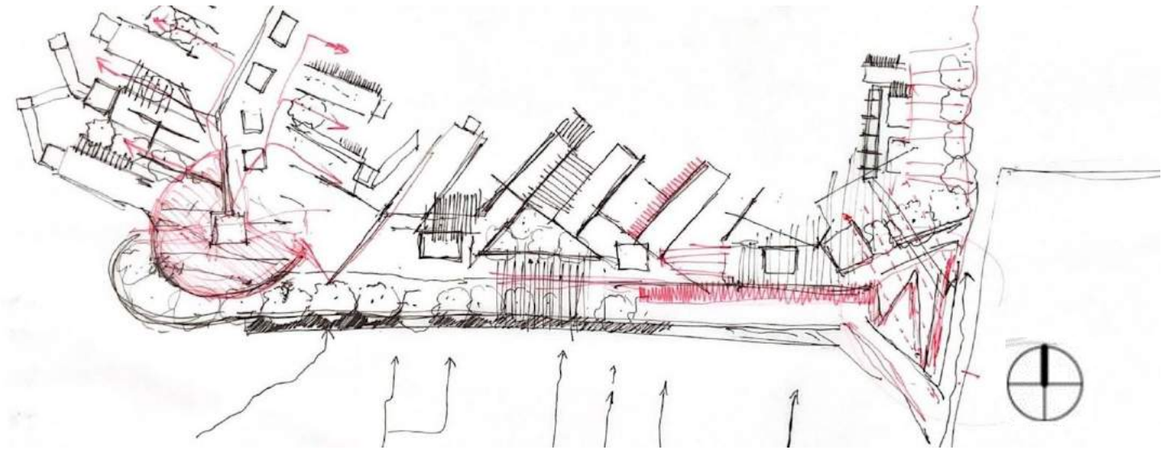


Figure 4.24: Concept sketch illustrating the pockets and interior courtyards (Author 2021).

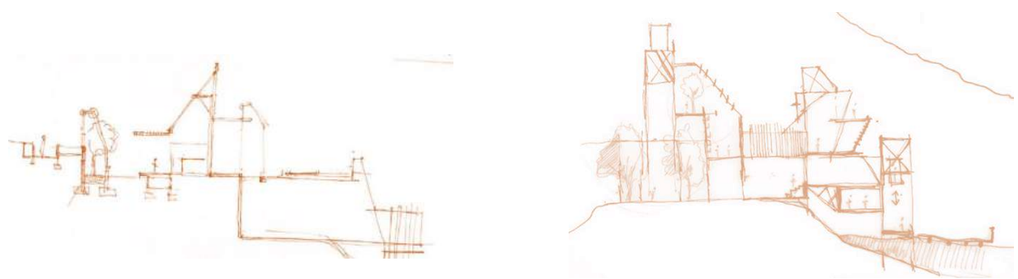
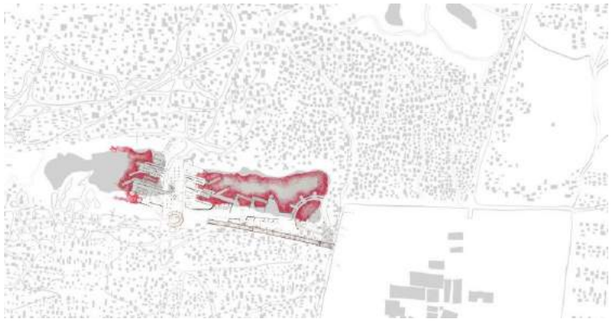


Figure 4.25: Concept section cantilevering over the quarry hole (Author 2021).

03



Design iteration corrected the orientation of the pockets cantilevering over the water body however the ration of structure to water might have a cost implication. The prospect and refuge principles weren't as prominent in iteration 3.

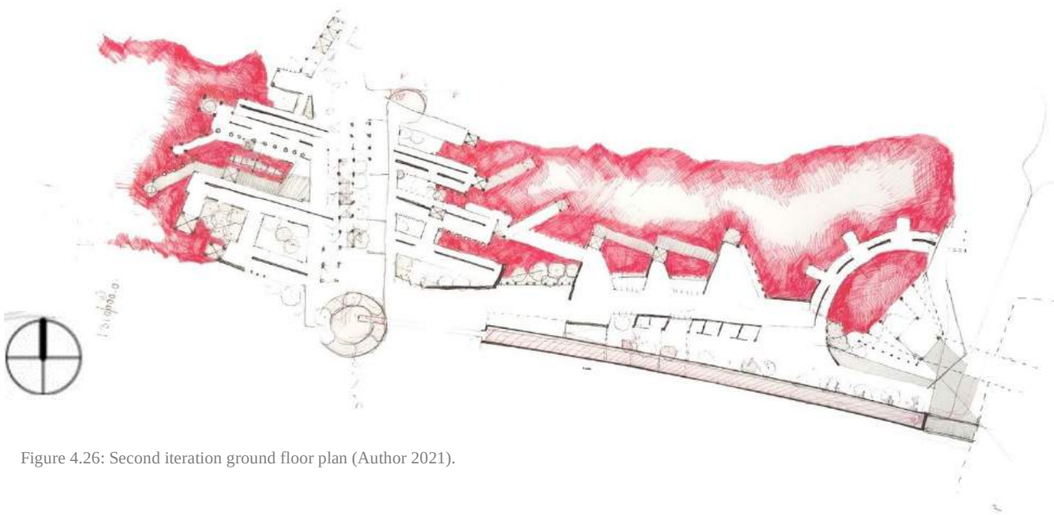


Figure 4.26: Second iteration ground floor plan (Author 2021).

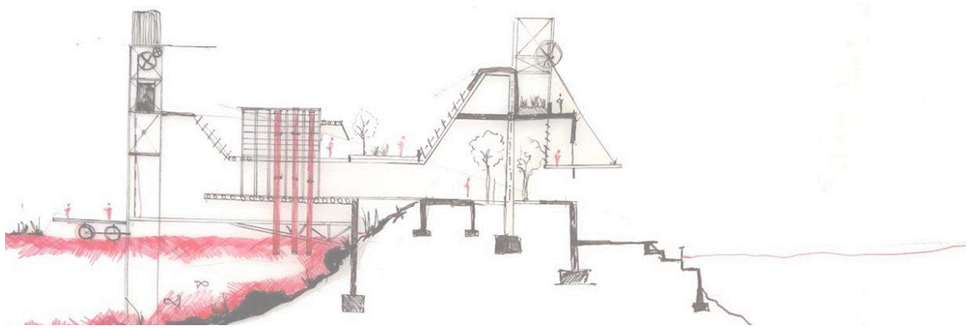


Figure 4.27: Second iteration section (Author 2021).

04

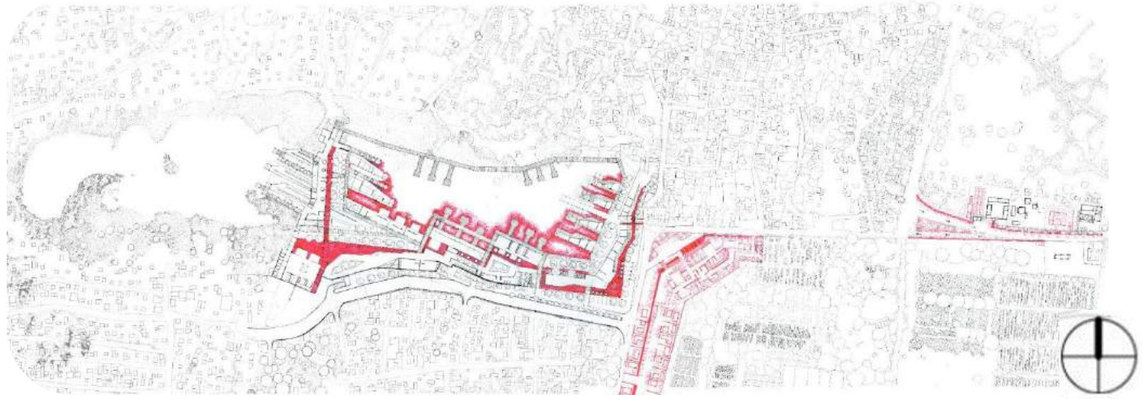


Figure 4.28: Third iteration ground floor plan (Author 2021).

Design iteration four is more successful in applying the prosect and refuge biophilic design principles by using the cut-and-fill technique to secure the edge. However, the extended structure over the quarry hole is overpowering.

Figure 4.29: Third iteration section (Author 2021).

05

Figure 4.30: First physical model (Author 2021).

Figure 4.31: First physical model indicating the pedestrian walkway around the quarry (Author 2021).

Figure 4.32: First physical model indicating the internal courtyard and water channels (Author 2021).

Buildings which will be developed technically and in Detail

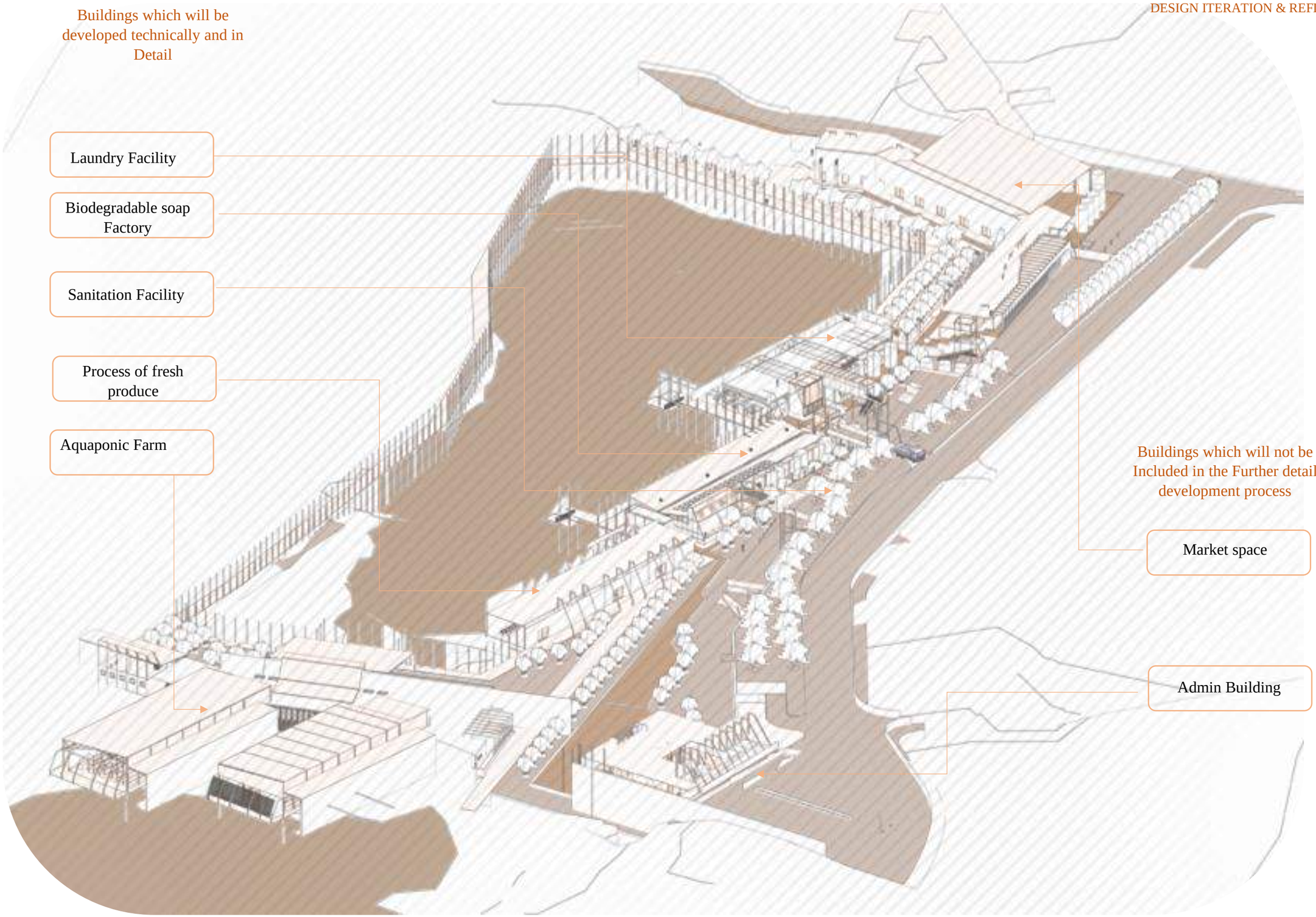
Laundry Facility

Biodegradable soap Factory

Sanitation Facility

Process of fresh produce

Aquaponic Farm



Buildings which will not be Included in the Further detail development process

Market space

Admin Building

Figure 4.33: Program allocation (Author, 2021)

MELUSI WATERFRONT

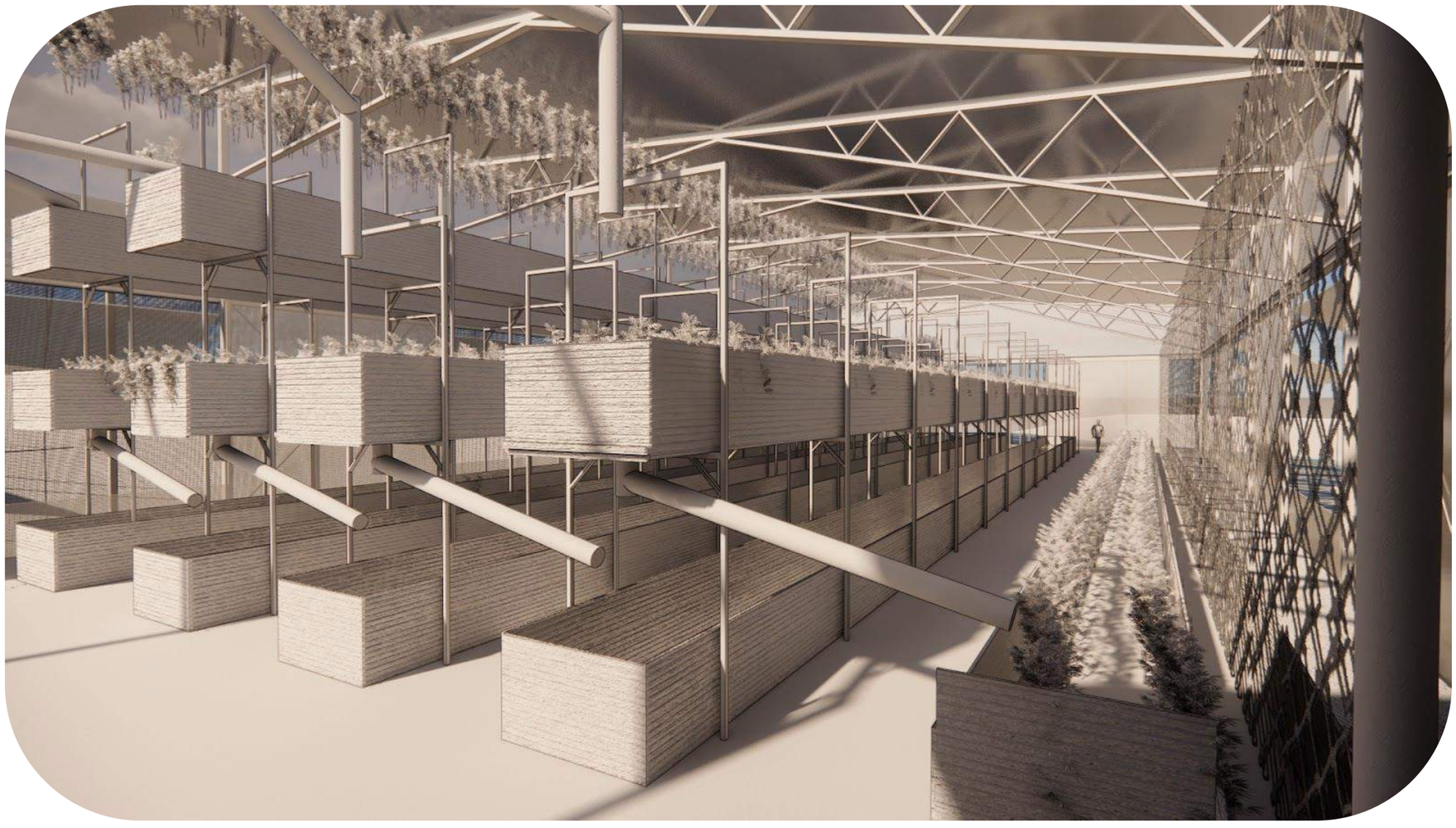


Figure 4.34: Renders of the community aquaponic system (Author 2021).

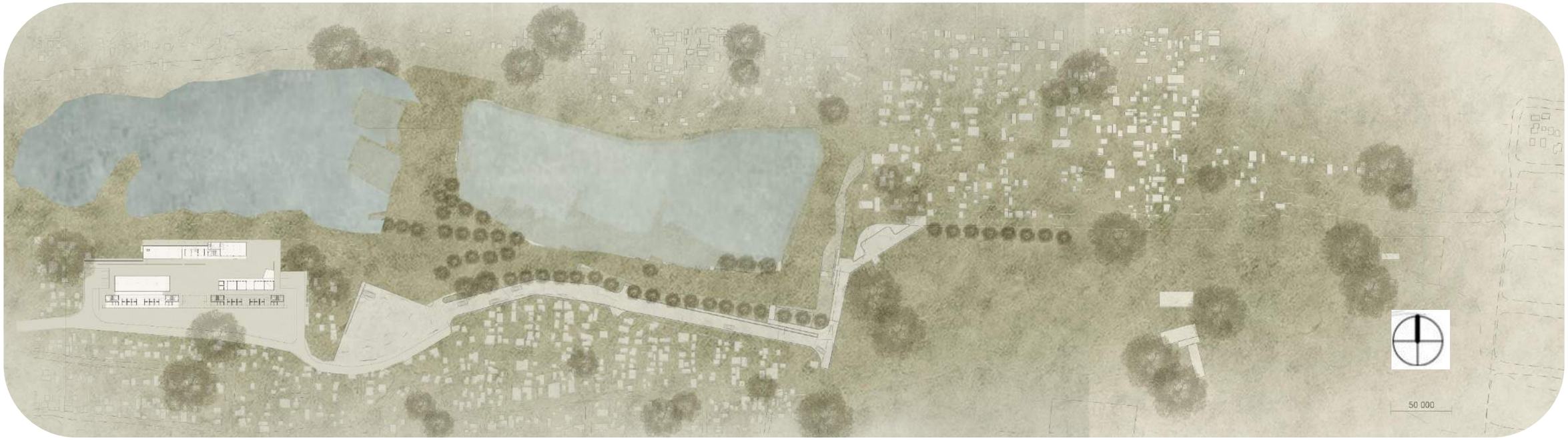


Figure 4.35: Site plan of phase 3 and phase 5 (Author 2021).

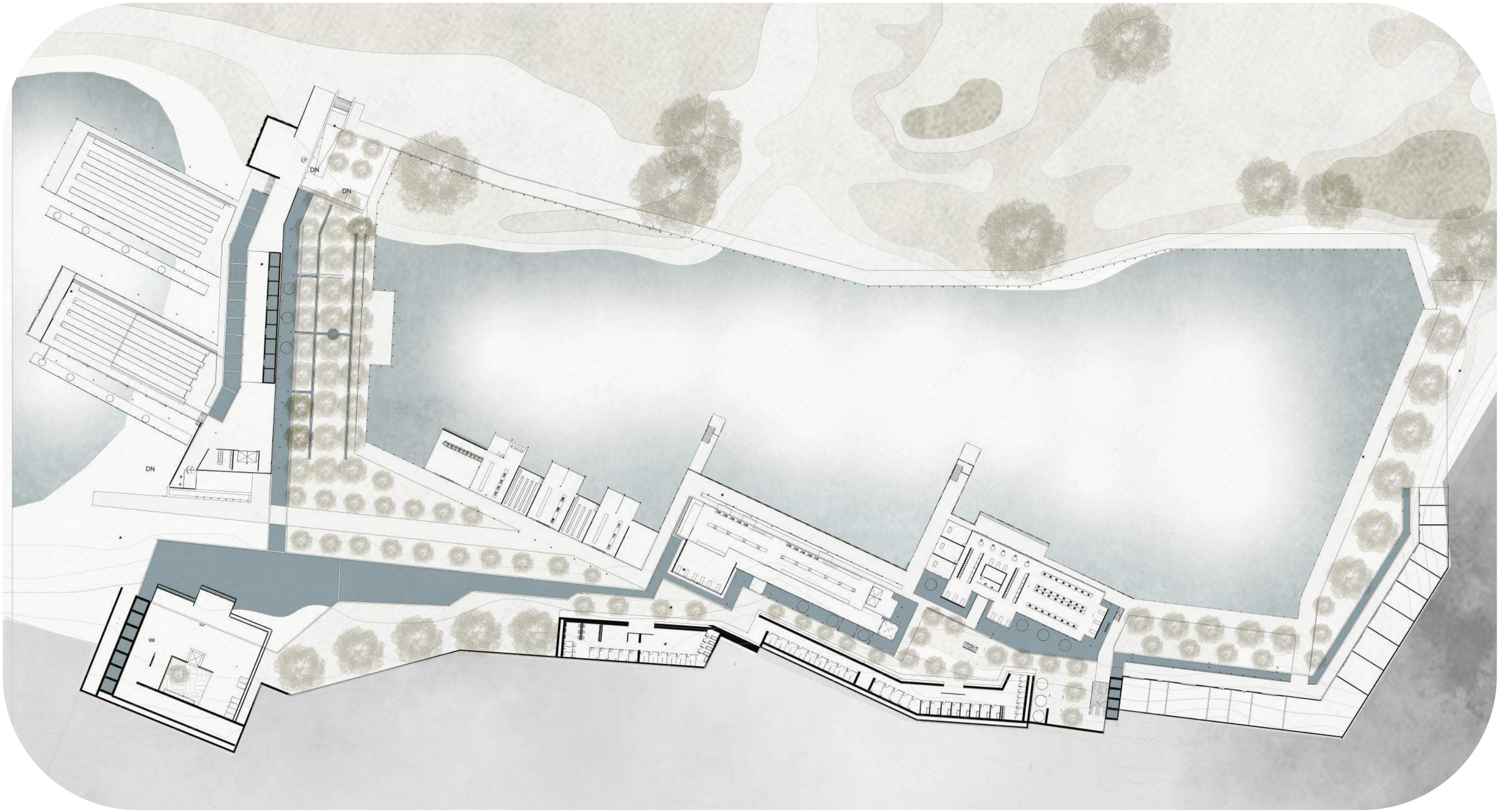


Figure 4.36: Ground floor plan of phase 5(Author 2021).

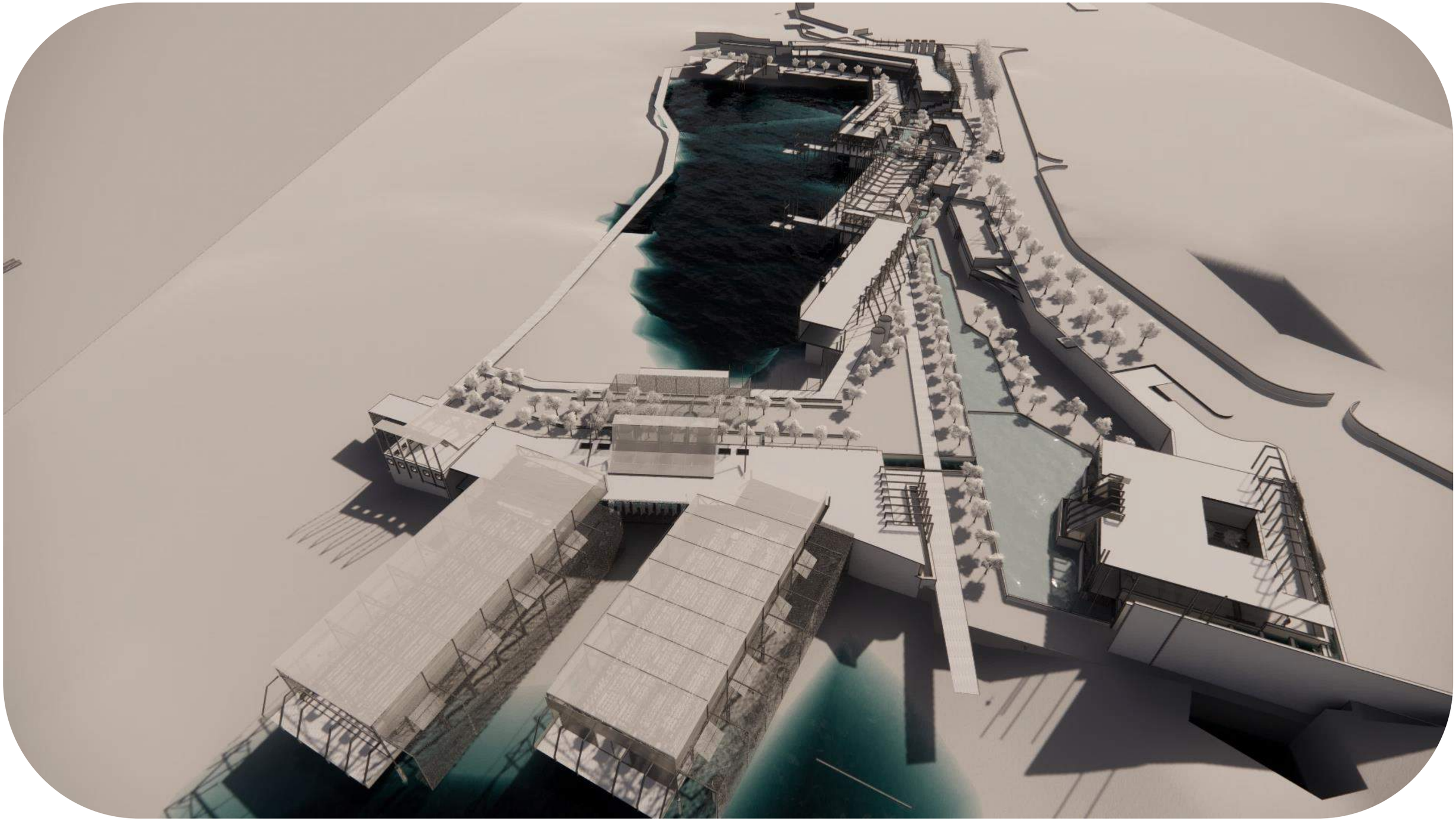
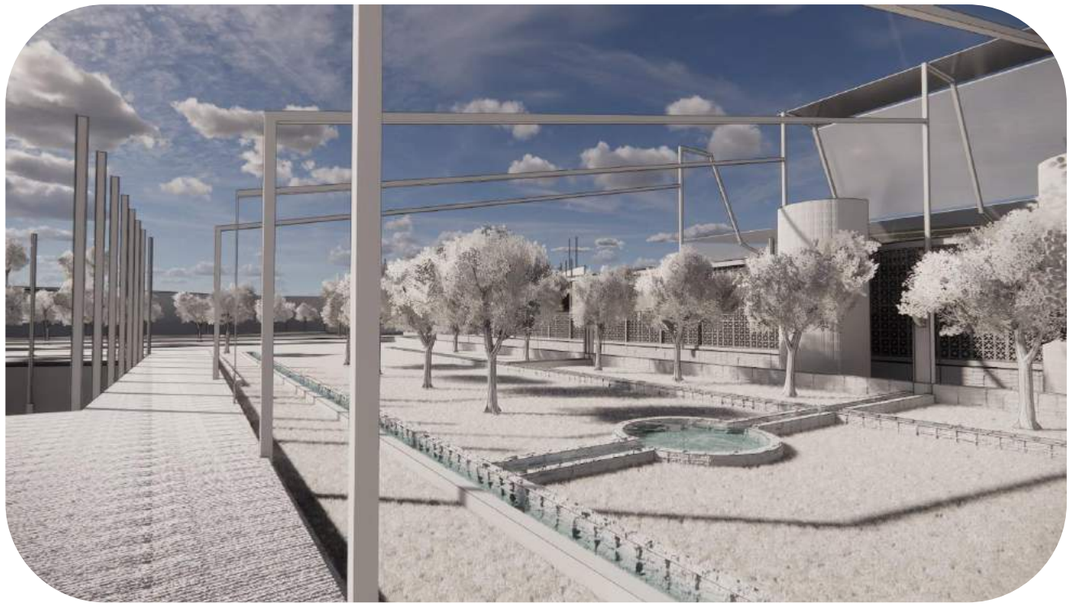
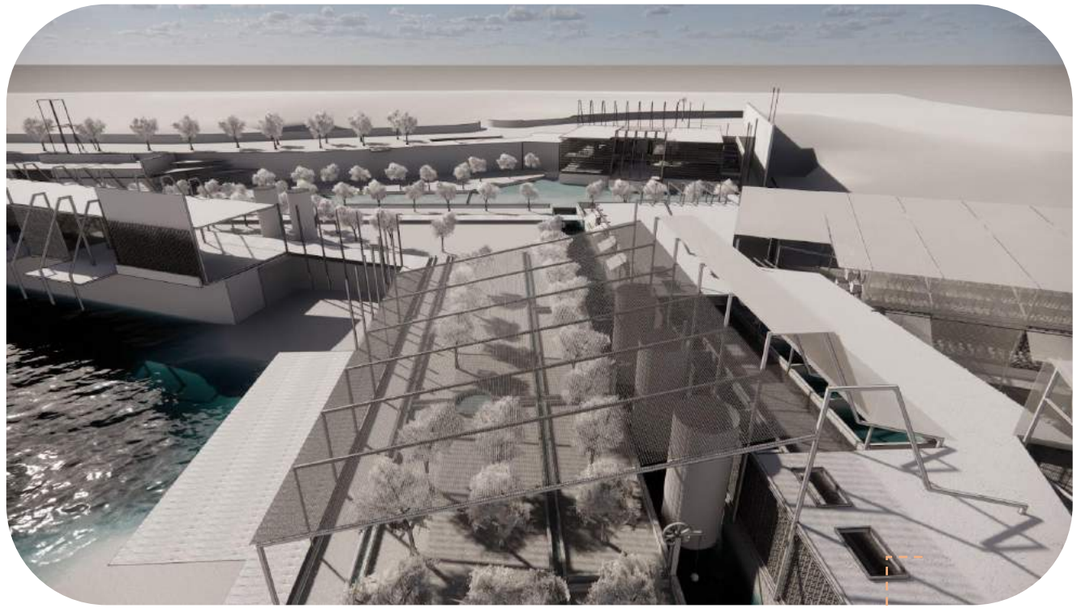


Figure 4.37: Melusi waterfront axonometric (Author 2021).



COMMUNITY FRUIT TREES AND WATER CHANNELS



OPEN PUBLUC SPACE INTEGRADED WITH SEMI-PUBLIC AQUAPONIC FARM

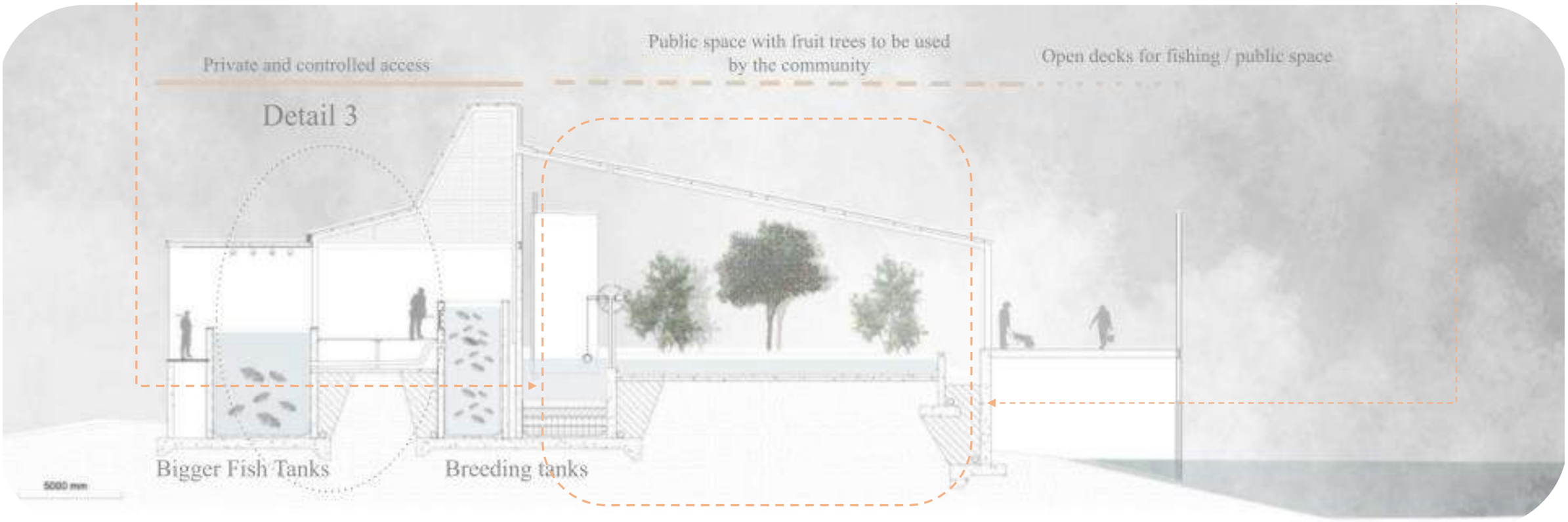


Figure 4.38: Section through aquaponic farm (Author 2021).

CHAPTER 05

TECHNÉ

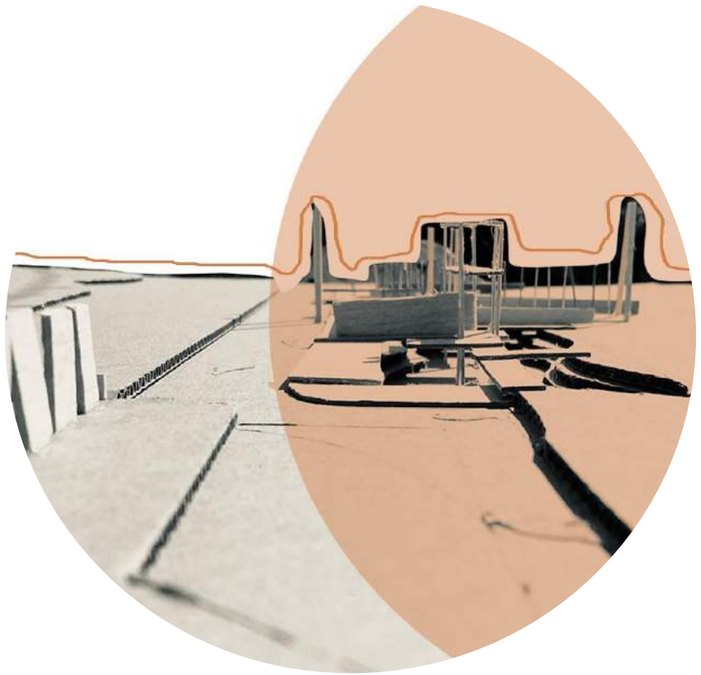


Figure 5.1: Concept model built by Author (2021), Illustrating the bridging (nexus) over the quarry hole.

A

TECHNICAL INTENT

Melusi, means Leader or Shepherd in Zulu

Melusi is an African origin name usually to define a strong group of people or person. Melusi means “Shepard” in Shona language and “Leader” in the Zulu language. The name of this community inspired the technical concept development (Names.org nd).

During fieldwork in the community, COPC researchers mentioned to the Reality Studio students that there is a strong sense of community and pride for Melusi and we could really feel the emotional connection the community have for their home. The technical concept is based on the principles of a leader and a shepherd or the backbone of the community. The project responds to the fact that there is already an emotional connection to Melusi but not a physical connection or intervention that the community really can rely on.

The following leader principles have been identified and how these personifications manifests into the technical principles, methods, and materiality.

TECHNICAL INTENT

Melusi, means Leader or Shepherd in Zulu

Figure 5.2: Backbone of Melusi diagram (Author 2021).

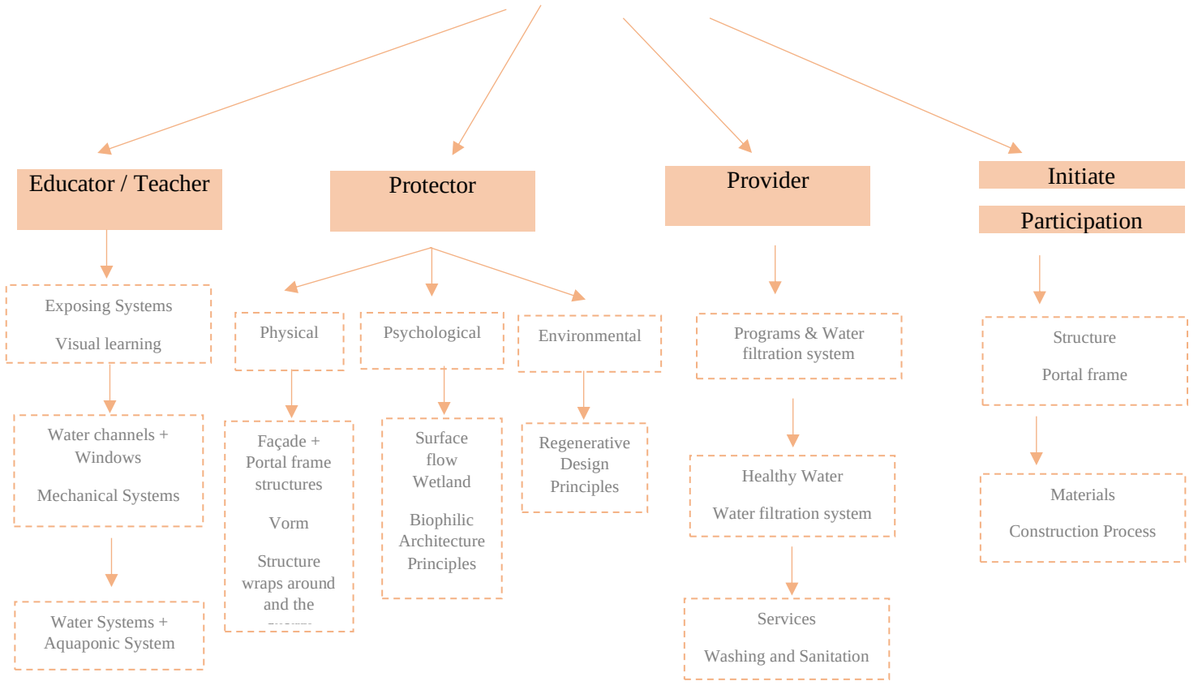


Figure 5.3: Diagram illustrates the technical concept being personified as a Leader or Shepard (Author 2021).

TECHNICAL INTENT

Melusi, means Leader or Shepherd in Zulu

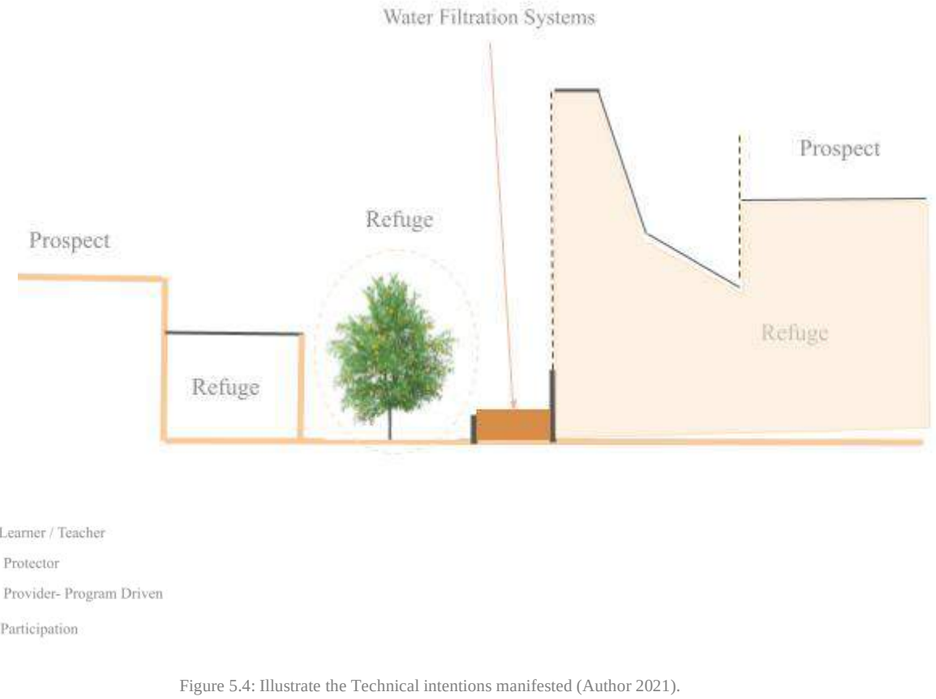


Figure 5.4: Illustrate the Technical intentions manifested (Author 2021).

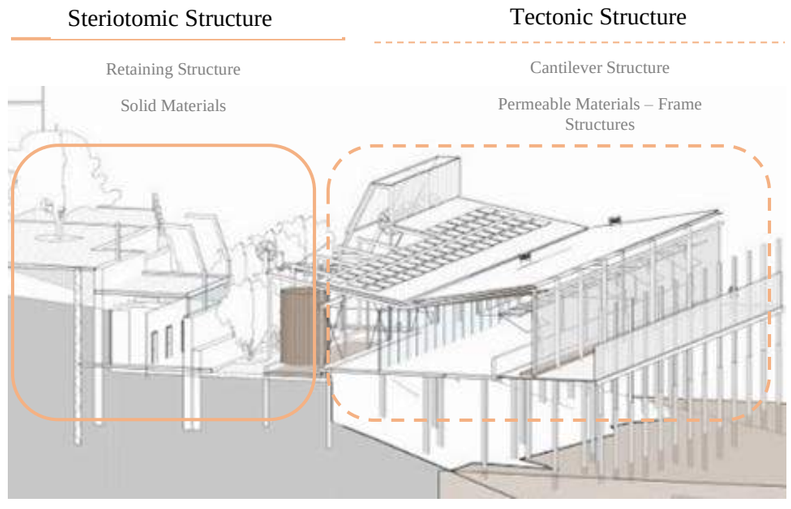


Figure 5.5: Illustrate the integration of seriocomic structure merges into Tectonic structure as the intervention stetches over the quarry hole (Author 2021).

TECHNICAL INFORMANTS

BIOPHILIC ARCHITECTURE PRINCIPLES

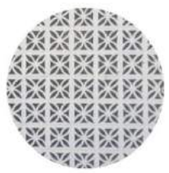
The following biophilic architecture principles manifests in the Melusi waterfront based on (Soderlund & Newman 2015).

PHYSICAL INFORMANTS

Visual Connection with Nature

Manifests through materiality choice

Breeze blocks



Glass bottles

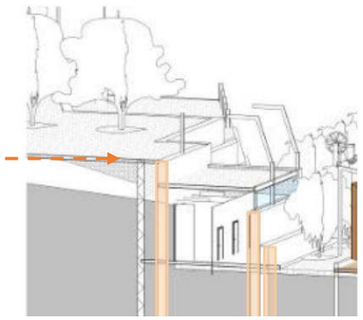
Non-visual connection to Nature

Manifestation through surface flow wetland, and cooling membrane rope mesh wall

Surface flow wetland

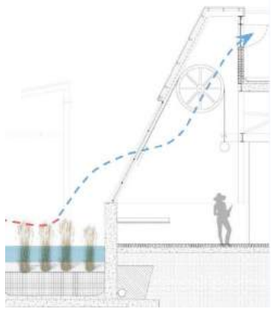
Manifested through material choice

Gabion Walls

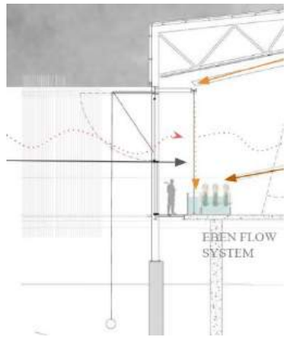


Access to Airflow

Manifests through cross ventilation strategies and colling of air with water membranes



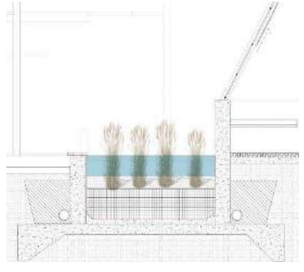
Cross ventilation



Using water membranes as cooling mechanism

Presence of water

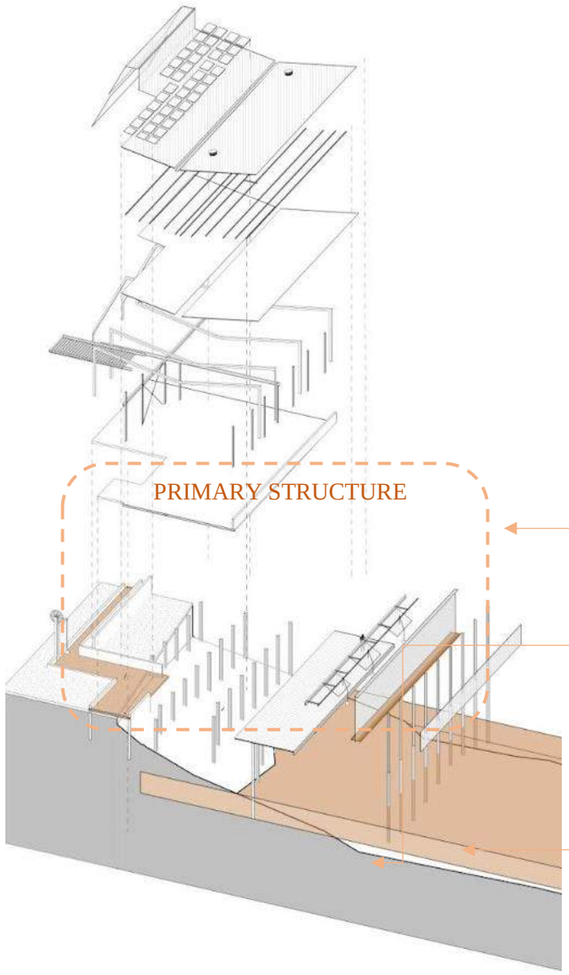
Manifests through cross surface flow wetlands



B

STRUCTURAL INTENTIONS

Nexus ad structure bridging



The structural intention and informant are to become a “nexus” or bridge.

The concept of bridge is conveyed into Portal frame structures. The portal frame structures also become the backbone and loadbearing elements. The infill elements such as walls and facades will be non-loadbearing elements

SECONDARY STRUCTURE

Cantilevering decking and pile foundations

TERTIARY STRUCTURE

Infill walls

Figure 5.6: Extruded structural intention (Author 2021).

STRUCTURAL TIMELINE & PROCESS

Phases of construction

PHASE 1

Due to the scale of this intervention and its location in a community with limited financial resources (funded by the Municipality) it is proposed to have a phased approach with the implementation. The ideal is to focus on the main design intentions in the first phase. The proposed process will be as follow:

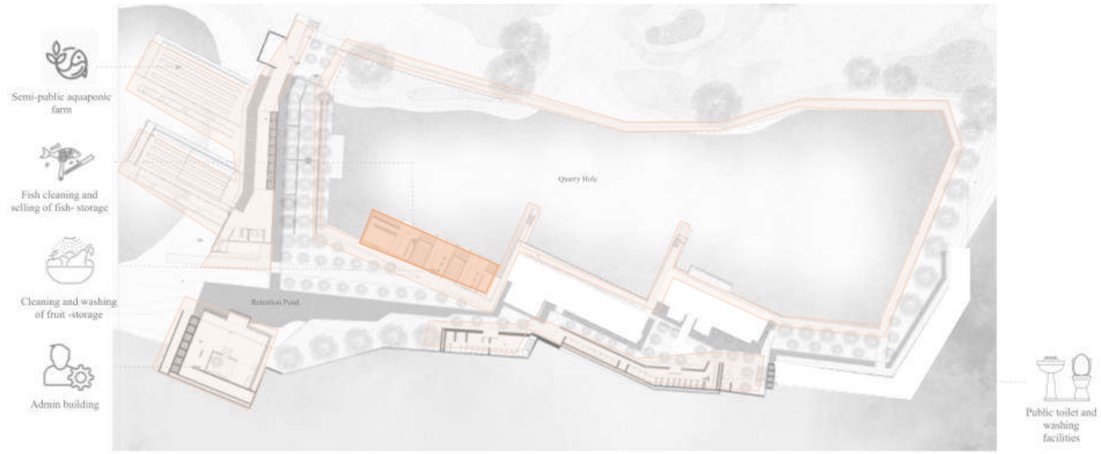
Phase 1: The phase will focus to make the existing dangerous steep quarry edge a safer public space. Construction of the main walking decks as well as the Aquaponic farm, admin building and the services. The first phase will also implement all the water filtration systems as seen in figure 5.7.

01

Figure 5.8: Floor plan Illustrate the first phase of construction (Author 2021).

02

Phase 2: The construction of the working spaces where the cleaning of fish (produce and storage facilities will be located. The storage facilities will store the produce produced by the aquaponic farm. This facility will supply multiple work opportunities.



Ground Floor Plan

Figure 5.9: Floor plan illustrate the second phase of construction (Author 2021).

03

Phase 3 will entail the construction of the biodegradable soap factory. The factory aims to supply the community with soap which enables the community to recycle grey water.

Figure 5.10: Floor plan illustrate the third phase of construction (Author 2021).

04

Ground Floor Plan

Figure 5.11: Floor plan Illustrate the fourth phase of construction (Author 2021).

Phase 4: This phase will entail the construction of the laundry facility as seen in figure 5.11.

Phase 5: The final phase will entail the construction of the market space as seen in figure 5.12.

05

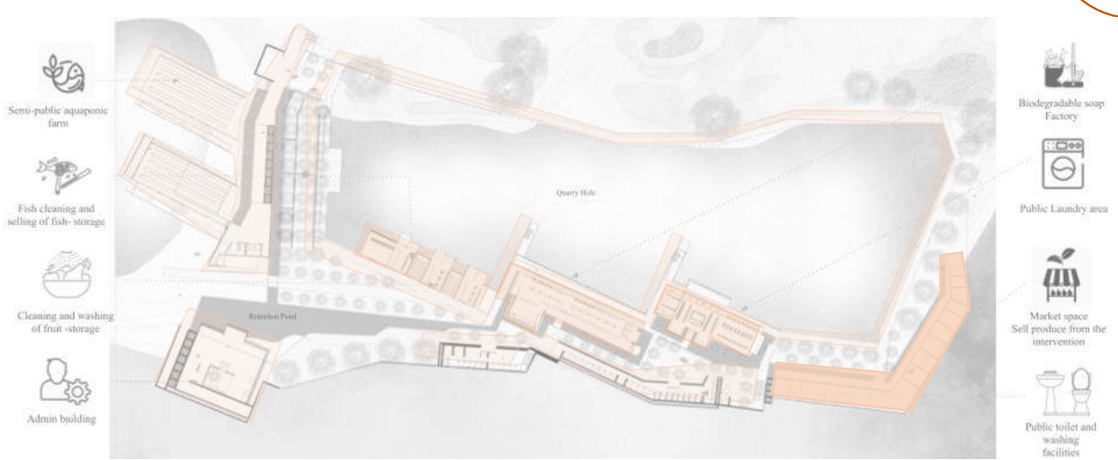


Figure 5.12: Floor plan illustrate the five phases of construction (Author 2021).

C

MATERIALITY

Phases of construction

Melusi Waterfront

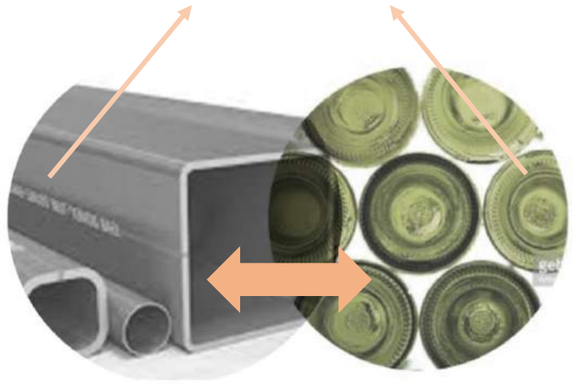


Figure 5.13: Nexus between materials available on site and materials prefabricated off site towards co-evolution and co-existence (Author 2021).

MATERIALS

Structural materials

Steel portal frame structure
Prefabricated

Gabion Structure

Off shutter concrete retaining walls

Eco-bricks Retaining walls

	STRUCTURE TYPE	FUNCTION	ENABLES CO-EVOLUTION
Steel portal frame structure Prefabricated	Tectonic structure	Load bearing Cantilever over	● ○ New introduced / Available materials
Gabion Structure	Stereotomic structure	Retain slope Enhance Community participation	● ● New introduced / Available materials
Off shutter concrete retaining walls	Stereotomic structure	Retain slope	○ ● New introduced / Available materials
Eco-bricks Retaining walls	Stereotomic structure	Retain slope	○ ● New introduced / Available materials

Figure 5.14: Illustrate how the structural materials are mostly from practices and technology from professionals to ensure structural stability (Author 2021).

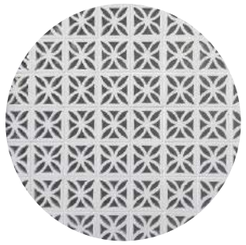
It is visible in figure 5.14 that the gabion walls and the eco-bricks retaining walls aims to increase community participation during construction process.

MATERIALS

Infill Materials

Red Clay Bricks

STRUCTURE TYPE	FUNCTION	ENABLES CO-EVOLUTION	
Stereotomic structure	Infill walls	● Newly introduced	○ Available materials



Precast Breeze blocks

STRUCTURE TYPE	FUNCTION	ENABLES CO-EVOLUTION	
Permeable Structure	Infill walls and Natural ventilation	● Newly introduced	○ Available materials

Recycled Wine Bottles

STRUCTURE TYPE	FUNCTION	ENABLES CO-EVOLUTION	
Tectonic Structure	Infill walls and natural daylight	● Newly introduced	○ Available materials

Exterior floor materials

Composite Decking

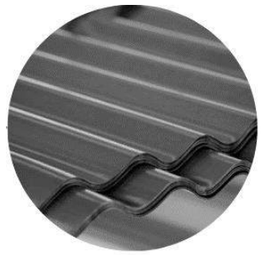
STRUCTURE TYPE	FUNCTION	ENABLES CO-EVOLUTION	
Tectonic Structure	Cantilever over Quarry hole	●	○

MATERIALS

Roof Materials

Polycarbonate corrugated sheeting

STRUCTURE TYPE	FUNCTION	ENABLES CO-EVOLUTION	
Tectonic structure	Let in Natural Day light	●	●



Corrugated Sheeting

STRUCTURE TYPE	FUNCTION	ENABLES CO-EVOLUTION	
Tectonic structure	Span distances	●	●

Interior materials

Red Clay Bricks

STRUCTURE TYPE	FUNCTION	ENABLES CO-EVOLUTION	
Stereotomic Structure	Extending streetscape to interior. Reduce maintenance	●	○

Figure 5.15: Material palette (Author 2021).

MATERIAL USAGE

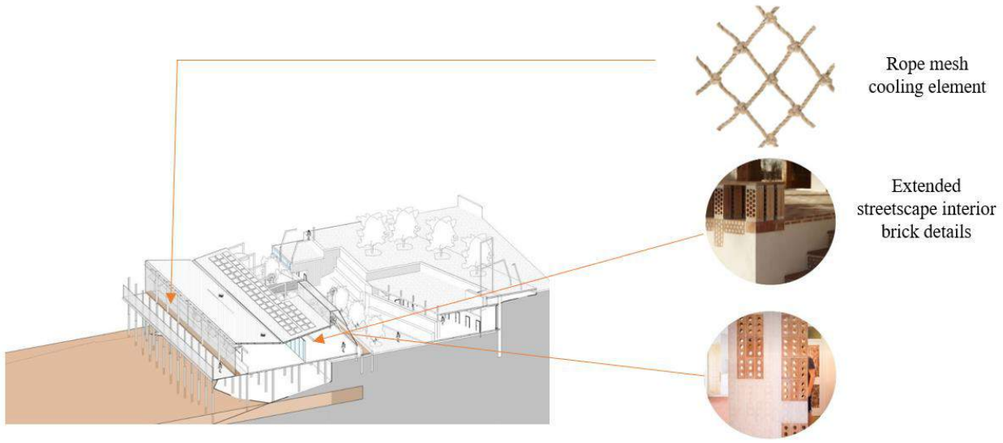


Figure 5.16: Axonometric cut through the Northern Slope of the Quarry edge indicating the main road (Author 2021).

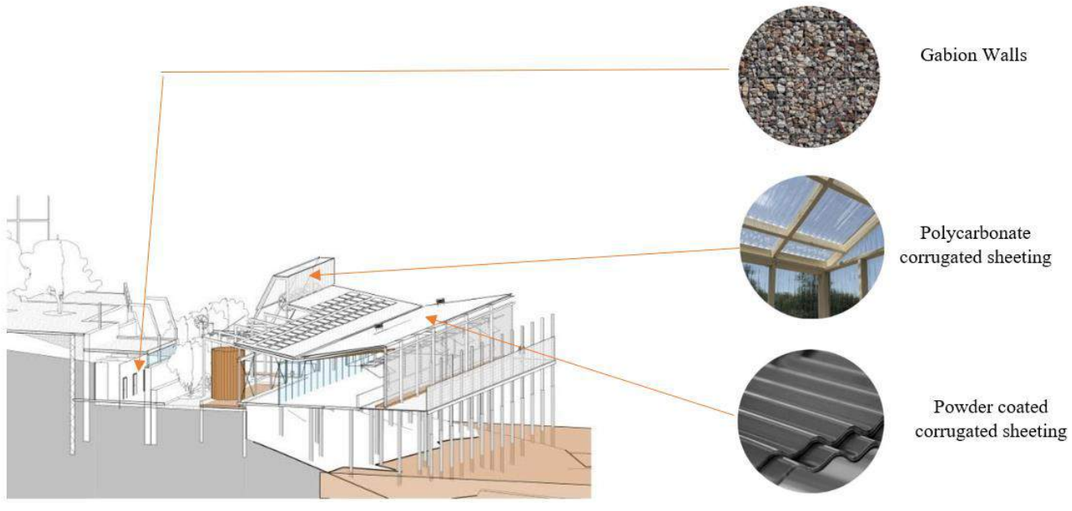


Figure 5.17: Axonometric cut through the Biodegradable soap factory illustrating the cantilevering structure over the quarry (Author 2021).

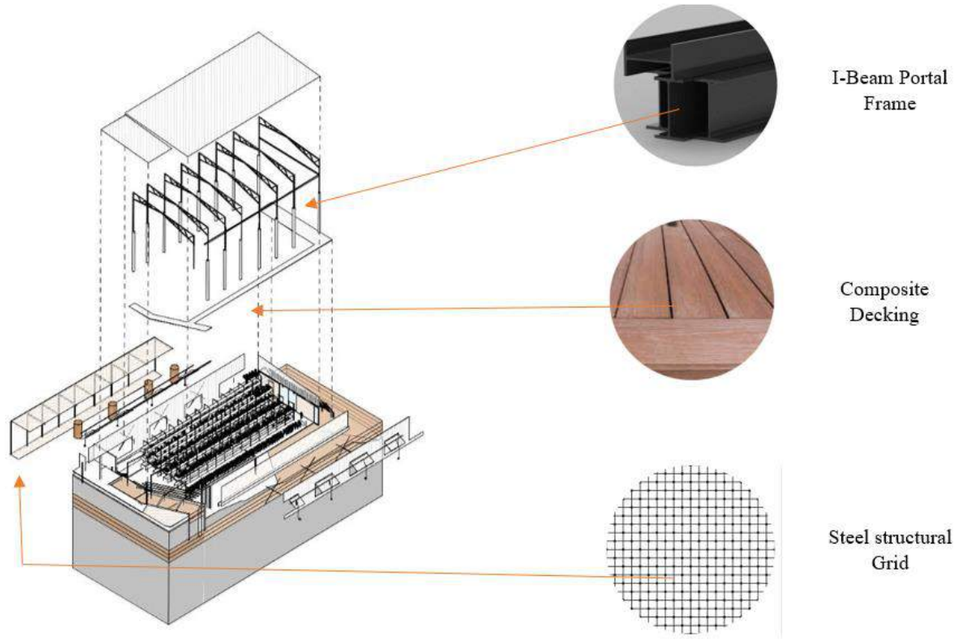


Figure 5.18: Axonometric of the aquaponic structure showcasing the portal frame structure (Author 2021).

STRUCTURE INTENTION IN TERMS OF PROCESS AND PARTICIPATION

The structural intention aims to always protect the user by utilising a portal frame structure with the potential to add to the structure to adapt to alternative conditions or uses. This will be achieved through infill non-loadbearing walls making it possible for community participation and co-construction to ensure successful transference of ownership. This process will work as follows: The portal frame structures will be designed and manufactured by engineers to ensure the structural safety and well as with the implementation and installation on site leaving the “Backbone” for the community to construct all the infill panels and walls. The steel portal frame makes it to add light weight layers to the primary structure. This ensured that the intervention function as a living organism, functioning as a closed loop system growing, moving, and changing when users interact with the intervention see figure 5.18.

STRUCTURAL INTENTION IN TERMS OF PROVIDER

The structure encapsulates into the role of the provider by accommodating growing and cooling membranes implemented in the intervention. The gabion walls retaining the upper walkway acts and become a planter wall for herbs and flowers needed in the biodegradable factory for aroma scents. The intention is to introduce an indoor-outdoor working condition extending the factory towards the outdoors where employees must harvest the fresh herbs and flowers to make the soaps. The structure also provides in terms of the programs chosen for this intervention. The structure also provides for optimal natural light especially on the southern façade as seen in figure 5.20. The chimney façade that wraps around the edge of the roof allows for natural sunlight to enter the building.

Figure 5.19: Site section through the laundry facility (Author 2021).

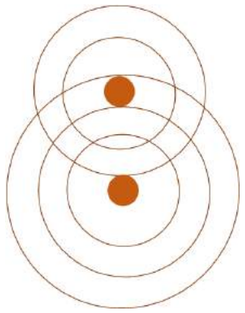
STRUCTURAL INTENTION IN TERMS OF PROTECTOR

The structure needs to protect not only inhabitants physically but also emotionally. Biophilic architecture design principles will be implemented to ensure well-being (Abdelaal & Soebarto 2018), as per discussed in chapter 1 and in figure 1.54-1.55. It is also the role of the architecture to protect the environment through responsible regenerative design principles to reduce the resources needed to operate as well as to ensure for optimal indoor comfort see figure 5.46-5.49.

STRUCTURAL INTENTION IN TERMS OF EDUCATOR

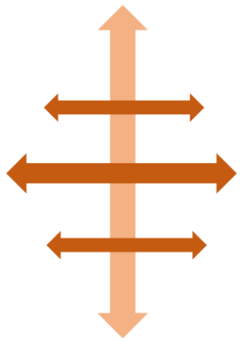
The intention is to expose most of the systems and how they function. As didactic systems inhabitants can observe and learn through observing them. Through teaching, it should inspire the viewer to apply mechanical systems and rain harvesting systems in their own structures in the community. It is also intended for the water channels to be exposed and by having mechanical channel openers for the community to participate in the stewardship of the community fruit trees.

HOW DOES THE TECHNICAL CONCEPT AID CATALYTIC NEXUS?



CATALYST

(Momentum)



NEXUS

(Bridge)

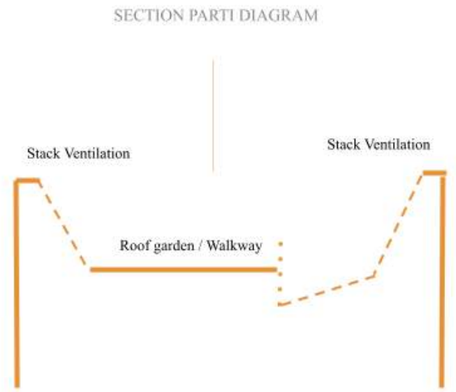
CATALYST

The technical catalyst lies in the structure as an educator, where the exposed systems awaken enticement, curiosity, and mystery. This phenomenon provides a sense of being teased which allows the user to investigate the space with curiosity. When a space has mysterious loci, it provides the desire to move deeper within the space and restore cognitive restoration (Kaplan, 1995). This will be the start of the momentum towards more complex residences and informal structures slowly improving Melusi through new knowledge and skills learned during the construction process of Melusi waterfront. The community members will undergo multiple workshops prior to the construction process learning new skills such as how to make eco-bricks and how to construct with it. The second workshop will educate the members on how to construct with glass bottles and the third workshop will be on how to make biodegradable soap and why it is important to use the product to ensure healthy water recycling methods as mentioned in chapter 2 with the precedent analysis.

NEXUS

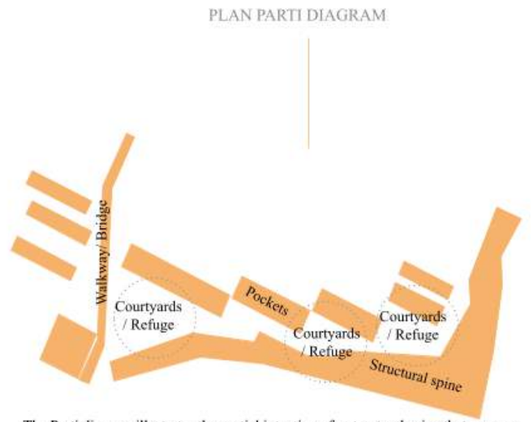
The technical Nexus lies in the physical bridge (north-south-axis) and in the threshold spaces where the structure integrates nature with the indoors, and through interior material choices. The intervention forms also a bridge between the community and the quarry hole. The bridge is articulated with permeable facades allowing the bridge to be visible and enable user interaction with the outdoors. One of the design intentions mentioned in chapter one stresses the need for safer and healthier public space, which is technically resolved by extending the exterior streetscape materials into the interior spaces.

TECHNICAL PARTI DIAGRAM



The Parti section illustrates the multiple opportunities for this roof structure being a platform and the diagonal wrap structure opens up the opportunities for a roof garden and the structure that wraps over the edges of the flat roof becomes the balustrade.

Figure 5.20: Parti section diagram (Author 2021).



The Parti diagram illustrates the spatial intention of a structural spine that merges with the existing street and the smaller pockets that feeds from the spine which cantilevers over the water body

This spine and pocket layout also creates possibilities of internal courtyards between the spine and the pockets.

Figure 5.21: Parti plan diagram (Author 2021).

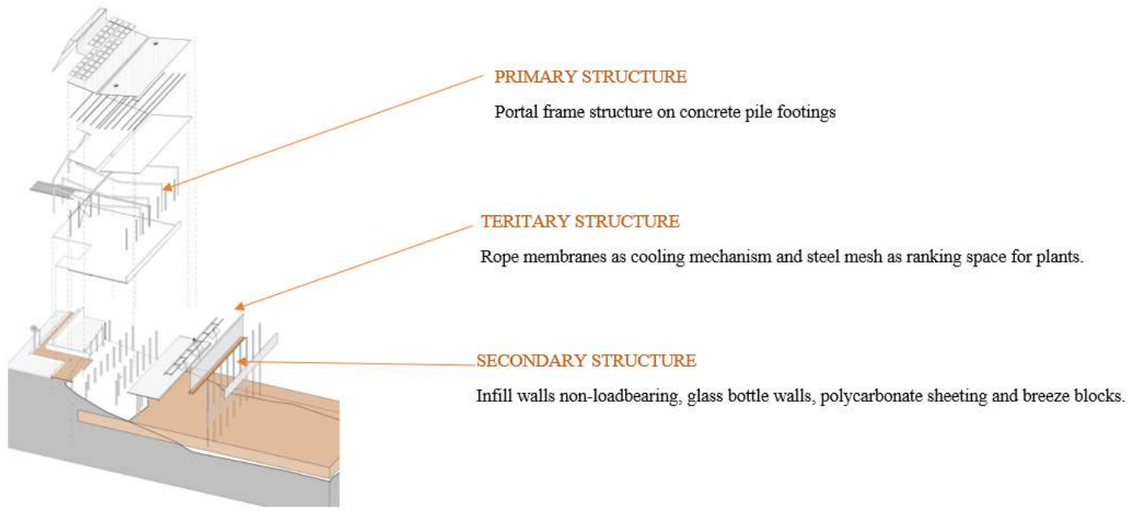


Figure 5.23: Axonometric of the structural configuration (Author 2021).

D

PRECEDENT STUDIES

Figure 5.24: Karoo Kafee aquaponic fish tanks (Author 2021).

PRECEDENT STUDIES

KAROO KAFEE- LYNWOOD ROAD PRETORIA

(Precedent for aquaponic systems)

Figure 5.25-5.26: Illustrates the natural fall of pumped water breaking the surface of the water which is the only way oxygen is achieved in the fish tanks. Photo by Author 2021 (Author 2021).

The author visited the Karoo Kafee Aquaponic Farm on 13 September 2021. This design informed the system proposed for Melusi Waterfront due to the minimal resources used to operate, sustain, and maintain the intervention. This entire system functions on gravity except for one regular pool pump. The pool pump pumps the water back to the top into the Tilapia fish tanks. Natural ways of putting oxygen into the water are visible in how the water falls onto the surface of the water as seen in figure 5.25-5.26. Another interesting fact learned was that their biggest client are shebeens located in townships for the Tilapia fish. Another benefit from this way of farming is that it has 8-week turnaround time to harvest crops. The business model is a linear system because profit can be received through the fish and the harvested vegetables and greens.

This system was also exposed the viewer could easily follow the process by only following the piped system see figure 5.27-5.28.

Figure 5.27: Illustrates the breeding fish tanks where smaller fish are carefully monitored and placed in new tanks once the fish grow. It is important to put fish of the same size in a tank because bigger fish will eat the smaller fish (Author 2021).

Figure 5.28: Illustrates the bottom planter which is an eben flow (Author 2021).

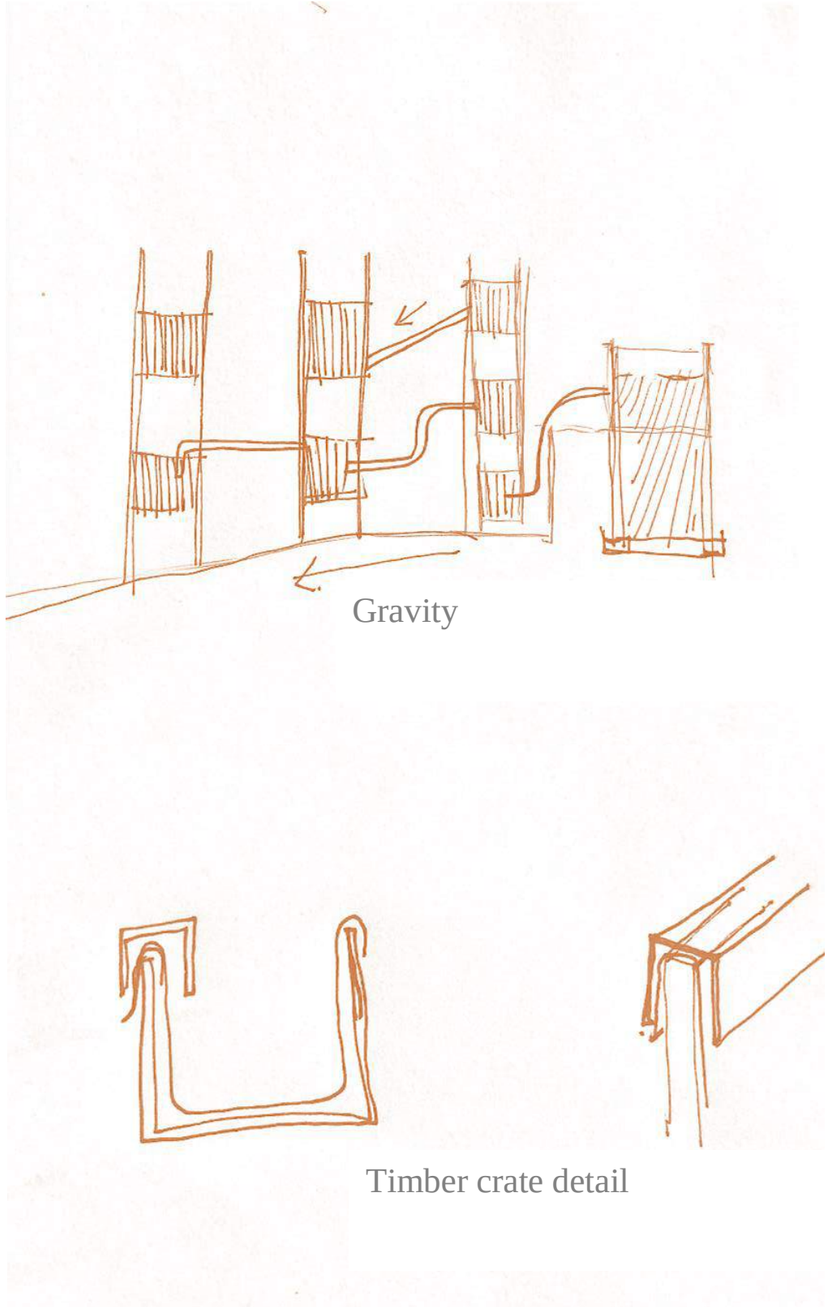


Figure 5.29: Concept drawing of the Karoo Kafee Aquaponic Farm (Author 2021).

GALLERY 242 STATE STREET- OLSON KUNDIG

(Precedent forMechanical systems)

RONDE SIRKEL VAN MECHANICAL SYSTEMS

Figure 5.29-5.30: Illustrates the Mechanical system which becomes a design feature (ArchDaily 2021).

This Gallery is a multifunctional space and by extending the interior to the exterior the architects replaced the front facade with a double- height floor to ceiling window which can be lowered and raised depending upon the need of the user (ArchDaily 2021). The wall is operated by a mechanical system and engine. This way of exposing systems will be applied in the Melusi Waterfront but will not be functioning with an engine but with a counterweight system where human power and movement will be needed to open windows.

Mechanical details will be used in the intervention to educate the community on how systems work and to keep the community engaged in the harvesting and growing of the fruit trees.

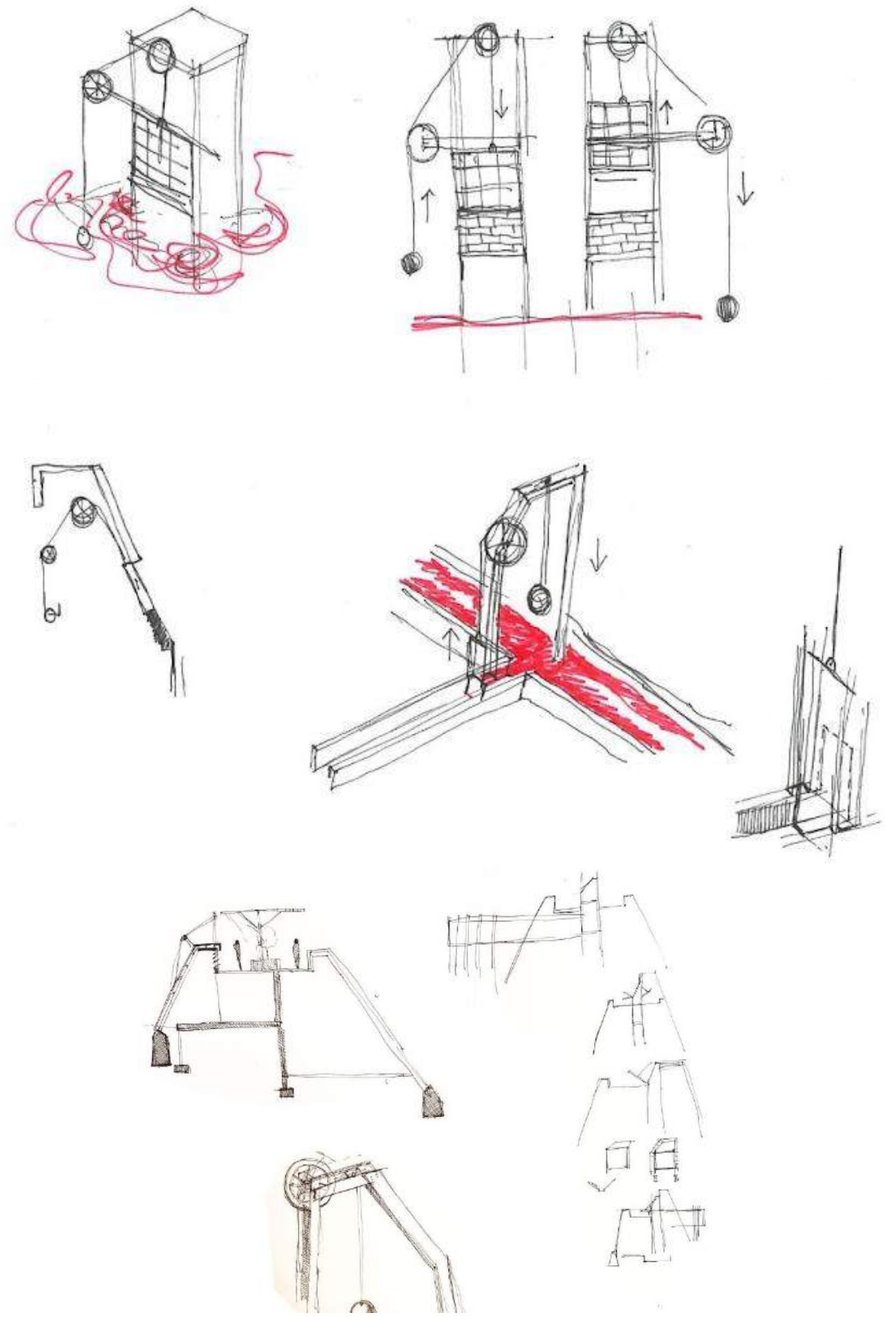


Figure 5.31: Concept drawing of mechanical system (Author 2021).

SILINDOKULE CRESH, GQEBERHA

(Precedent for infill non-loadbearing walls)

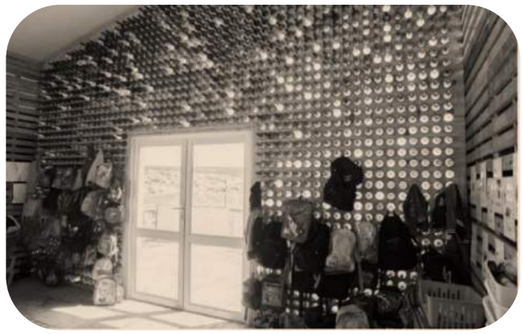


Figure 5.32: Illustrates the beautiful natural light the glass bottles give to the interior quality (Chapman 2019).

Figure 5.33: Timber portal frame structure filled with glass bottles (Chapman 2019).

This crèche inspired Melusi waterfront to non-loadbearing walls which is also called infill walls which contributes to community participation and community engagement. This will also lower the construction cost due to the use of recyclable materials. This method of construction is a good balance between the community and the construction team contributing to the process.

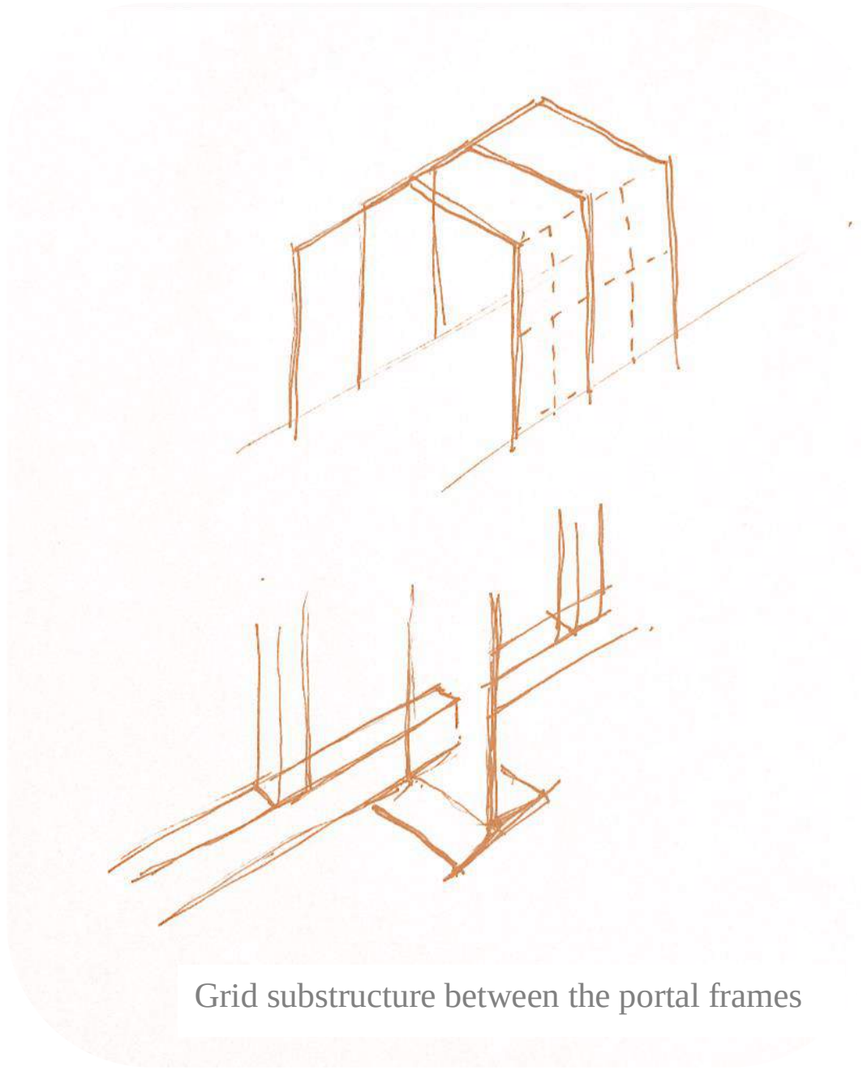
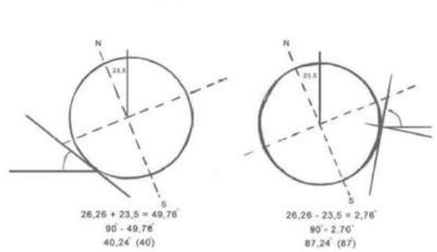


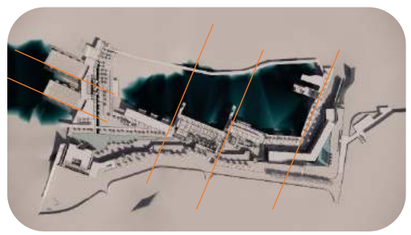
Figure 5.34: Concept detail of portal frames and glass bottles (Author 2021).

SITE INFORMANTS

Orientation and Solar Angles

Manifestation through building orientation

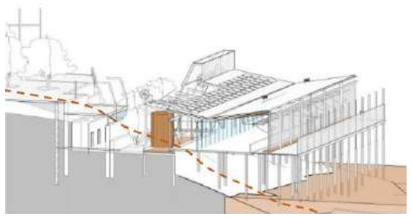




Building is tilted 15 degrees towards East for optimal solar radiation

Slope of site

Manifests in the cut and fill site results in terraced intervention



Water Levels

Due to the uncertainty of the water level fluctuations the structure cantilevers over the quarry hole

Island in Quarry

The quarry consists out of an island which makes it possible for intervention stretching over the quarry hole

Figure 5.35: Site informants incorporated into the design (Author 2021).

E

SYSTEMS

WATER FILTRATION

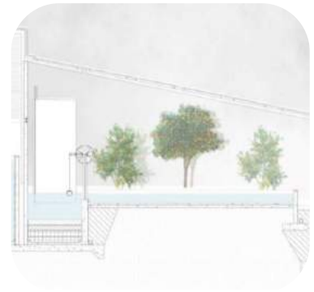
MECHANICAL SYSTEMS

AQUAPONIC SYSTEM

Water Filtration system

(Vosloo 2017)(Touter & Mauck 2017)

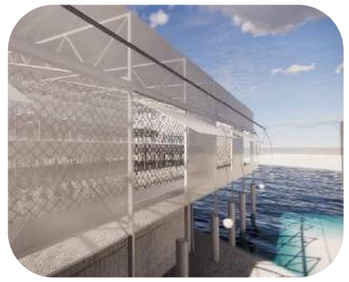
Surface flow wetlands



Mechanical Systems

(ArchDaily n.d)

Counterweight pulley systems



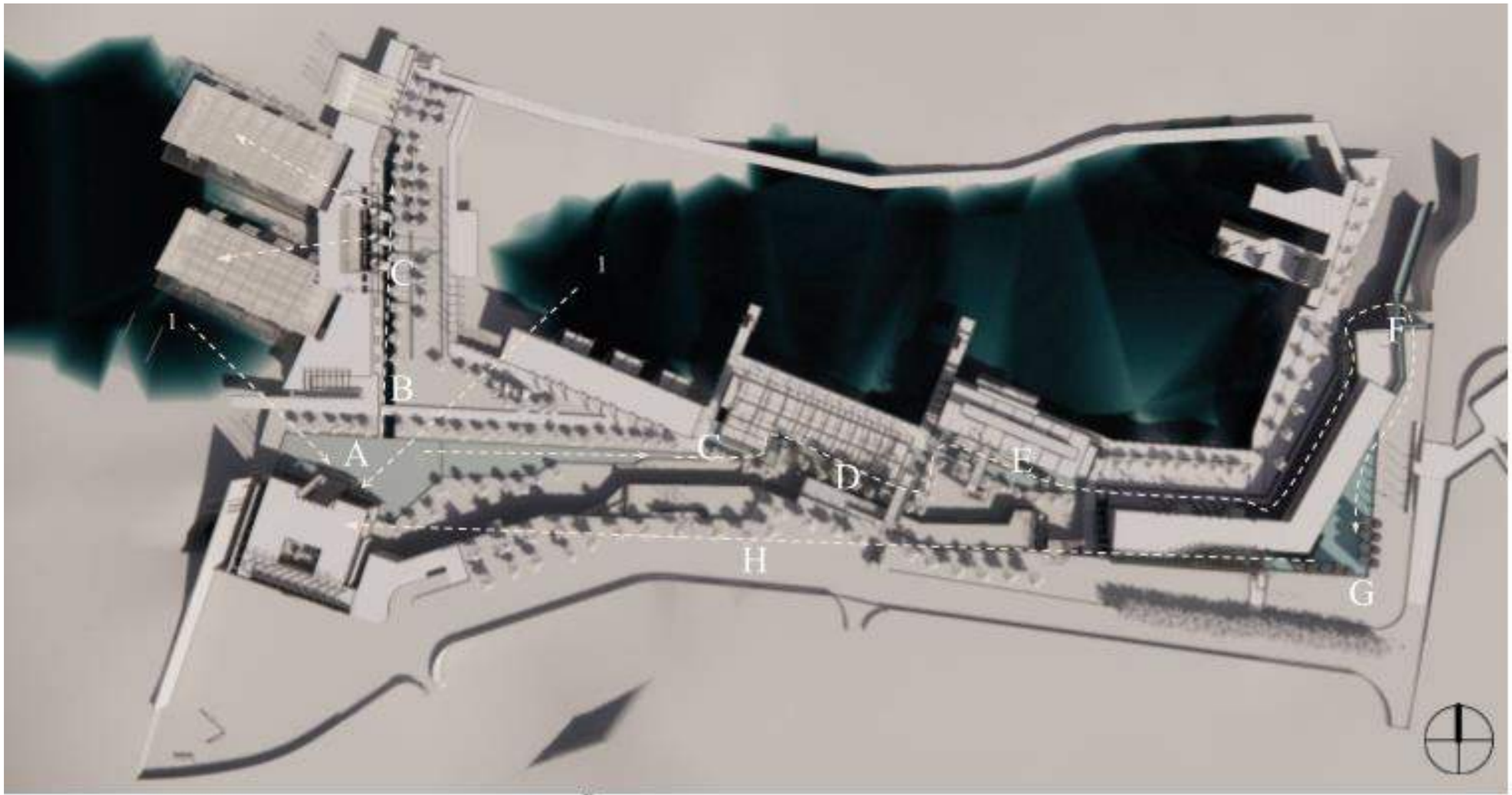
Aquaponic system

(De Kock 2015)

Counterweight pulley systems

Figure 5.36: Mechanical systems manifested in the intervention (Author 2021).

WATER FILTRATION SYSTEM



1 Water is pumped from the quarry to the admin building filtration Reed bed

2 UV Irradiation water flows in two directions into surface flow wetlands using wetland plants

3 Filtered water are pumped into tanks to be used in the aquaponic system where only a 3% top up is needed with fresh water every month.

A Reed bed

B UV Irradiation

C Surface Flow wetland

D Clean water pumped into storage tanks to be distributed to the soap factory

E Clean water pumped into storage tanks to be used by the laundry facility

E Clean water pumped into storage tanks to be used by the laundry facility

F UV Irradiation

G Water pumped into tanks for drinking water

H Water pumped to reed bed

Figure 5.37: Top view of Melusi Waterfront filtration process (Author 2021).

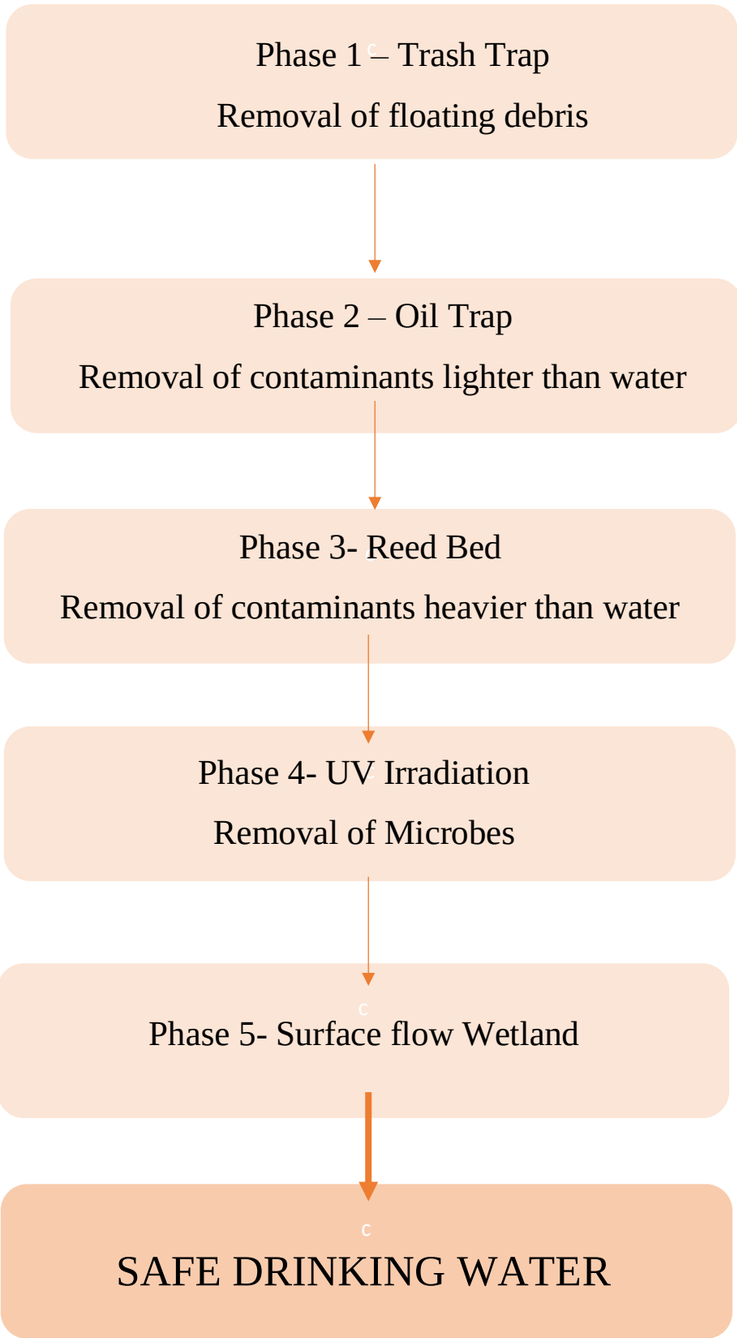


Figure 5.38: Diagrammatic representation of the water filtration system (Smit 2018).

Stormwater catchment

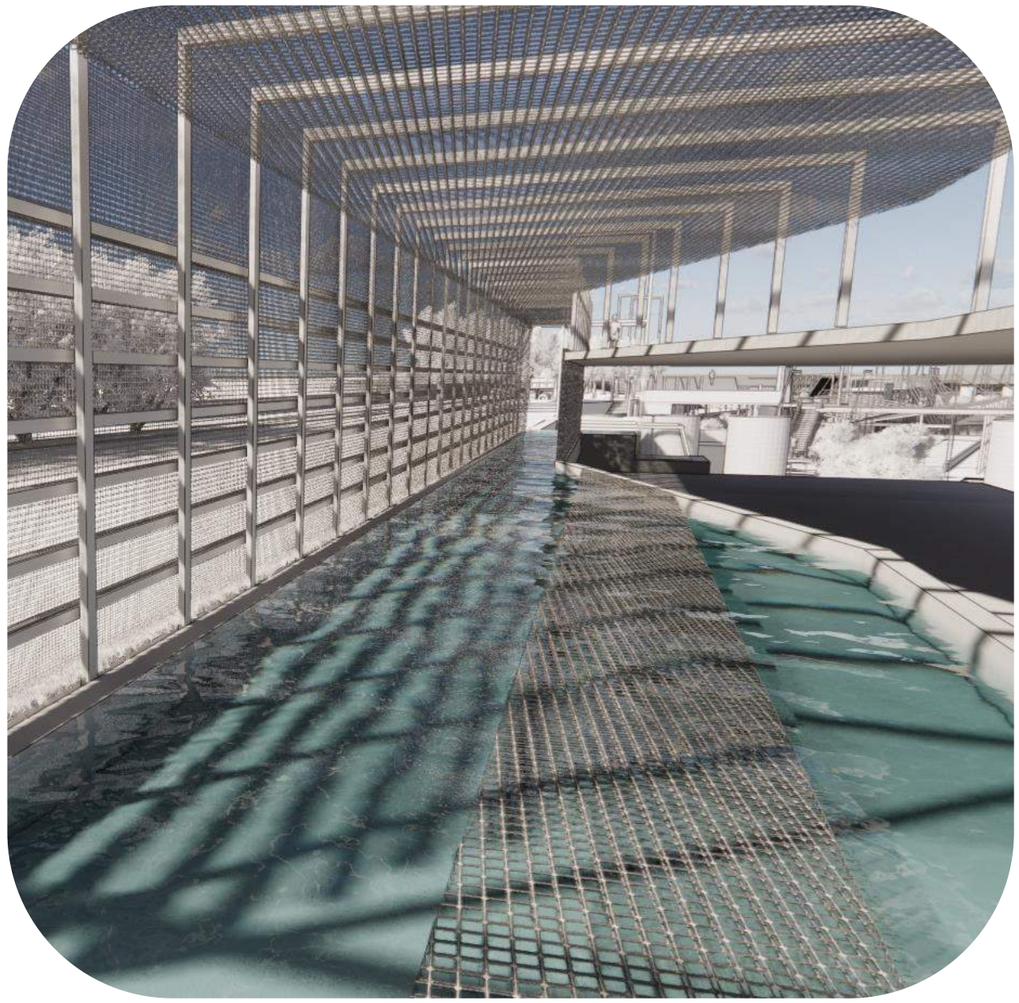


Figure 5.39: Diagrammatic representation of the stormwater catchment system (Author 2021).

The water filtration system is the main system of this intervention. The intention is to expose the water filtration system for passive education and observation. The water filtration system runs through the entire site linking in with the other programs supplying the program with fresh water. The smaller buildings supply the water filtration system with grey water. Rainwater is also connected to the water filtration system. The Filtration system starts at point A as per figure 5.37. The filtration process starts with a reed bed where the water then undergoes UV radiation. The water flow splits into two directions. The first direction is north, flowing towards the aquaponic system. The water flows slowly across the surface flow wetland until the water gets pumped into the water tanks. These water tanks supply the freshwater tilapia fish of new fresh water as needed. The water in the surface flow wetland is also used for the watering of the fruit trees through the mechanical channels.

The second route is as follows: The water runs slowly on the surface flow wetland towards the biodegradable soap factory where the fresh water then gets pumped into tanks and is used to make soap. The surface flow wetland also supplies the laundry facility of fresh water to wash clothes. The grey water used by the laundry facility is stored in a tank and pumped back to the reed bed starting point of the water filtration system. The end point of this water filtration system is point G, which is the water collection point, which is safe to drink.

STORMWATER HARVESTING SYSTEM

The service road makes it possible to catch stormwater in a channel that feeds into an oil trap removing all oils and then feeds into the reed bed filtration system as seen in figure 5.40.

Figure 5.40: Top view of Melusi Waterfront showcasing the stormwater catchment system (Author 2021).

SANITATION SYSTEM

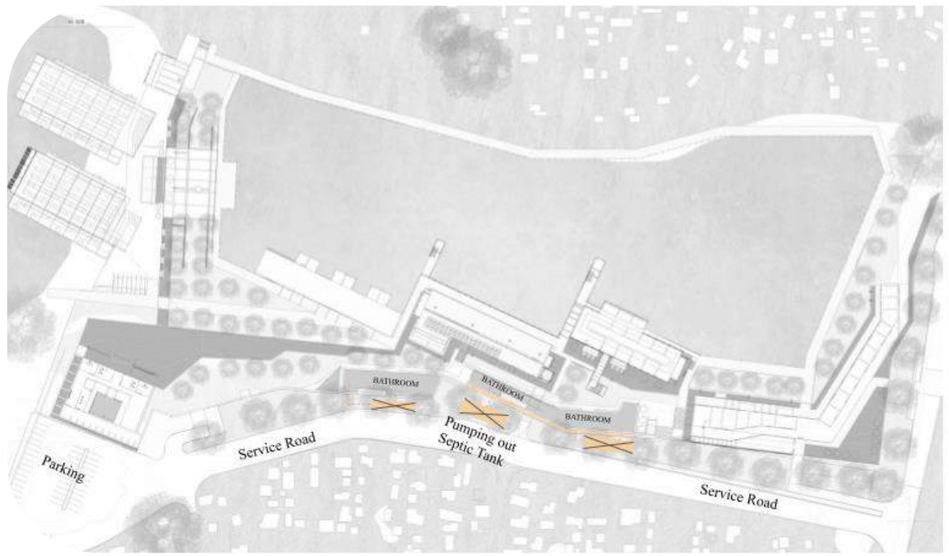


Figure 5.41: Illustrate the location of the conservancy tanks in the retained soil near the bathrooms for easy access to be pumped out by municipal sewage works (Author 2021).

Due to no municipal connection to the mainstream sewage lines conservancy tanks will be used to store the sewage. The municipality will have to empty the tanks regularly due to the high traffic users. The service road makes is possible for a truck to empty the tanks. Only the brown water will be linked with the conservancy tanks, the hand wash basins, showers, and bathtubs (grey water) will be connected to the water filtration system. Biodegradable soap will be used at all facilities, such as laundry and bathroom facilities, which allows the water to be recycled.

WATER CALCULATIONS

Yield Water Calculations

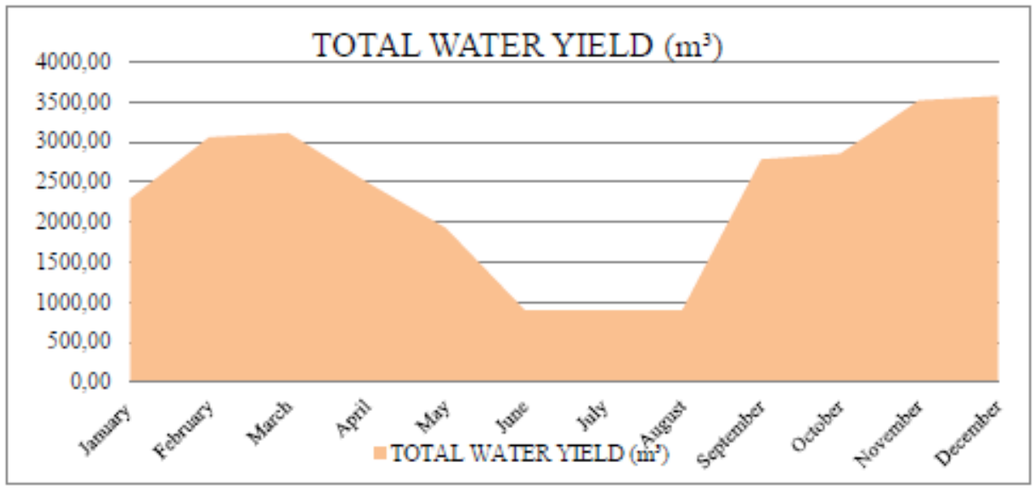


Figure 5.42: Yield calculations of proposed intervention (Author 2021).

Demand Water Calculations

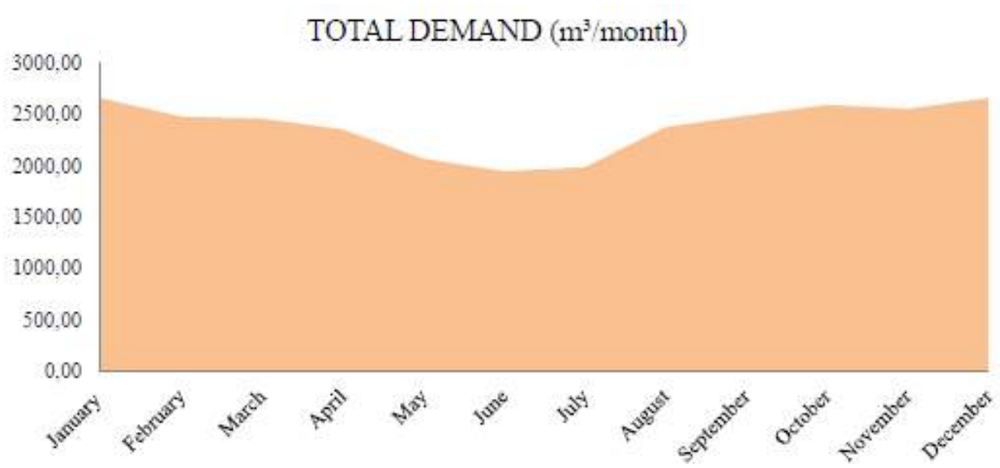


Figure 5.43: Demand water calculations for proposed intervention (Author 2021).

WATER CALCULATIONS

Water Budget Calculations

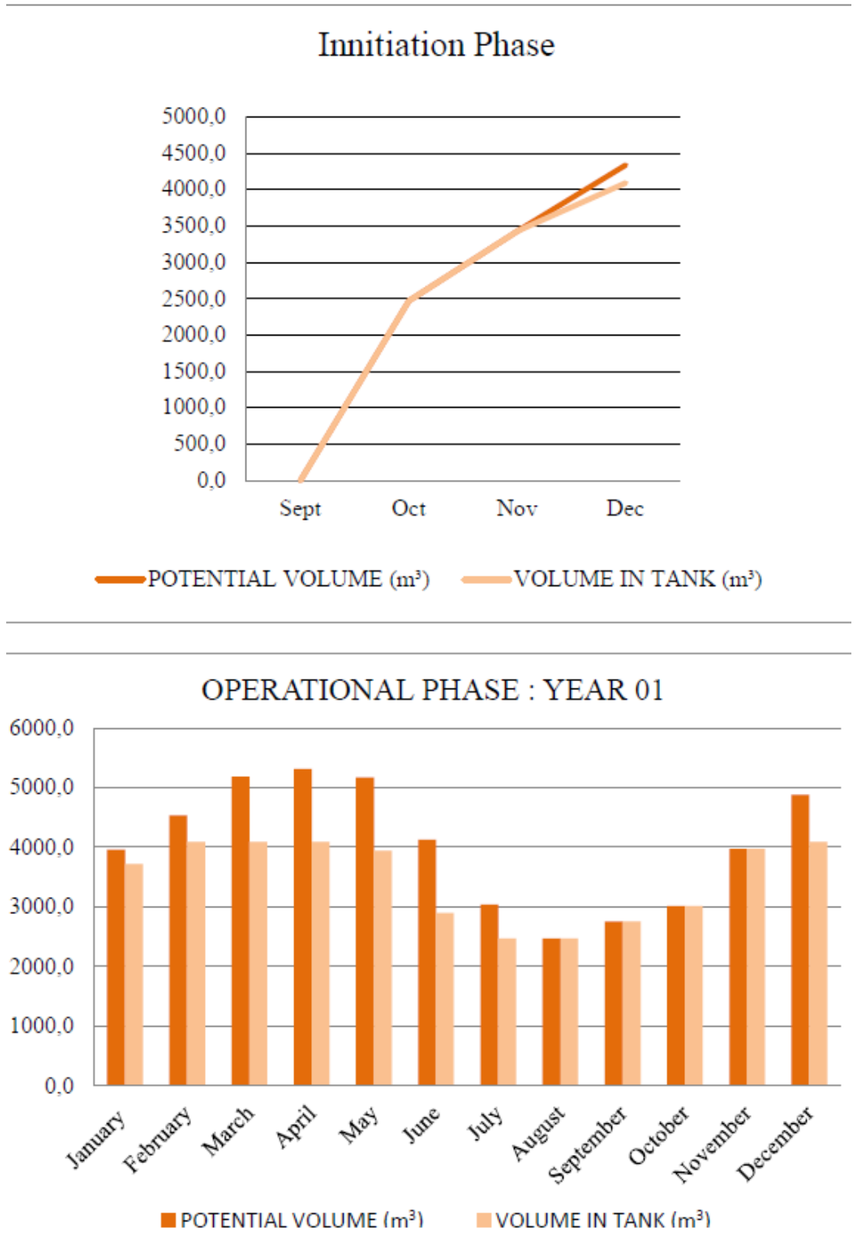


Figure 5.44: Water budget calculations for proposed intervention (Author 2021).

CONCLUSION

In conclusion, the water calculations confirm that rain water harvesting will mostly be sufficient to sustain the intervention in a sustainable manner. As seen in Table C2 (figure 5.44) one can see that the water collected form the site willprovided 58% of the water use.Therefore it is proposed to use from the quarry hole's water to fill up the tanks during the winter period with limited available water. The demand is not extensively more than the yield and therefore can be solved by filtering quarry hole water into safe drinking water and be stored into emergency storage tanks.

*Please read this conclusion in conjunction with Annexure A.

SUSTAINABLE BUILDING ASSESSMENT TOOL

Melusi Waterfront rated a 3.9 / 5 on the SBAT (Sustainable Building assessment Tool) see figure 5.45. Categories such as reducing transport, water efficiency, inclusion, education, health and resource use all rated above 4/5. Other categories still need more attention in future projects in Melusi.

SEFAIRA DAYLIGHTING

The Sefaira tool have been used to determine the effect of a southern tower to the indoor quality. Due to the nature of the facility only operating in normal office hours (8:00-17:00) the mazimum daylight is needed to illuminate the interior to reduce alternative recources such as artificial lighting. The basecase indiacted that the interior quality would be mostly underlit and in the tower profile the interior is mostly overlit see figure 5.46-4.49. Therfore the tower profile has been selected. This profile also improves natural ventilation through stack ventilation.

SUSTAINABLE BUILDING ASSESSMENT TOOL RESIDENTIAL
1,04

	Achieved
SB SBAT REPORT	**3,9**

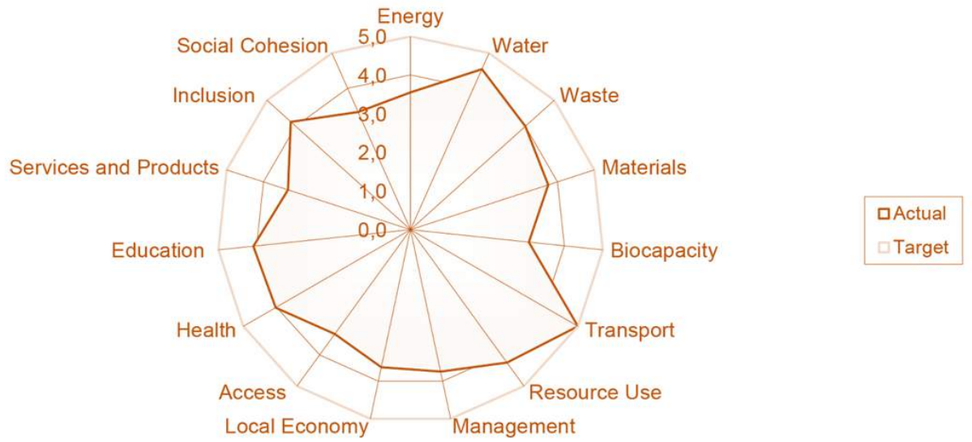
SB1 Project

0

SB2 Address

0

SB3 SBAT Graph



SB4 Environmental, Social and Economic Performance	Score
Environmental	3,8
Economic	4,0
Social	3,8
SBAT Rating	3,9

SB5 EF and HDI Factors	Score
EF Factor	3,9
HDI Factor	4,0

SB6 Targets	Percentage
Environmental	76
Economic	80
Social	76

SB7 Self Assessment: Information supplied and and confirmed by

Name Jua Greeff	Date	08-11-2021
Signature		

Figure 5.45: SBAT rating for the new intervention (SBAT 2021).

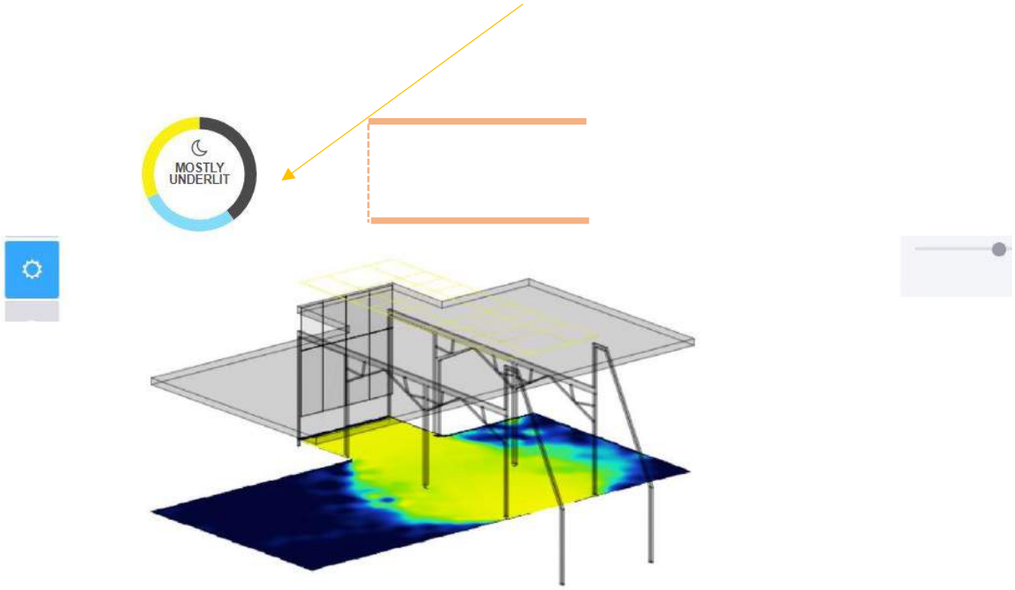


Figure 5.46: Sefaira base case illuminance rating (Sefaira 2021).

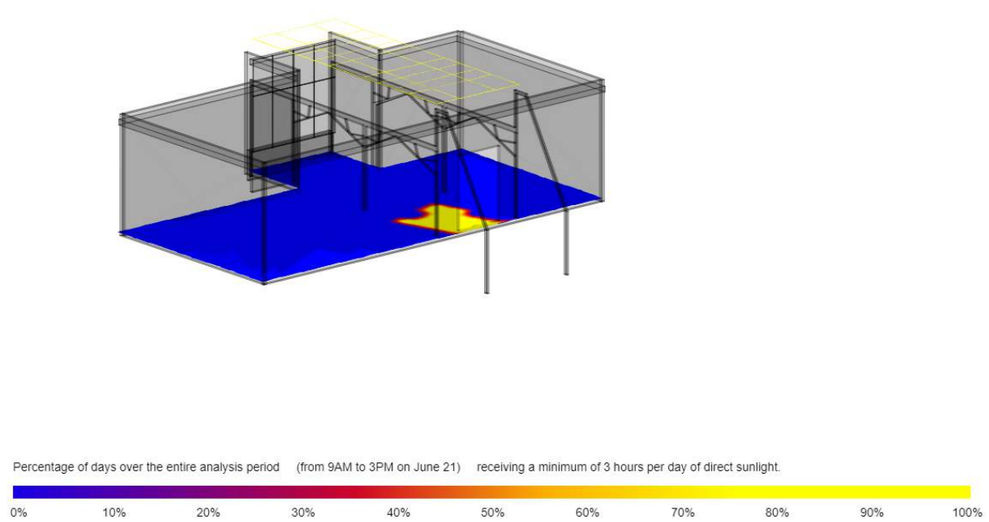


Figure 5.47: Sefaira base case direct sunlight (Sefaira 2021).

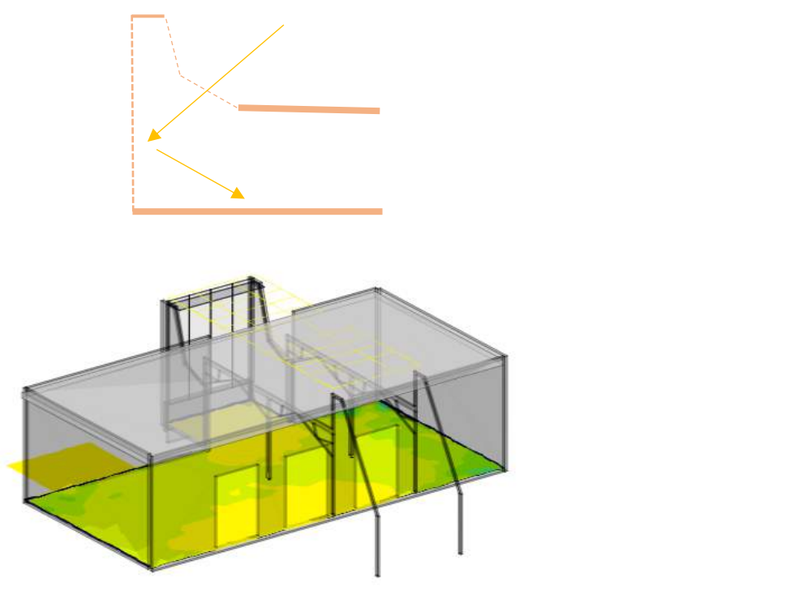


Figure 5.48: Sefaira altered profile illuminance rating (Sefaira 2021).

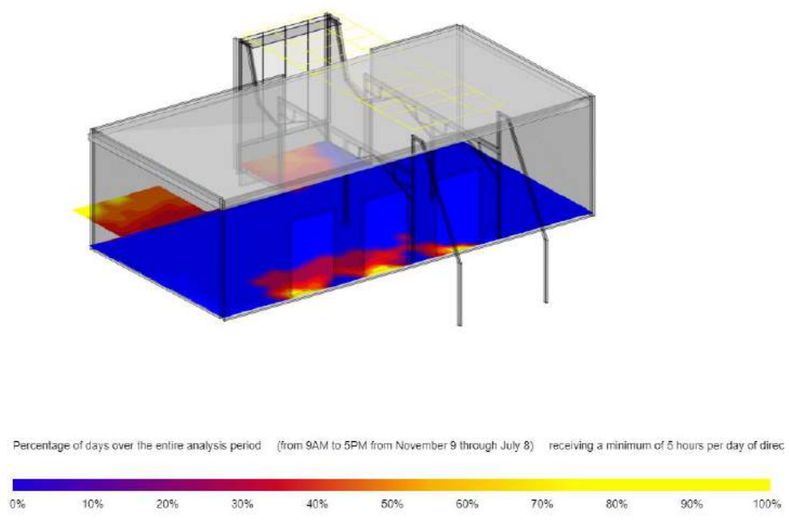


Figure 5.49: Sefaira altered profile direct sunlight (Sefaira 2021).

F

DETAILS

Figure 5.50: Ground floor section of Melusi waterfront (Sefaira 2021).

AQUAPONIC SITE SECTION ACROSS THE ISLAND

Semi-private aquaponic farm integrated with public space

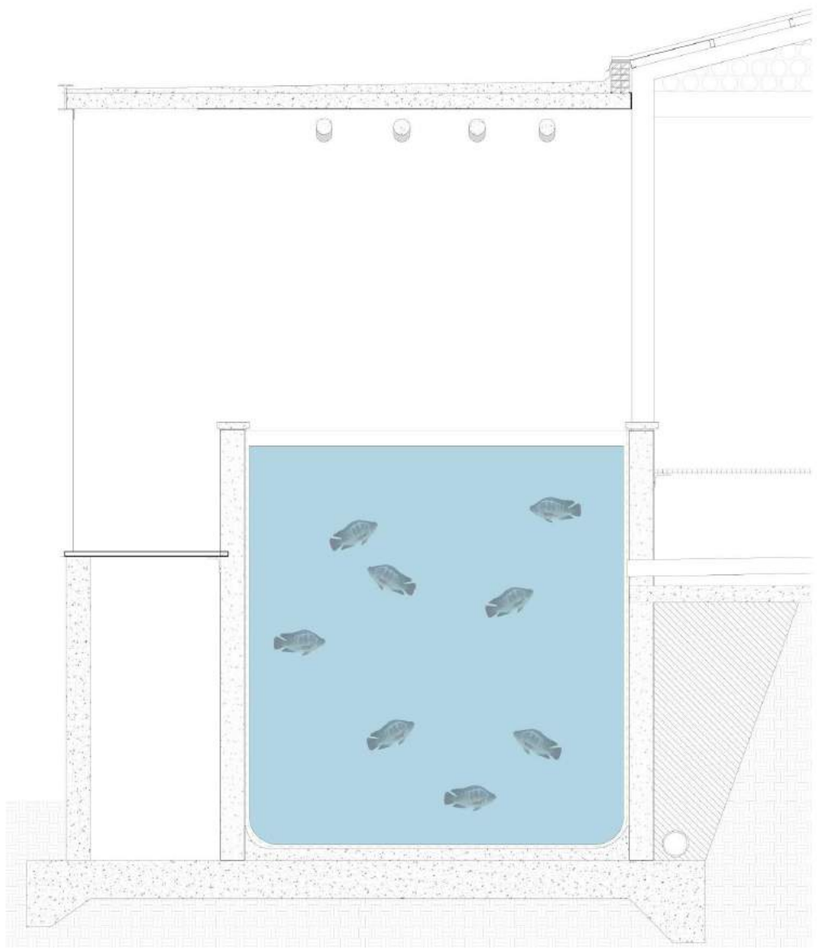


Figure 5.51: Section A-A Submission for technical crit (Author 2021)

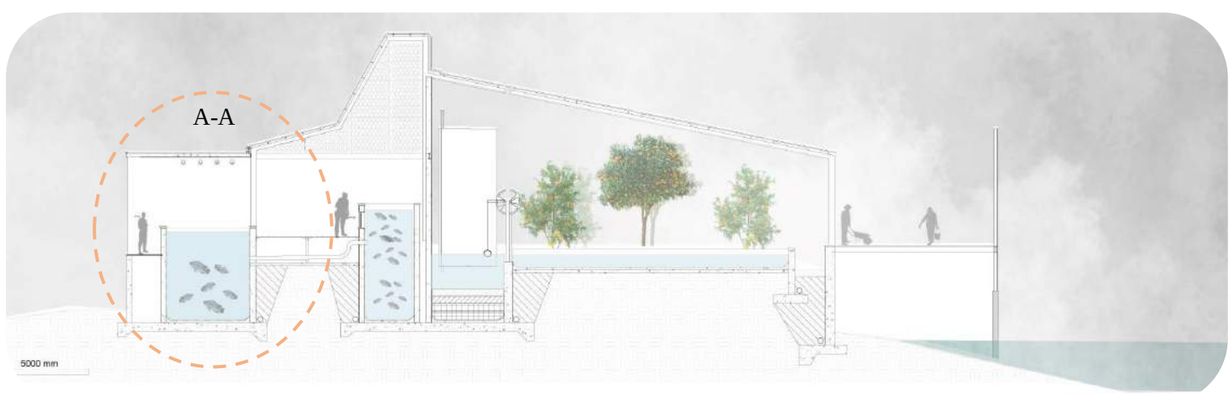


Figure 5.51: Section A-A Submission for technical crit (Author 2021)

AQUAPONIC SITE SECTION ACROSS THE QUARRY

Aquaponic Farm cantilevering over the Quarry Hole

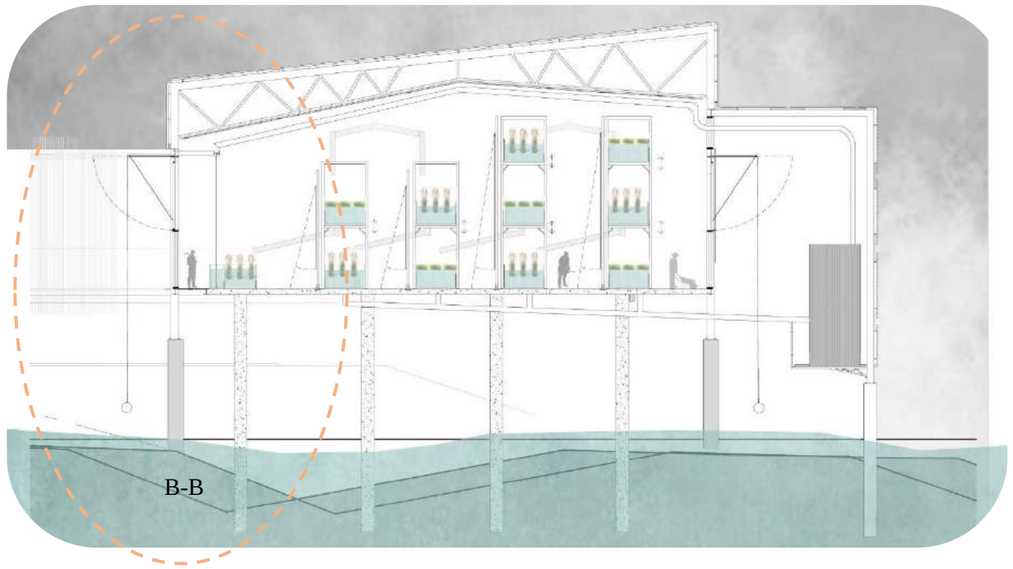
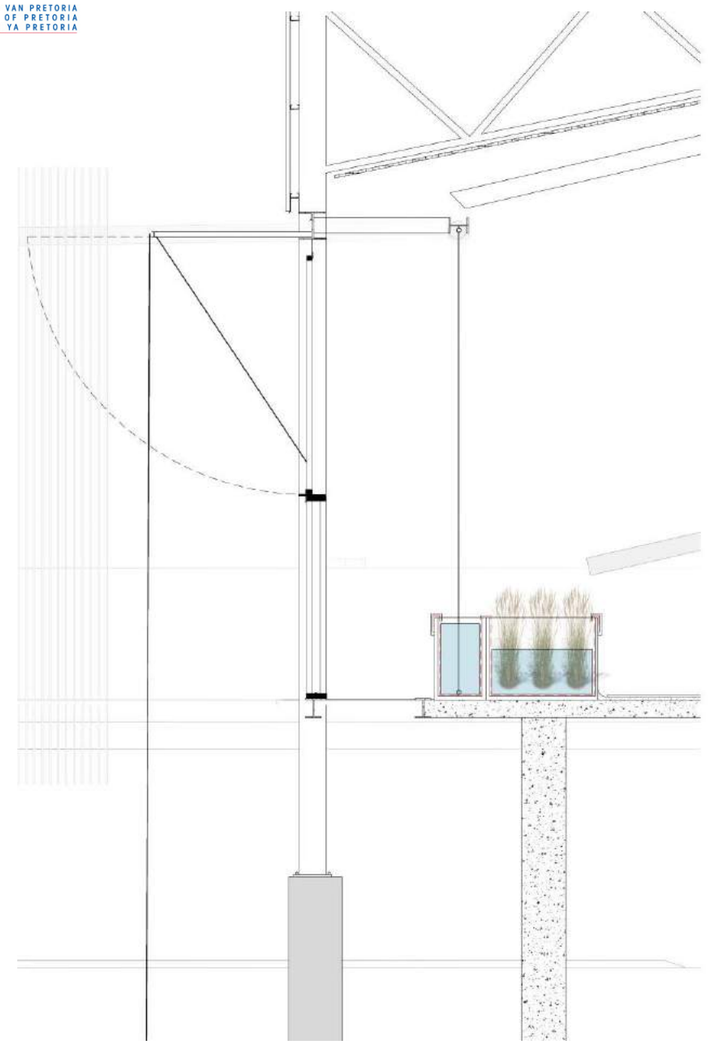


Figure 5.52: Site section through the Aquaponic farm for technical crit submission (Author 2021).



Polycarbonate corrugated sheeting fixed to 100 mm x 50 mm x 20 mm colled rolled steel lip channel purlins at 1000 mm c/c in strick accordance with manufacturer's specifications and approved by and engineer.

1000 x1000 mm panels of 50 mm x 50 mm grating size light dutty aluminium vitagrid grating panels fixed and bolted to the portal frame trusses as per engineers specifications.

Aluminium frame with polycarbonate corrugated sheeting within the aluminium frame fixed with a hindge system to a steel plate welded to the 203 x203 mm H-section beam. The moveable panel opens and closes with an counter weight precast concrete ball as per engineers design and specifications

100 mm diameter PVC water pipe connected to an 100 mm diameter flexi pipe.

25 x 30 mm diameter HDPE 100 x 100mm woven mesh rope fixed to the galvanised steel hooks fixed to the bottom of the timber crates.

30 mm thick timber crates built by community members with a 4mm thick waterproofing membrane glued onto the internal timber box.

500 mm x 500 mm white mat vinyl composite tile glued onto the reinforced concrete slab.

200 mm thick in situ reinforced concrete slab on the 5m interval concrete columns.

50 mm thick aluminium frame with an fixed exterior polycarbonate corrugated sheeting with a 60 mm air gap and on the interior have a Ethylene Vinyl Acetate sheeting. A strip LED light in the cavity as per electician and engineers specifications.

203 x 203 mm H-profile beam bolted to the 305 x 165mm I-section portal frame supporting the 400 x 400mm solar light fitted composite decking boards.

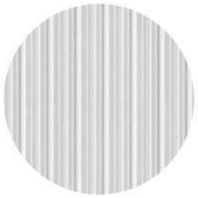
305 x 165 mm I section portal frame structure fixed and bolted to a round reinforced concrete fooing with a pile foundation as per engineerds design and specifications

Reinforeed concrete pile foundation and upstand every 5m as per engineers design and specifications

Figure 5.53: Detail B-B submission for technical crit (Author 2021).

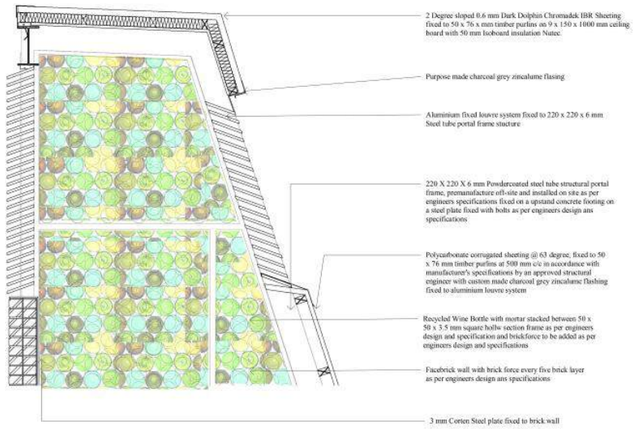
Recycled wine Bottles

Red Facebrick



Polycarbonate Sheeting

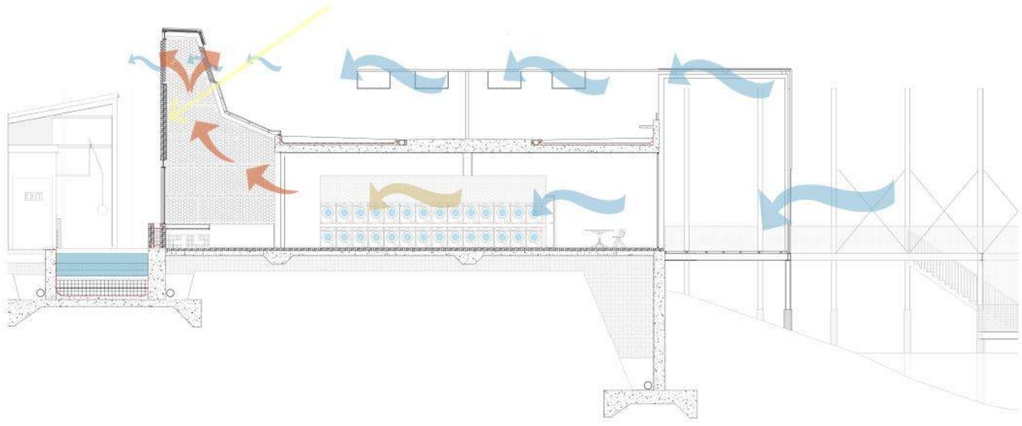
Chromadek IBR Sheeting



DETAIL A

Laundry facility Stack Ventilation Tower

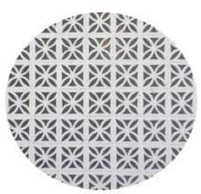
1:25



STACK VENTILATION

Laundry facility

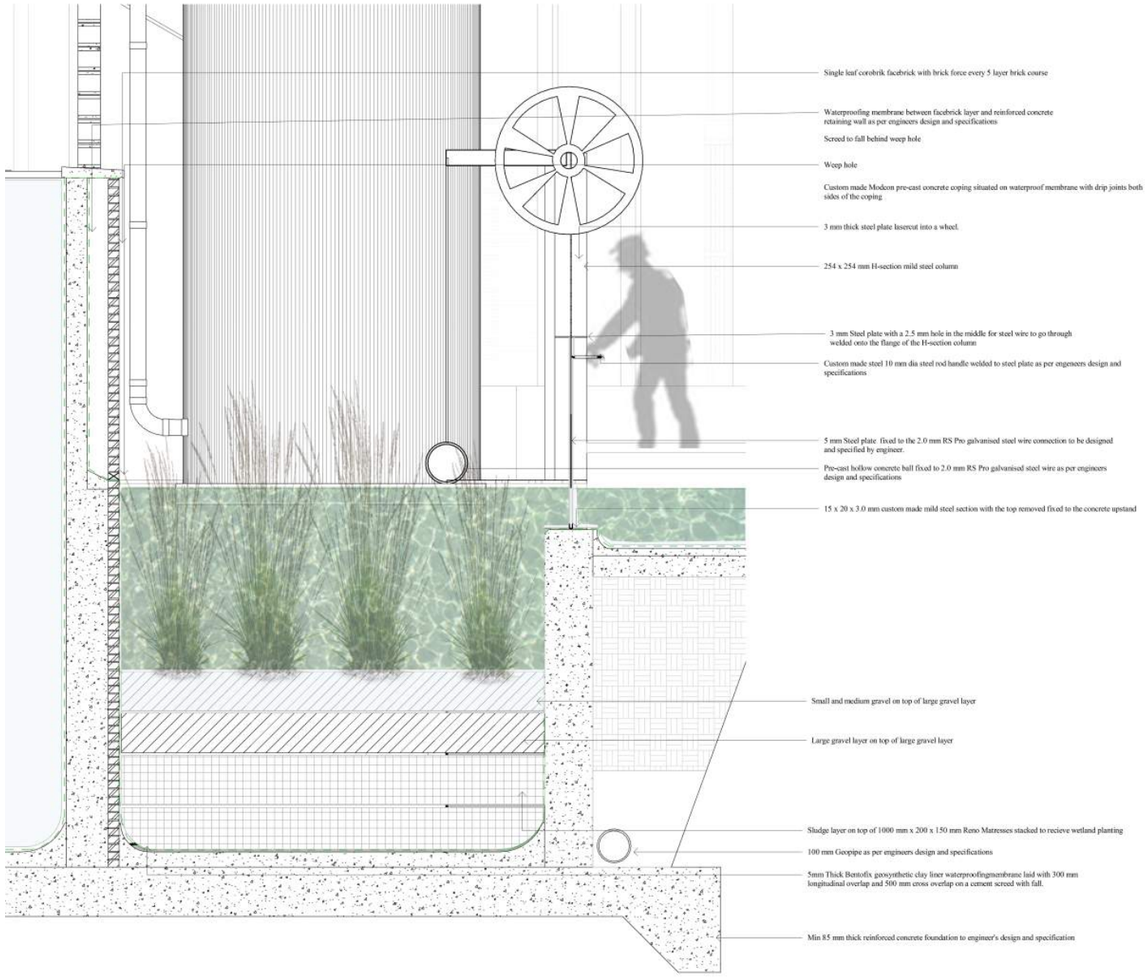
Figure 5.54: Detail A-A poster for Exam purposes 15 December 2021 (Author 2021).



Pre-cast Concrete Breeze Blocks

Corrugated Sheeting

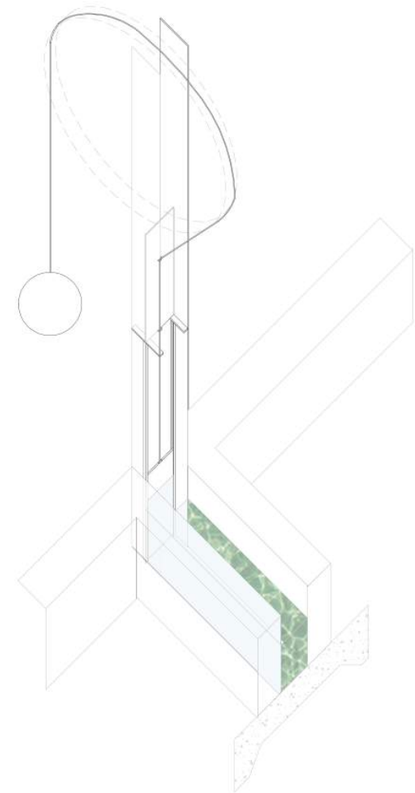
Off shutter Reinforced Concrete



DETAIL B

Surface Flow Wetland & Water Channel

1:25



AXONOMETRIC DETAIL B

Fruit Tree Water Channel

1:10

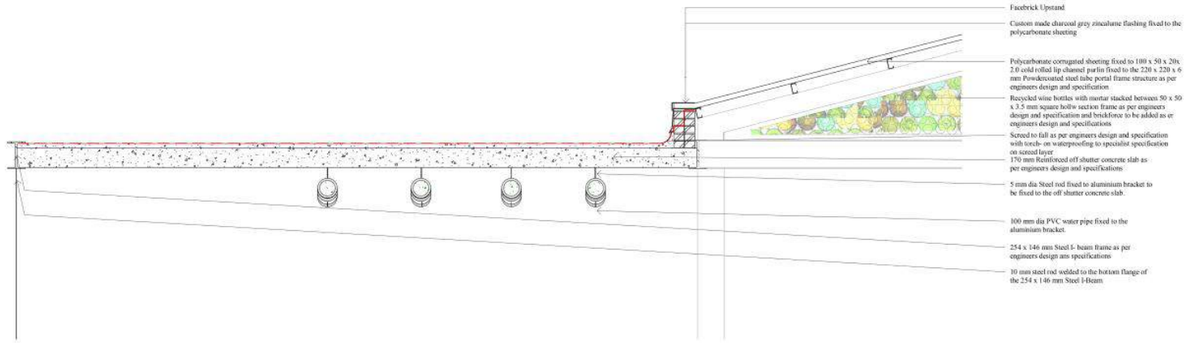
Figure 5.55: Detail B-B poster for Exam purposes 15 December 2021 (Author 2021).

Recycled wine Bottles

Red Facebrick

Polycarbonate Sheeting

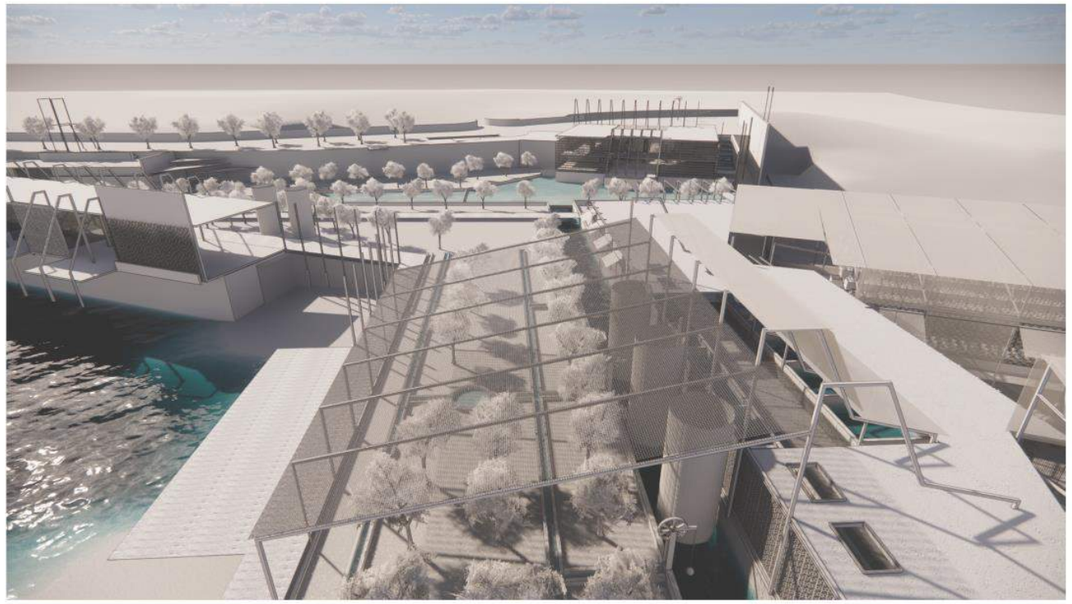
Off shutter concrete



DETAIL C

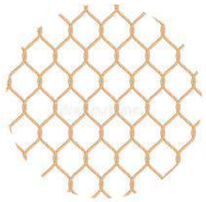
Aquaponic roof and water aerate system

1:25



ROOF PERSPECTIVES

Figure 5.56: Detail C-C poster for Exam purposes 15 December 2021 (Author 2021).

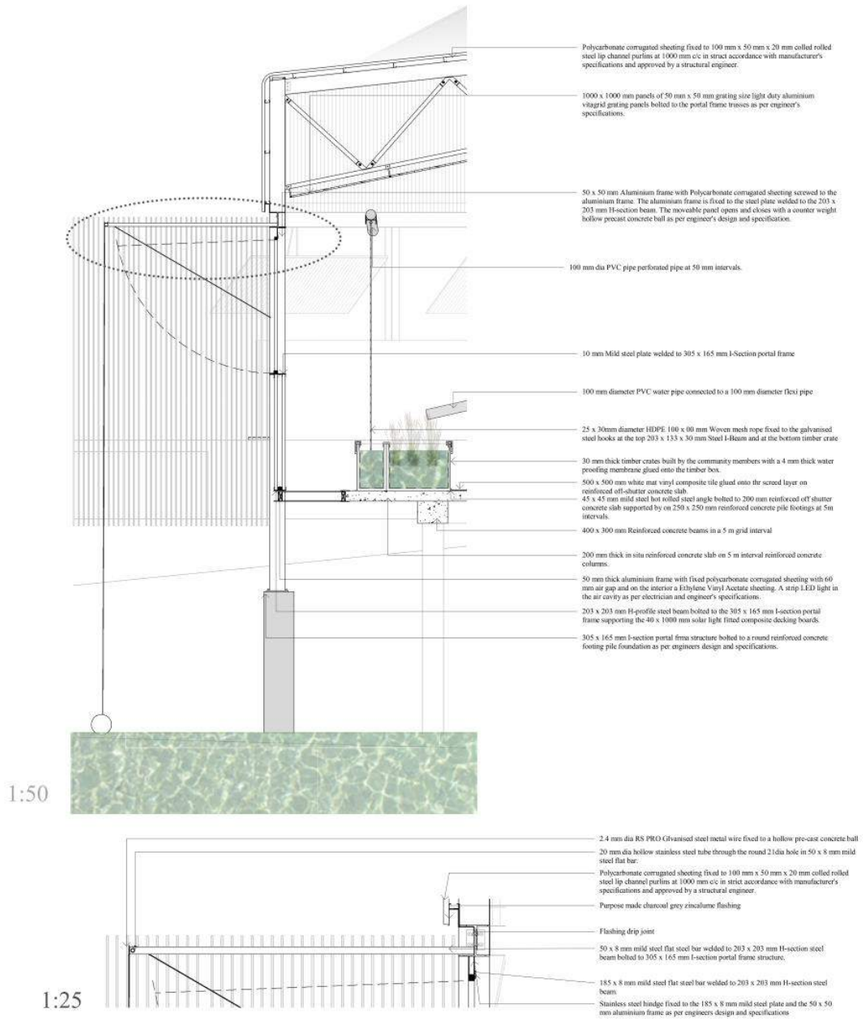


Woven Rope

Composite Decking

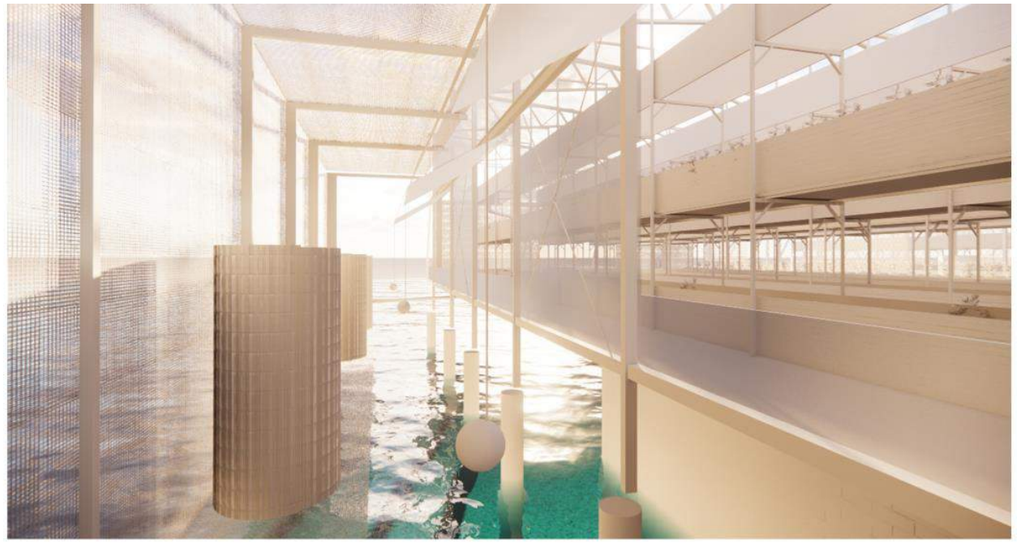
Polycarbonate Sheeting

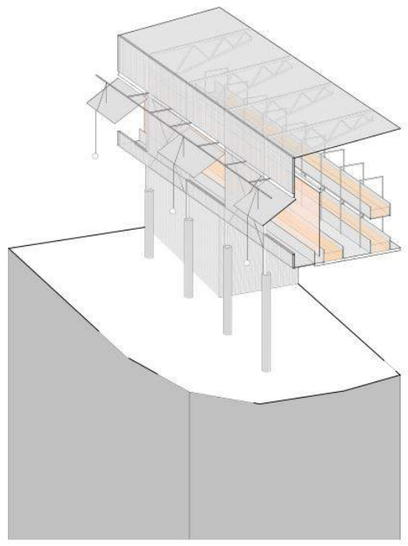
Off shutter Reinforced Concrete

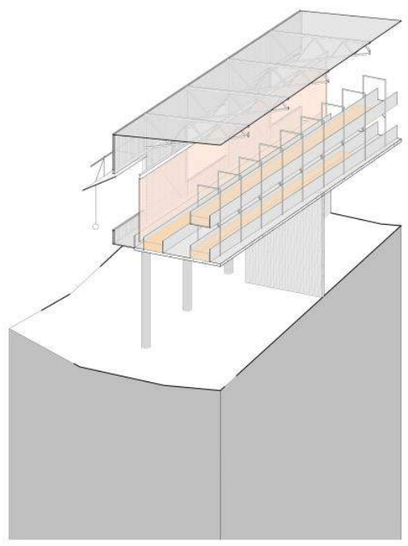


DETAIL D

Counterweight Panels Aquaponic Facility







AXONOMETRIC DETAIL D

Aquaponic Facade

Figure 5.57: Detail D-D poster for Exam purposes 15 December 2021 (Author 2021).

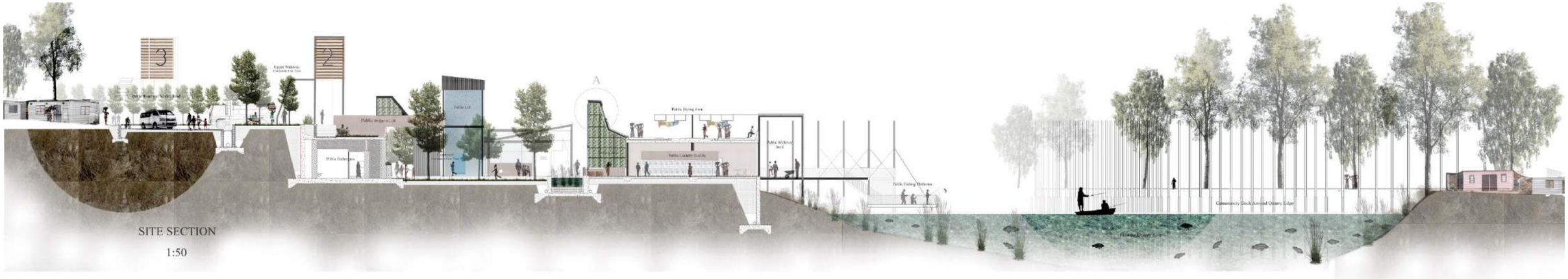


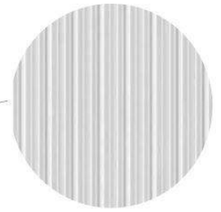
Figure 5.58: Site section for Exam purposes 15 December 2021 (Author 2021).

Figure 5.59: Section A-A for Exam purposes 15 December 2021 (Author 2021).

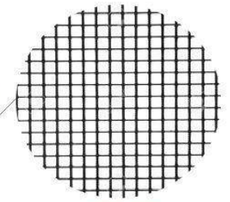
Figure 5.60: Section B-B for Exam purposes 15 December 2021 (Author 2021).

Figure 5.61: Ground floor plan for Exam purposes December 2021 (Author 2021).

Figure 5.62: First floor plan for Exam purposes December 2021 (Author 2021).

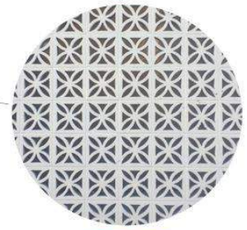


Polycarbonate sheeting



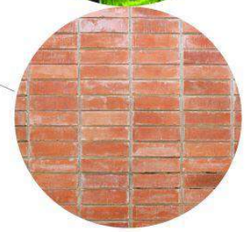
Steel Grating

De Hoop Matt Brown
Corobrik



Precast Concrete
Breeze Block

Recycled Wine Bottles



Firelight Satin pavers
Stack Bond

Composite Decking

MATERIALITY

Laundry Facility

Figure 5.63: Materiality of laundry facility for Exam purposes December 2021 (Author 2021).

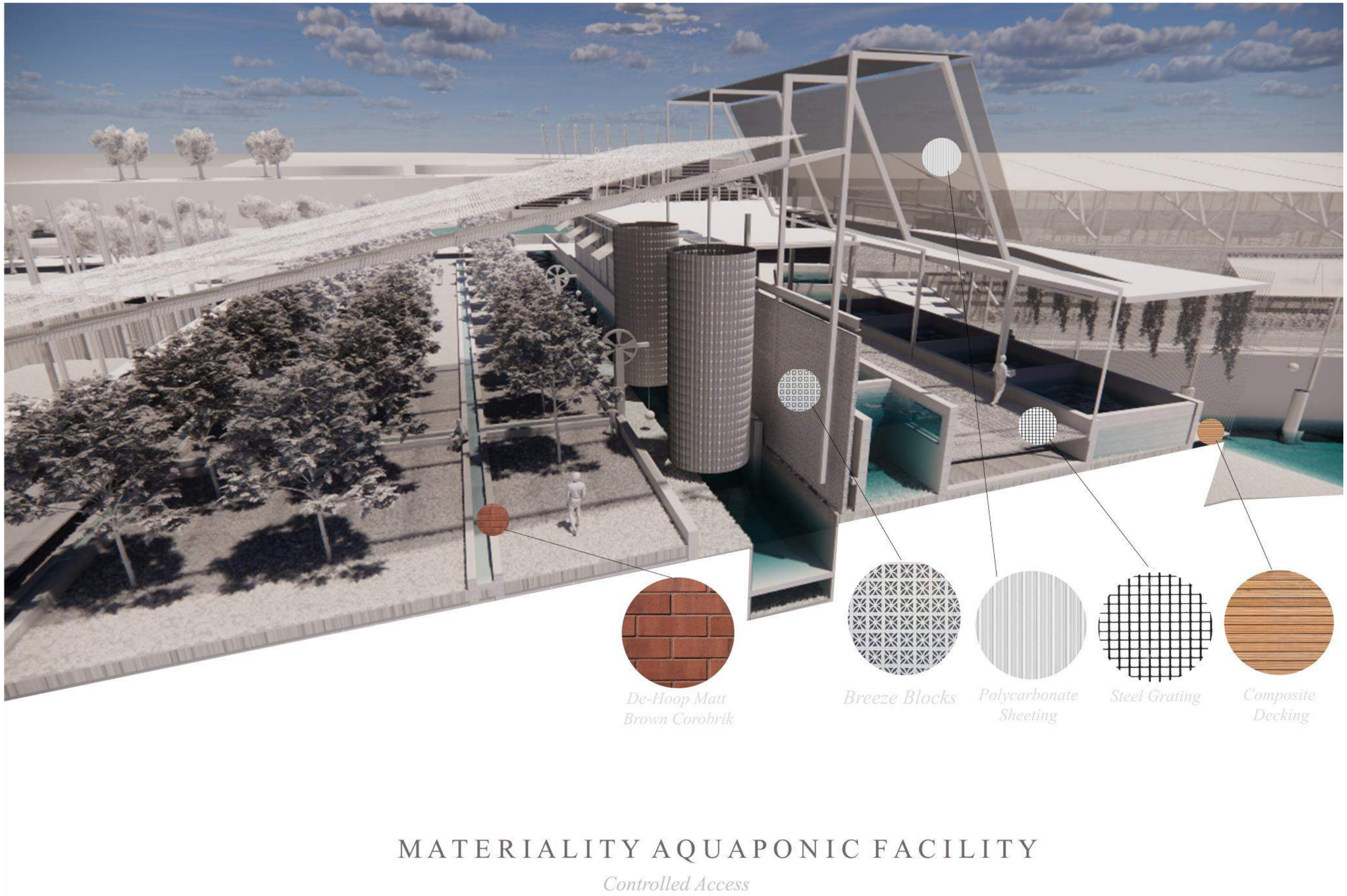
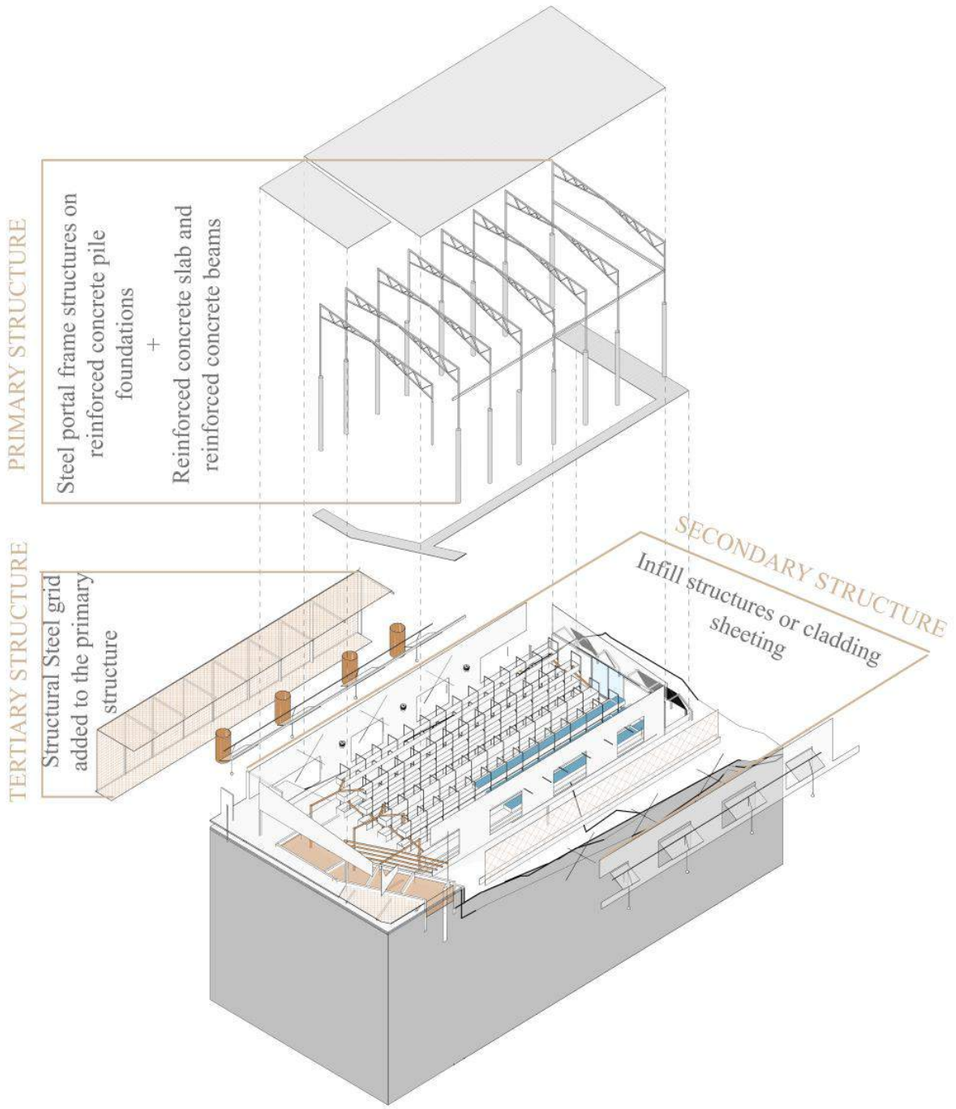
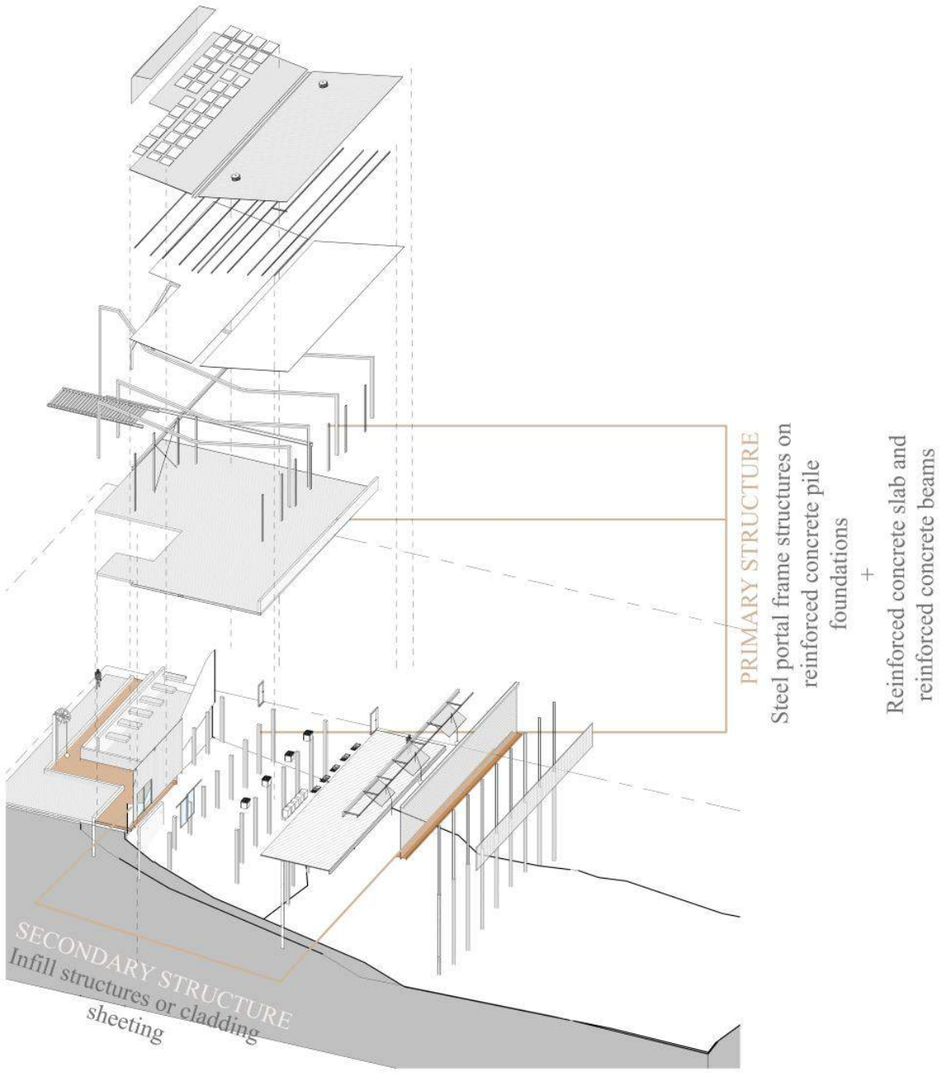


Figure 5.64: Materiality of aquaponic facility for Exam purposes December 2021 (Author 2021).



STRUCTURE

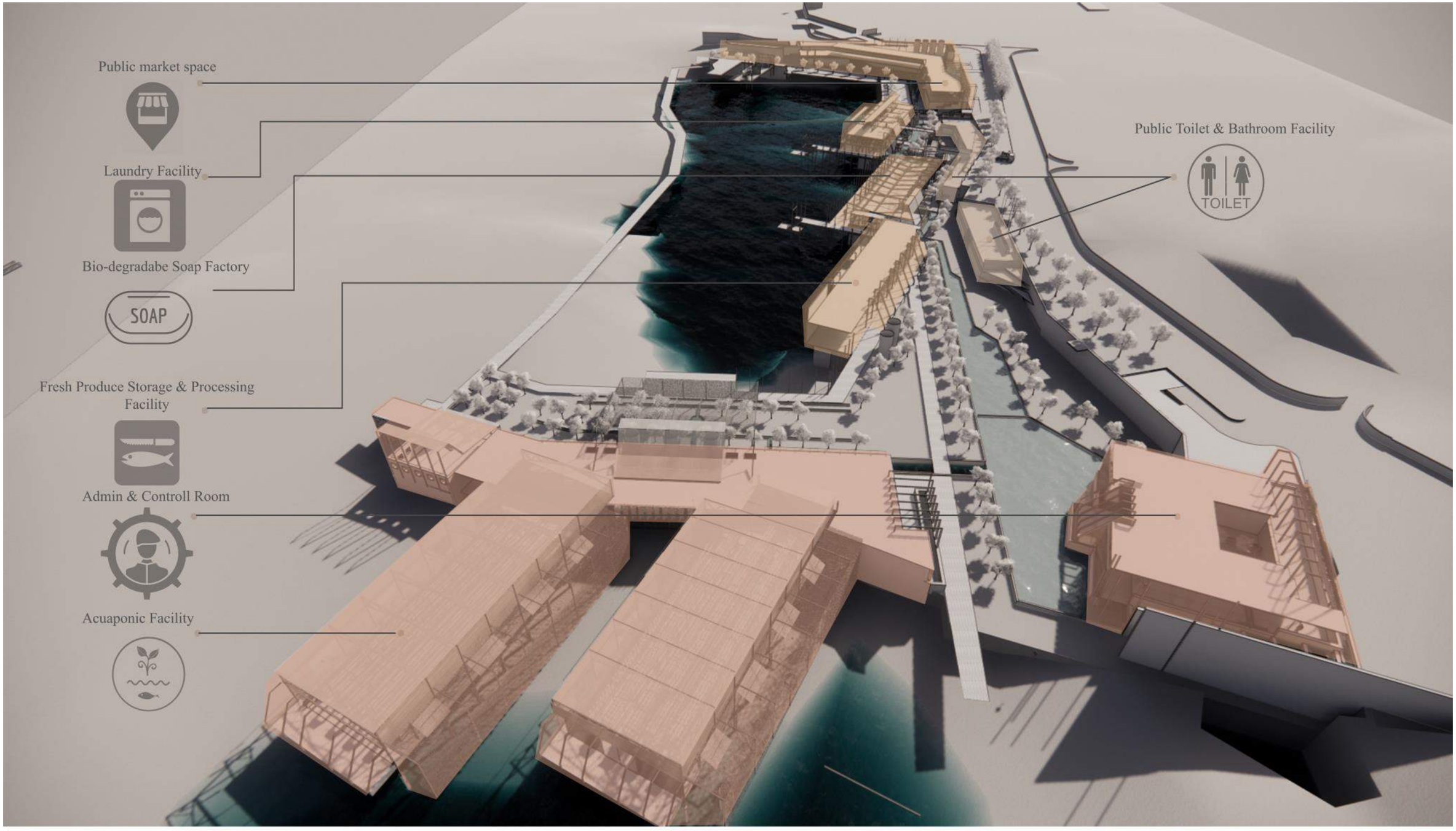
Aquaponic facility



STRUCTURE

Biodegradable soap Factory

Figure 5.65: Structural composition for Exam purposes December 2021 (Author 2021).



FACILITIES

Public & Private Spaces

Figure 5.66: Allocation of the multiple facilities on site for Exam purposes December 2021 (Author 2021).

Views

Figure 5.67: Location of views taken on site for Exam purposes December 2021 (Author 2021).

View A

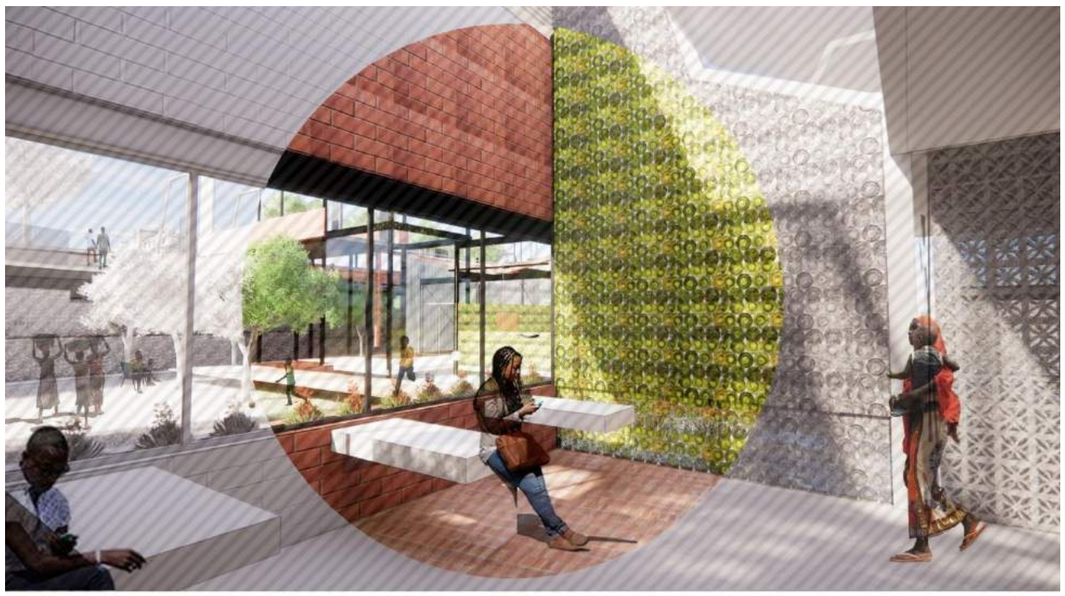
LAUNDRY ACCESS TO ROOF

Public Area

View C

LAUNDRY WAITING AREA EXTERIOR

Public Area



View B

LAUNDRY WAITING AREA

Public Area

View D

BIODEGRADABLE SOAP FACTORY

Public Area

Figure 5.68: Views A-D for Exam purposes December 2021 (Author 2021).

View E

COURTYARD

Public Area

View G

LAUNDRY FACILITY

Public Area

View F

PUBLIC BATHROOMS ENTRANCE

Public Area

View H

AQUAPONIC FACILITY

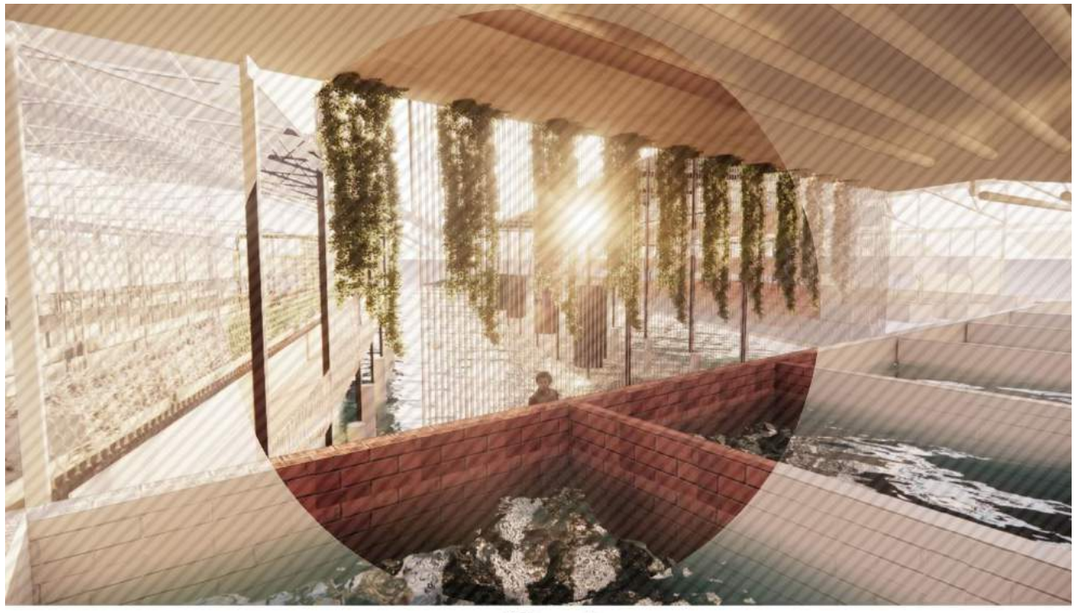
Semi-public Area with Controlled Access

Figure 5.69: Views E-H for Exam purposes December 2021 (Author 2021).

View I

PUBLIC FRUIT TREES

Public Area + Bridge over the quarry

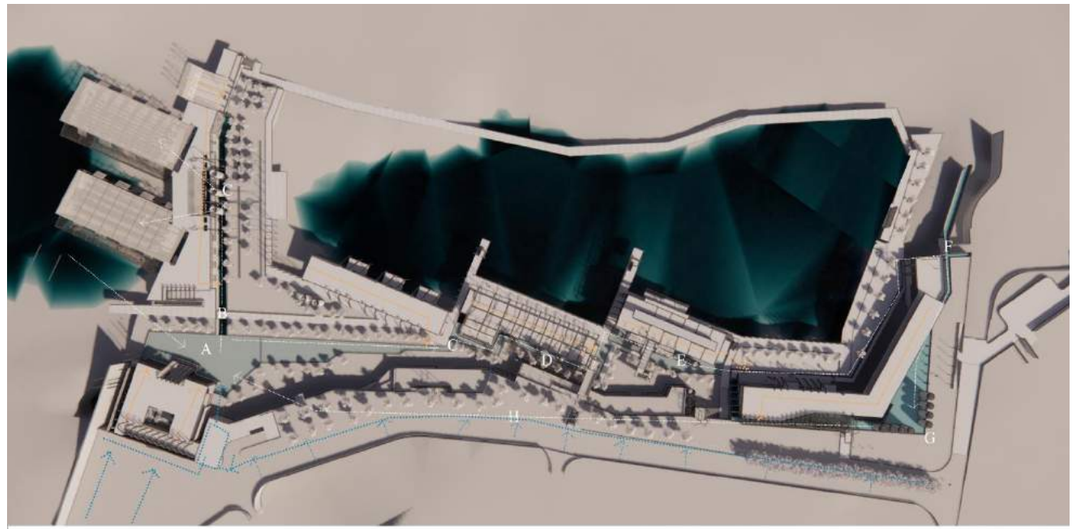


View J

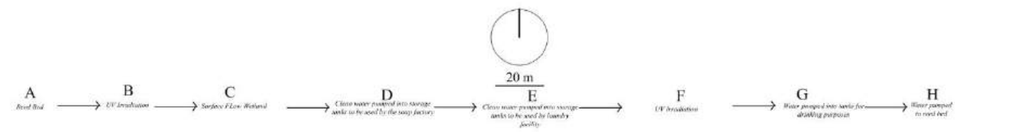
AQUAPONIC FACILITY

VIEW

Figure 5.70: Views I-J for Exam purposes December 2021 (Author 2021).



WATER FILTRATION & CATHMENT STRATEGY



GREY WATER & BLACK WATER MANAGEMENT SYSTEM

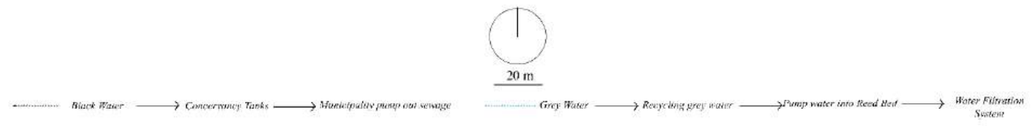


Figure 5.71: Water management schemes for Exam purposes December 2021 (Author 2021).

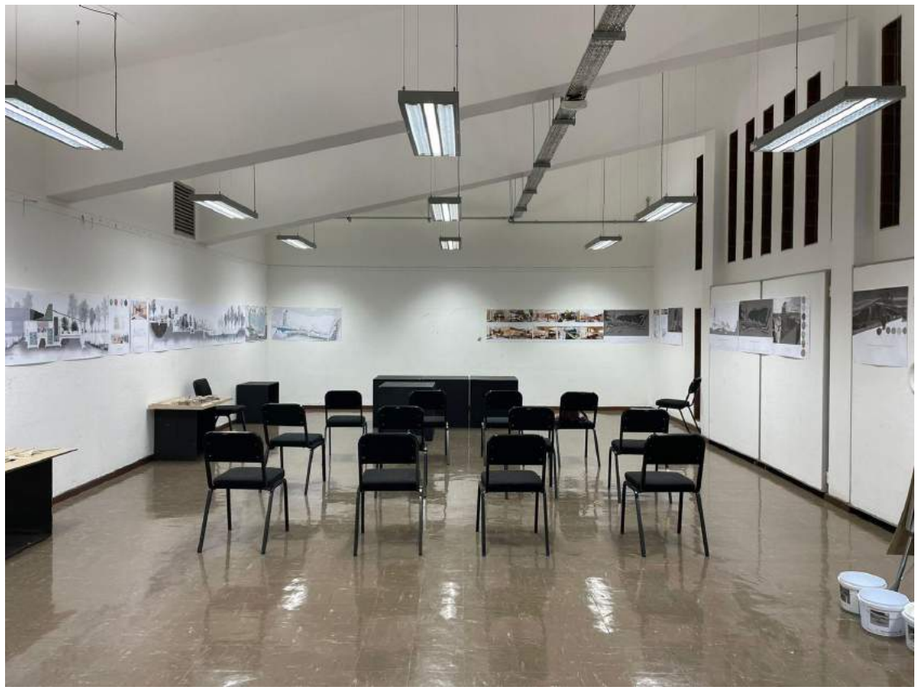


Figure 5.72-5.75: Photographs of final Exam 15 December 2021 (Author 2021).

CHAPTER 06

CONCLUSIONS

Figure 6.1: Concluding aquaponic render (Author 2021).

This mini-dissertation's main intention is to act as a Catalytic Nexus. The catalytic aspects of tl project manifested through community engagement and co-design workshops as well as through the theoretical framework developed by the author on how to have a balanced approached to establish co-evolution towards self-efficiency in informal settlements chapter 4. It is important to understand that the project needs both the *Catalyst* (momentum) and the *Nexus* (bridging) to be self-sustaining and not dependent on external resources. Ultimately contributing to an emerging city such as Melusi.

The Nexus manifested itself through the process of community engagement and co-design workshops, bridges multiple stakeholders to establish stronger relationships through the proposed five phased upgrading process based on group work from the Reality Studio and stakeholder evolution (see chapter 3). Furthermore it developed to bridge and repair the relationship between the socio landscape and the ecological landscape. The intervention's intention is to physically bridge between the community and the existing quarry hole. The second intention is to supply the community with a healthy, safe, and resourceful public space.

The technical intention was inspired by the definition of the name Melusi. The name means *"Leader"* or *"Shepard"* in the Zulu language. The COPC researchers showcased a psychological connection towards the community during informal interviews which idealizes Melusi as a space of refuge and safety which is contradicting due to the physical hazards visible and experienced on site, especially around the existing quarry hole. The architectural intention aims to restore the invisible boundary and tends to repair the relationship with the quarry through introducing Piet Vosloo's (2018) theory of rehabilitate post-industrial abandoned quarry holes into healthy open public space which will enhance co-existence between Melusi dwellers and the rehabilitation of the existing polluted quarry edges. This process will include activating the edges with programs which will reduce the pollution and transform the current edge from dumping site to resource. The National Environmental Act 107 of 1998 states that "Everyone has the right to have the benefit of present and future generations." (Burmeister 2014:2-3). Karina Landman (2018:2) also raised the challenge of rapid urbanisation experienced by cities in South Africa and therefore open public spaces are limited and are increasingly needed. Every post-industrial abandoned landscape has the potential to be rehabilitated to add more value towards healthy public spaces for informal dwellers.

To achieve the following intentions, the project was implemented the following theories such as resilience thinking, biophilic design, as well as Maslow's hierarchy of needs (Maslow 1943). This manifested as the technical structure which personified as a *Leader* or *Sheperd*. It has the following qualities:

PROVIDER- Which is manifested in the programs – Aquaponic farm, sanitation services and a water filtration system.

PROTECTOR- Translates into three categories namely the physical, psychological, and environmental. The physical protector is translated into the form imitating a spine wrapping around the dangerous quarry edge. The second implementation of protector is visible in the biophilic architecture principle- Prospect and Refuge. Prospect and Refuge refers to the phenomena where one obtains information of the environment while being in a protective shelter, which has positive health and well-being results, leading to a reduction in stress, boredom, irritation, fatigue, and perceived vulnerability (Browning et al, 2014).

TEACHER / LEARNER- Manifests through the technical language of exposing systems such as mechanical systems inspired by Olson Kundig project- Gallery 242 State Street (ArchDaily n.d). Another exposed system is the Aquaponic farm based on the process and principles of The Karoo Kafee in Lynwood, Pretoria. The exposure of the systems implements experimental learning through observation and improves community participation through mechanical systems.

PROCESS- COMMUNITY PARTICIPATION- Translates through the material choices of using recyclable materials into the design process. Community members participates in the construction process when using recyclable materials, this will improve community participation and the transference of ownership towards a sustainable community.

VALUE ADDED TO THE ARCHITECTURAL PROFESSION

In conclusion by evaluating the success of this intervention by using the theoretical framework the project is in balance and addresses both the Socio and Ecological principles as defined in chapter 4. Through analysing previous informal upgrading projects, it was evident to ensure success a more balanced approach is necessary when working in vulnerable communities. This project adds to the Architectural profession in terms of how to approach emerging cities in South Africa by applying the balanced approach towards co-evolution and community independence. This project also contributes by defining the project intentions through community engagement and co-design workshops. This mini dissertation also discovered the importance of the child's perspective in public design processes, where children have been previously ignored as important stakeholders in community upgrading projects. Finally, the Architectural contribution lies in the circular system and defining symbiotic programs that function in a bigger eco-system. The value of this intervention lies in the possibility of providing an income for the community by allowing them to improve personally by acquiring new skills and taking ownership of a project to achieve self-actualization.

PERSONAL REFLECTION

This mini dissertation has been such an inspiring process. This project widened my horizons and challenged me by placing myself outside my comfort zone. The COVID-19 pandemic and social distancing have been challenging by not have as much personal contact with study leaders and peers. As well as getting COVID-19 myself in September which placed physical and mental stress on myself. COVID-19 fatigue is a reality and took me some time to get back into my usual work pace. This was a very big mental obstacle for me which led to scaling down on my design. While I struggled at the beginning of the year to scale down on my design, because it was too ambitious and on a design level not that successful, it came naturally after contracting COVID-19.

I am truly thankful that I could pursue my master's degree in this difficult time. I grew personally and mentally to be stronger and to reach out from my circumstances.

I will be able to reapply the skills I learned through the year in practice and in my professional career. I learned how to work remotely and to collaborate with teams online. The second skill I will be able to reapply is to define a brief, specifically in informal communities where language barriers are challenging. In these contexts, my exposure to community engagement, co-design activities and by playing games has been beneficial.

FRAMEWORK ANALIZING THE FINAL PRODUCT

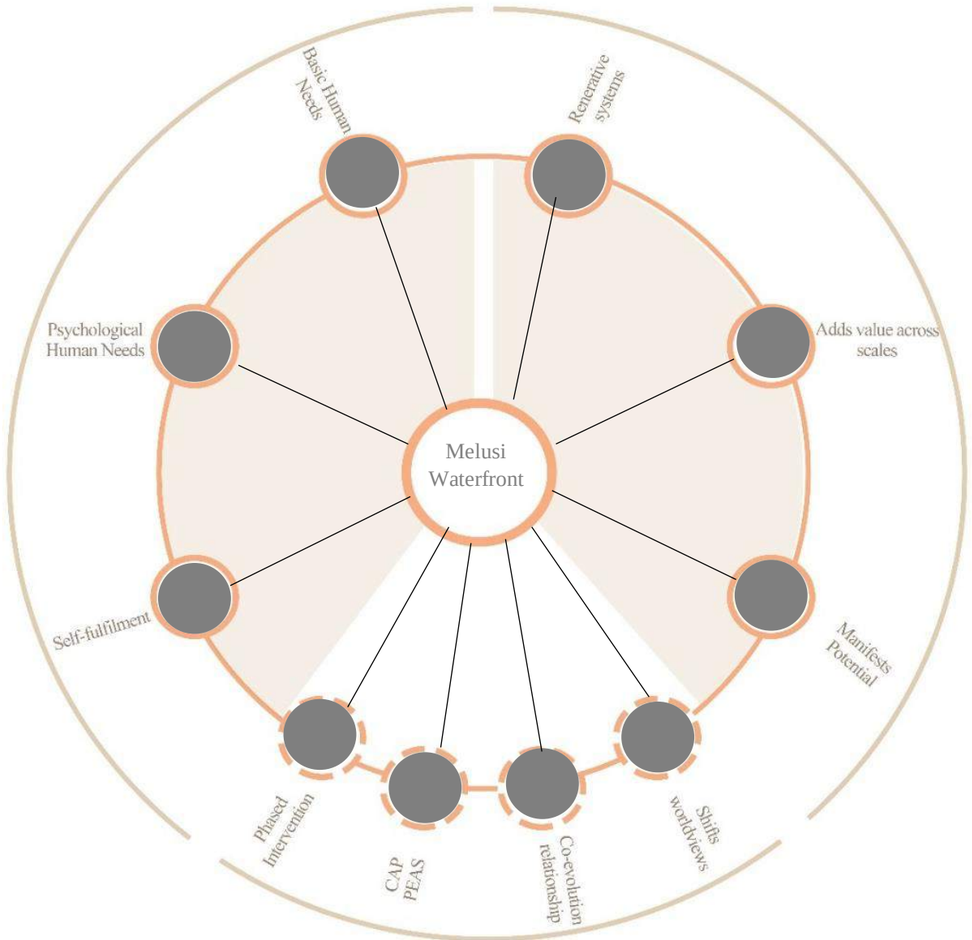


Figure 6.2: Theoretical framework assessing Melusi waterfront (Author 2021).

The Melusi Waterfront is a balanced upgrading intervention and entails the potential to manifest a sustainable community towards self-efficiency and independence.

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ANNEXURE

A

WATER CALCULATIONS

WATER MANAGEMENT MODEL

A WATER RESOURCE INFORMATION (YIELD, m^3)

A1 RAIN WATER HARVESTING DATA

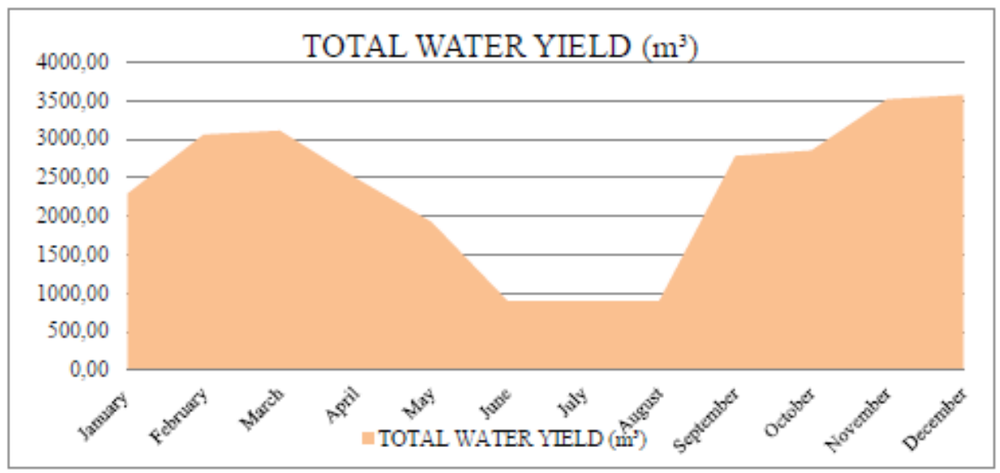
DESCRIPTION	AREA (m^2)	RUNOFF COEFF. (C)
Roof structures	6928,44	0,9
Road and Parking	7711,3	0,8
Movement ramps	100	0,6
Paved Courtyards	104,2	0,7
Lawn	12815,7	0,1
Wetland	3363,3	1
TOTAL AREA (A)	31022,94	
WEIGHTED C		0,55

A2 RECYCLED / ALTERNATIVE WATER SOURCE

MONTH	GREY WATER		AQUAPONIC SYSTEM		TOTAL / MONTH (m^3)
	WEEKLY YIELD (m^3)	MONTHLY YIELD (m^3)	WEEKLY YIELD (m^3)	MONTHLY YIELD (m^3)	
January	100	400,00	300	1200,00	1600,00
February	100	400,00	300	1200,00	1600,00
March	100	400,00	300	1200,00	1600,00
April	100	400,00	300	1200,00	1600,00
May	100	400,00	300	1200,00	1600,00
June	100	400,00	100	400,00	800,00
July	100	400,00	100	400,00	800,00
August	100	400,00	100	400,00	800,00
September	100	400,00	300	1200,00	1600,00
October	100	400,00	300	1200,00	1600,00
November	100	400,00	300	1200,00	1600,00
December	100	400,00	300	1200,00	1600,00
ANNUAL AVE.		4800,00		12000,00	16800,00

A3 TOTAL WATER YIELD

MONTH	AVE RAINFALL , P (m)	CATCHMENT YIELD (m^3) (Yield = PxAxC)	ALTERNATIVE WATER SOURCE (m^3)	TOTAL WATER YIELD (m^3)
January	0,13	2275,56	13,00	2288,56
February	0,09	1454,31	1600,00	3054,31
March	0,09	1505,64	1600,00	3105,64
April	0,05	889,69	1600,00	2489,69
May	0,02	325,08	1600,00	1925,08
June	0,01	102,66	800,00	902,66
July	0,01	102,66	800,00	902,66
August	0,01	102,66	800,00	902,66
September	0,07	1180,56	1600,00	2780,56
October	0,07	1248,99	1600,00	2848,99
November	0,11	1916,26	1600,00	3516,26
December	0,12	1967,59	1600,00	3567,59
ANNUAL AVE.	0,70	13071,66	15213,00	28284,66



B WATER DEMAND

B1 LANDSCAPE IRRIGATION DEMAND (m³) X X X

DESCRIPTION:	LAWN (m²):	12815,7	AGRI (m²):	1478,4	PLANTING (m²):	800	
MONTH	WEEKLY IRR. (m)	MONTHLY DEMAND (m³)	WEEKLY IRR. (m)	MONTHLY DEMAND (m³)	WEEKLY IRR. (m)	MONTHLY DEMAND (m³)	TOTAL MONTHLY IRR. DEMAND
January	0,015	768,942	0,025	147,84	0,005	16	932,782
February	0,015	768,942	0,025	147,84	0,005	16	932,782
March	0,015	768,942	0,025	147,84	0,005	16	932,782
April	0,015	768,942	0,025	147,84	0,005	16	932,782
May	0,01	512,628	0,025	147,84	0,005	16	676,468
June	0,01	512,628	0,025	147,84	0	0	660,468
July	0,01	512,628	0,025	147,84	0	0	660,468
August	0,015	768,942	0,025	147,84	0	0	916,782
September	0,015	768,942	0,025	147,84	0,005	16	932,782
October	0,015	768,942	0,025	147,84	0,005	16	932,782
November	0,015	768,942	0,025	147,84	0,005	16	932,782
December	0,015	768,942	0,025	147,84	0,005	16	932,782
ANNUAL TOTAL		8458,362		1774,08		144	10376,442

B2 AQUAPONIC FARM WORKERS

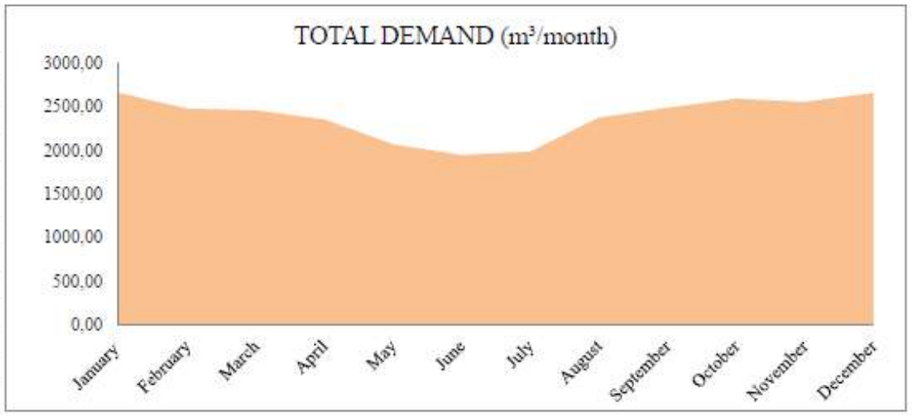
X

MONTH	PERSONS/DAY	WATER/ CAPITA/ DAY (l)	DOMESTIC DEMAND (m³/month)
January	30	11	10,23
February	30	11	9,24
March	30	11	10,23
April	30	11	9,9
May	30	11	10,23
June	30	11	9,9
July	30	11	10,23
August	30	11	10,23
September	30	11	9,9
October	30	11	10,23
November	30	11	9,9
December	30	11	10,23
ANNUAL TOTAL			120,45

B3 EVAPORATION LOSS (For 'open' reservoirs) 35mm - 45mm/week in summer

AREA OF RESERVOIR (m²): 3363,47

MONTH	EVAPORATION RATE (m/week)	EVAPORATION RATE (m/month)	TOTAL LOSS (m³/month)
January	0,04	0,16	538,1552
February	0,035	0,14	470,8858
March	0,025	0,1	336,347
April	0,02	0,08	269,0776
May	0,015	0,06	201,8082
June	0,01	0,04	134,5388
July	0,01	0,04	134,5388
August	0,02	0,08	269,0776
September	0,03	0,12	403,6164
October	0,035	0,14	470,8858
November	0,035	0,14	470,8858
December	0,04	0,16	538,1552
ANNUAL TOTAL	0,32	1,26	4237,97



B5 TOTAL WATER LOSS & DEMAND

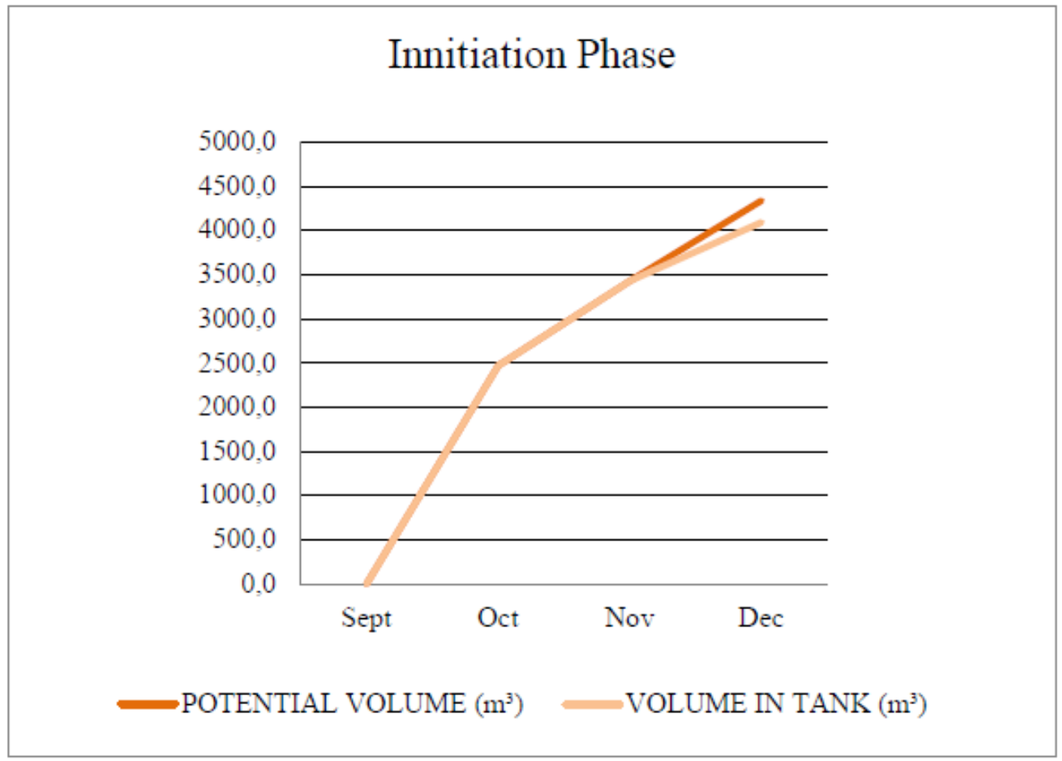
MONTH	TOTAL DEMAND (m³/month)
January	2662,27
February	2479,71
March	2460,46
April	2354,76
May	2069,61
June	1947,91
July	1986,34
August	2377,19
September	2489,30
October	2595,00
November	2556,57
December	2662,27
ANNUAL TOTAL	28641,3642

C WATER BUDGET

TANK CAPACITY (m³):	**4090**
MIN VOLUME (m³):	**2470**

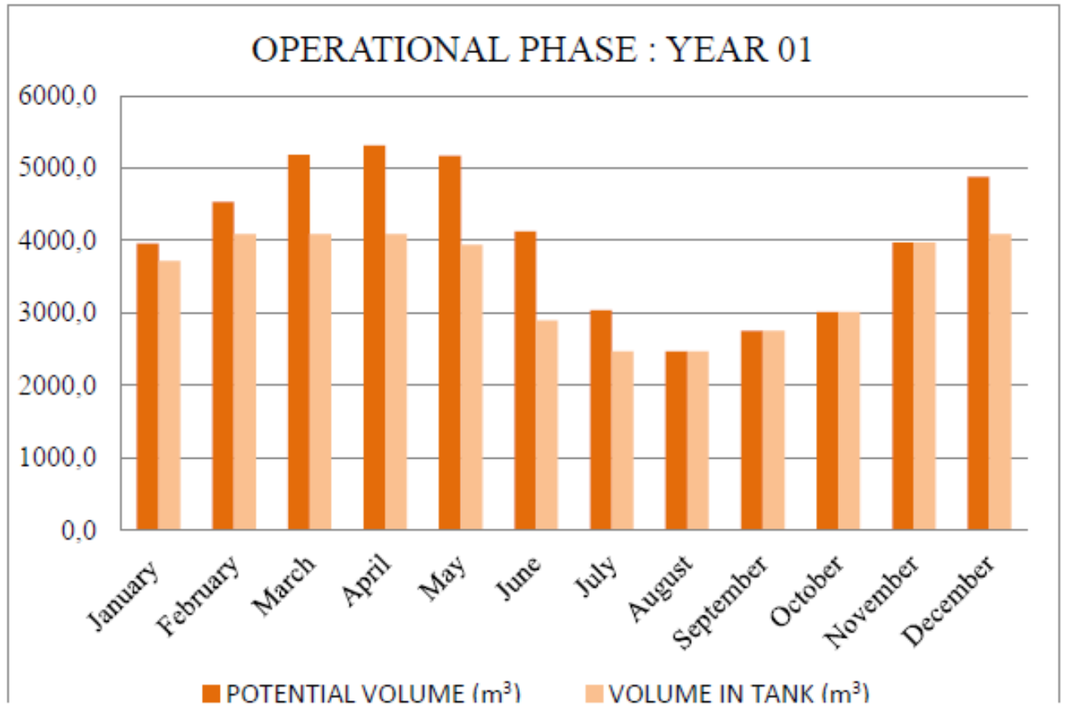
C1 WATER BUDGET INNITIATION PHASE

MONTH	YIELD (m³/month)	DEMAND (m³/month)	MONTHLY BALANCE	POTENTIAL VOLUME (m³)	VOLUME IN TANK (m³)
Sept	2780,6	2489,3	291,3	**0,0**	**0,0**
Oct	2849,0	2595,0	254,0	**2470,0**	**2470,0**
Nov	3516,3	2556,6	959,7	**3429,7**	**3429,7**
Dec	3567,6	2662,3	905,3	**4335,0**	**4090,0**
	12713,4	**10303,1**	**2410,3**		



C2 WATER BUDGET YEAR 1

MONTH	YIELD (m³/month)	DEMAND (m³/month)	MONTHLY BALANCE	POTENTIAL VOLUME (m³)	VOLUME IN TANK (m³)
January	2288,6	2662,3	-373,7	**3961,3**	**3716,3**
February	3054,3	2479,7	574,6	**4535,9**	**4090,0**
March	3105,6	2460,5	645,2	**5181,1**	**4090,0**
April	2489,7	2354,8	134,9	**5316,0**	**4090,0**
May	1925,1	2069,6	-144,5	**5171,5**	**3945,5**
June	902,7	1947,9	-1045,2	**4126,3**	**2900,2**
July	902,7	1986,3	-1083,7	**3042,6**	**2470,0**
August	902,7	2377,2	-1474,5	**2470,0**	**2470,0**
September	2780,6	2489,3	291,3	**2761,3**	**2761,3**
October	2849,0	2595,0	254,0	**3015,3**	**3015,3**
November	3516,3	2556,6	959,7	**3975,0**	**3975,0**
December	3567,6	2662,3	905,3	**4880,3**	**4090,0**
ANNUAL AVE.	**28284,7**	**28641,4**	**-356,7**		



ANNEXURE

B

REALITY STUDIO GAMES

Report written by

Jua Greeff

Juliana Achi

Jonathan Naraine

Adam Elinder

Why games?

Why we created games to collect information

Games as icebreakers

The pre-game workshops have been conducted to introduce the children to the students and to get to know each other. The two games conducted at the ECD and the Mydo Youth Centre where also tested out for further development and refinement. The pre-game workshop is definitely a useful tool as icebreakers to ensure dedicated participation in future.

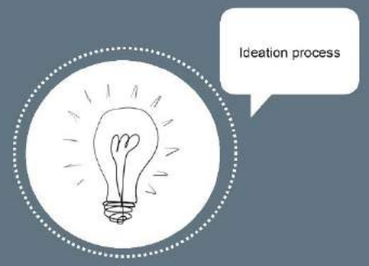
Gamification & conversations

All the games have a gamification aspect designed into the game to add to the excitement and overall enhancing the children participation. The gamification we used was a point system , timers and groups.

The groups added a competitive dynamics in the group and the conversations they had with each other were rich and insightful.

Figure 27: Children participating in the water game (Zorn, 2021)

Figure 28: Community member (Zorn, 2021)



Initial game ideas

We intended to conduct more games with the children but only got time to do two games which where the Melusi plate game (tested nutrition) where altered for the two different age groups. The Shades of water game (tested knowledge regarding reuse of water) which were only conducted with the Mydo Youth Centre children. This game is more advanced where the children needs an understanding of what the different types of water is. The third game is Follow the food game which tested the children's understanding of where different food comes from.

Choosing two games

The team decided to work only with the Melusi plate game and the Shades of water game. The Follow the food game was not implemented due to the high complexity to understand abstract concepts. This game also required full facilitation and in our previous games conducted we became aware of the language barriers and the lack of translators. The team also decided not to implement the third game due to time constraints.

Designing games

Designing a Food Game and a Water game

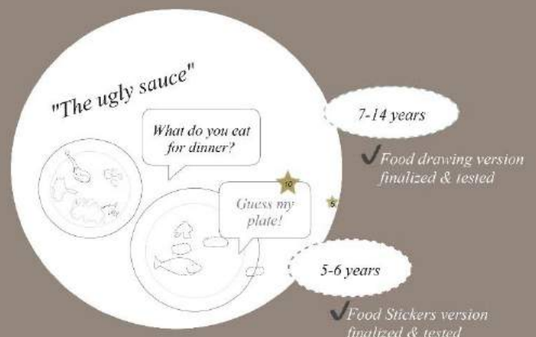



Figure 30: Plate game at MYDO (Zorn, 2021)


Figure 29: Stickers for plate game at ECD (Zorn, 2021)

The plate game

Our initial ideas of the game were to simply ask three main questions to the children: What they eat for dinner, What is the most nutritious food they can imagine and What is their dream meal look like. Each question would be organized as a game session with stickers to put on ones plate, then after each session we would discuss the answers or record them in some way. And ideally something fun would happen, but at this stage we had not come up with something to make it fun.

Two variations for different ages

After the initial idea of the food sticker game was developed we asked ourselves how to make it more fun, especially for the older children and so we tried to *gamify* it even more and developed a game where the children would draw and guess what was on each others plates. But to make it as simple as possible for the younger children we later developed the initial ideas of the food stickers game as a second variation of the game.


Figure 31: Water game (Zorn, 2021)

The water game

The initial idea of the water game was two different games. One being a simple icebreaker where the kids would stand in a line and pour water to each other with the goal to spill as little as possible. In the end no icebreaker game was needed, Our final game was fun enough and we did not have time to try this out.

The second idea was developed further and also simplified and built based on easily accessible material. The main concept was to have the kids pour different types of water and having it go to different potential uses of water - to understand their knowledge of how each water type could or could not be (re)used.

Game process & wall structure

The game process was also designed and developed in detail and the gamification of the initial idea of putting each water type in the "right place" had to be made more fun. So we came up with the idea of having a wall and then one person on each side working together and having to communicate what water was poured and where they think it shall go.


Figure 32: Water game (Background image by Zorn, 2021)

Plate game workshops

Playing the game at MYDO - with 7-14 year olds!

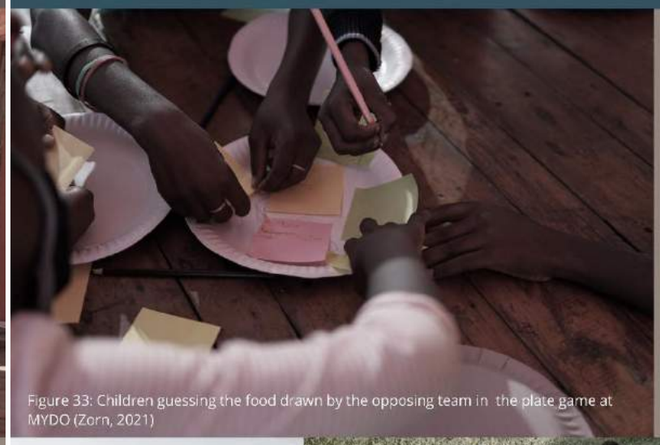


Figure 33: Children guessing the food drawn by the opposing team in the plate game at MYDO (Zorn, 2021)

First game at Youth center

Just a day after the testing of our test game we had our first game session with the kids and youth and the plan was to have 4 kids in each team each guessing on each others plate similar to our test game on the previous page and ask all 3 questions. However we were overwhelmed by how many children wanted to play the game and so we had to adapt on site by making 2 bigger groups of around 8 children and changing the the dynamic of the guessing and the size of the teams.

Second game - smaller group

We did a second game session with a smaller group of kids taking into account the learnings from the first session - and organized a very relaxed game session outdoors with 7 kids that also gave us the chance to have deeper conversations and really get to know the children, hearing their stories and understanding their lives better.

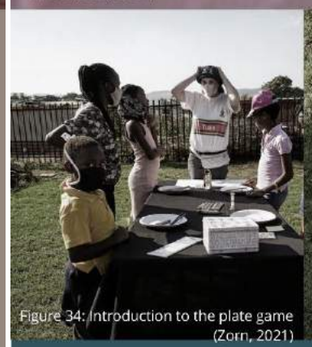


Figure 34: Introduction to the plate game (Zorn, 2021)


Figure 35: Discussion after the game "circle of trust' (Zorn, 2021)


Figure 36: Photos of children taking part in the plate game (Zorn, 2021)

Stickers game at ECD - with 5-6 year olds!


Figure 37: Children 'dishing their plates' during the plate game at the ECD (Zorn, 2021)

Planning the workshop

We saw in our first drawing workshop with these children that there was a need for visual aid to held the children communicate what food they ate at home. Therefore we developed the stickers version of the plate game. The plan was to have 3 different questions and have each child go alone to the stickers buffé table to not influence each other too much - and then be grouped into tables of smaller groups to have some kind of playful and fun process of guessing. We decided to eliminate the game or guessing process as it'd be fun enough to just pick stickers for this age group.

Reflections and learnings

The main insights around the game was to simplify it to just one question as the process of playing this game with 24 children needed time and each child needed to fully understand the questions and food stickers. The teacher played a vital role to make sure the kids understood the task and gave us the right type of data. It was time consuming to design, print and cut out all the stickers but it was worth it when seeing the children's big smiles and realizing that they understood the task thanks to visual aid and great support from the teacher.


Figure 38: Children showing their dinner plates (Zorn, 2021)

Plate game - Take aways

Analysing the data

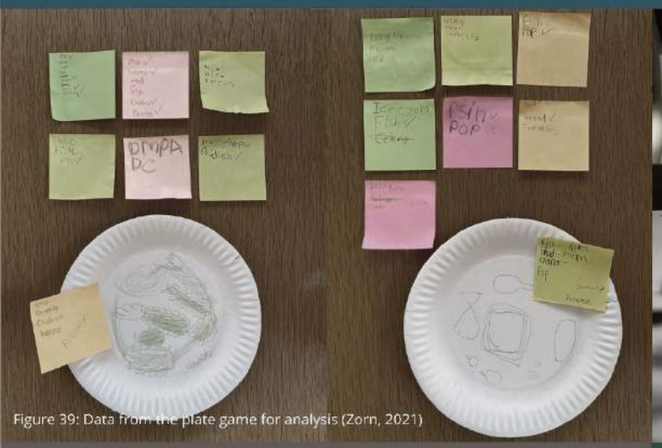


Figure 39: Data from the plate game for analysis (Zorn, 2021)

Figure 40: Children "dishing their dinner plates" during the plate game (Zorn, 2021)

Many layers of data

The game with the older children at Mydo had several layers of data being collected, as both the drawings and the guesses on the drawings gave us data. The correct answer of what was on the childrens plate made us understand what the children ate (or wanted to eat) but the other childrens guesses also gave us ideas of what where the common perceptions around food. Perhaps the children guessed on food types that you ate yourself or wanted to eat. We saw this as a pattern as some children actually had guessed what they themselves had drawn on their plate.

Actual dinner vs. Desired dinner?

Many children (both old and young) interpreted the question of what they ate for dinner in different ways. Some took it quite litteral and draw or added stickers of what they ate regularly every evening while some (we assume) added more or their desired foods. This is exemplified by the example of the McDonalds menu seen in the picture to the right, where the child as well as drawings and guesses of ice cream etc. It might be true that they eat this occasionally but we assume that due to limited budgets the childrens families might not afford to eat this type of food. It might actually show stigmas - and that they wouldn't like to show the "poor mans food" they eat but rather fast food that might be more a symbol of status and success that the children want to show off for others.

Figure 41: Children showing their dinner plates (Zorn, 2021)

Take aways:

Findings

We counted all the foods selected by the children and sorted the most common foods based on how many foods were selected out of all the available foods - here processed food dominated over whole foods.

Lots of processed food

After analyzing the results of the plate game at the ECD we saw that processed food was overrepresented among the foods selected by the children. A pattern that also existed in the youth center plates. From the top foods (that at least 5 or more of the 23 kids selcted) almost half were processed foods, compared what they had to chose from where it was under 23% processed foods.

Vegetables/fruits underrepresented

Both vegetables, fruit, nuts and seeds (basically all whole foods from plants) were very underepresented compared to what the children had to choose from. Also fish were quite un common. More common was hamburgers and the popular dish "Vetkoek's".

Its difficult to know if this is because most children actually eat a lot of processed foods and very little vegetables or if they are more familiar to these due to advertising. But either way the childrens responses indicated a lack of whole foods, fruits and vegetables.

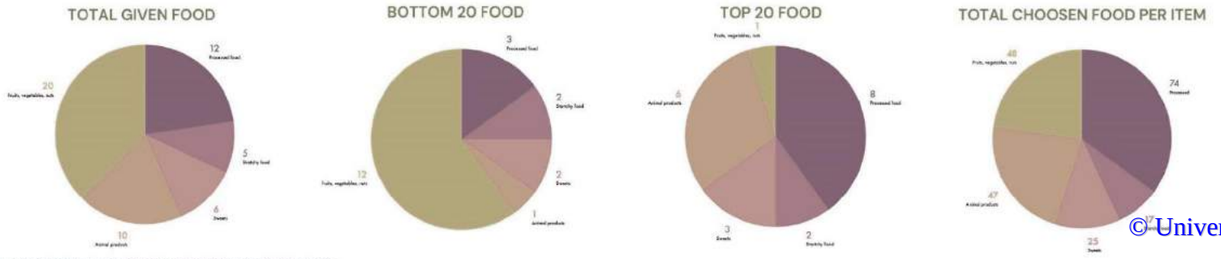


Figure 42: Results from the plate game data analysis

Water game workshop

Playing the water game at Youth center

Figure 43: Children participating in the construction of the water game (Zorn, 2021)

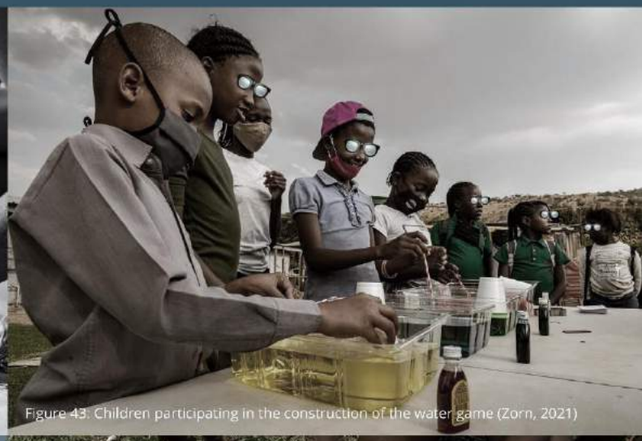


Figure 43: Children participating in the construction of the water game (Zorn, 2021)

Playing the water game

The shades of water game have been played with the children from the Mydo youth centre. The aim of the game was to understand the general understanding of water usages and re-usages practices.

Building the structure together

The children helped with the construction of the game structure. This almost served as the icebreaker making the children excited for what is to come. By co-constructing also strengthen the relationships between the students and the children.

Figure 44: Water game (Zorn, 2021)

Figure 45: Water game (Zorn, 2021)

Drawing as a warm up activity

When the structure have been constructed we asked the children to draw water pictures on the timber sheets while they waited for the other team mates to join. By adding this activity gave them authorship and ownership to this structure.

Figure 46: Drawings made by the children after building the water game (Zorn, 2021)

Reflections and learnings

The different water types have been coloured with food coloring where the children had the opportunity to colour and play with the water which was a very nice sensory experience for the children. This water game was the second game played and when this game is compared to the plate game it is evident that this was by far the most enjoyable game just because of the little co-creation elements we introduced and by activating multiple senses.

Water game - take aways

Analysing the water game data

Figure 47: Post- water game discussion and story-telling (Zorn, 2021)

"There is a "Mangash" living in the Quarry hole! The Mangash eats people, we do not go near the quarry" -

Mydo Youth Centre Children

Figure 48: Post- water game discussion and story-telling (Zorn, 2021)

Discussion to collect data

The discussion we had afterwards with the children also gave us interesting insights of how they use water at their homes:

- The children like to take baths heating the water with kettles to make it warm
- The cook with water such as pasta, meat, and pap.
- The quarry hole water dam is a very scary place for the children and they believe that the "mangash" will kill their family if they go near the water body. The "mangash" looks like big snake monster.
- The children mentioned that they capture rain water with buckets at home for bathing, drinking and cooking purposes.

Where did the water go?

The children showed overall a good understanding of the different water types. The also show signs of reuse practices as home however these practices can be enhanced.

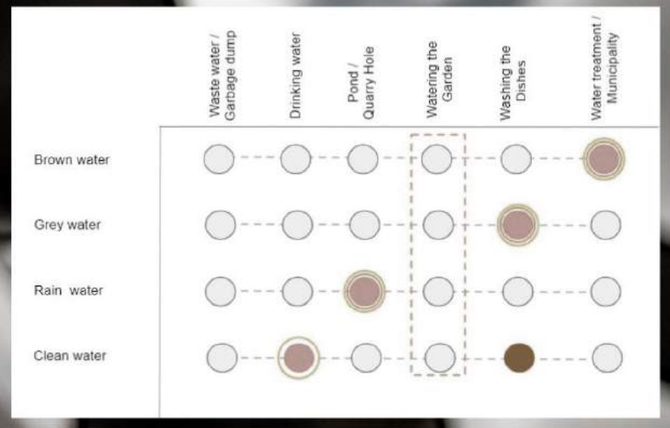
- The children put the Brown water at the dumping site because that is where the dump goes.
- Rain water have been put at the drinking water.
- Grey water have been reused in the toilets.

Figure 49: Post- water game discussion and story-telling (Zorn, 2021)

The main insights and data

The insights of this exercise mede it evident that there is more education needed to reuse greywater to water the garden.

Another important insight was that the children capture rainwater but there is opportunities to enhance this practice using a bigger surface such as roof and gutter to capture even more water reducing their trips to the municipal tanks.



Take aways

Figure 50: Data analysis of the water game (Background image by Zorn, 2021)

Co-design workshop

Design thinking workshop in collaboration with Play Africa

Figure 51: Mapping exercise during the Play Africa workshop (Zorn, 2021)

Pilot workshop with Play Africa

We did an analysis of all the main stakeholders we could think of and organized them in a circle diagram (bellow) where the most important stakeholders in our project are closer to the middle. In the first iteration of this analysis we did not even include the NGO which plays a crucial role and later came to be seen as one of our main stakeholders (in their role of building and facilitating new schools/ECD's and Youth centers in the area).

Part 1-2: Empathize & Define

The youth identified different spots on the map and could add emojis here to express their feelings and identified problems around these area. This was a very efficient way to understand the each child's perspective and the children could lead us into defining problems. The children had presented their problems and we could quickly start defining common problems that many children agreed on.

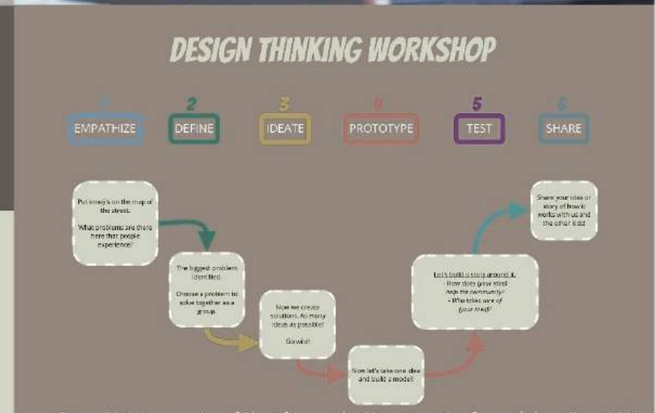


Figure 52: Interpretation of Play Africa method in preparation for workshop (Zorn, 2021)

Figure 53: Prototyping exercise (Zorn, 2021)

Part 3-4: Ideate & Prototype

The next phase was the ideation phase as we fastly jumped over the define stage. Here the children starting sketching on ideas, not always directly related to the chosen problem from previous part. The children did drawings which had a lot of depth them.

Part 5-6: Test & Share

The final part of the workshop was testing and sharing ideas. But here the testing (in which we had in mind to work with storytelling as a way to test ideas was simply not something we had the time for. Sharing though was great fun and and important part of each of the steps.

Figure 54: Prototyping exercise (Zorn, 2021)

Co-design - take aways

Take aways from the Play Africa workshop

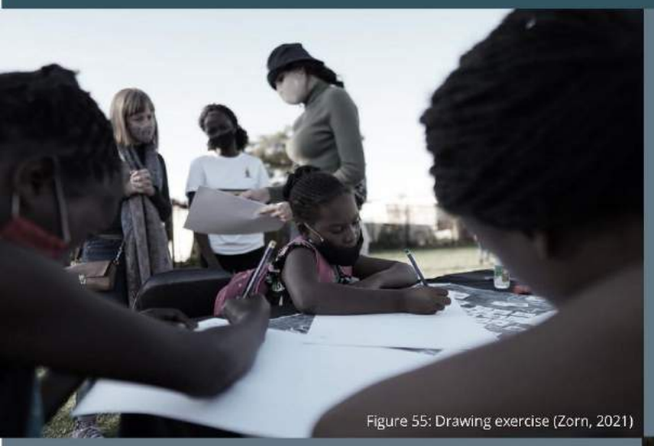


Figure 55: Drawing exercise (Zorn, 2021)

Method & Adaptations

For the workshop, we designed a black and white map, drawn upon a satellite picture of Melusi and Dwar's Avenue. When printed it reached around 1x1 meters.

On this map, a main task for the kids was to put out emojis and for pointing out different thoughts connected to space. By using different emojis, it was possible to connect different spaces to different feelings, thoughts and attitudes.

The map also offered a sort of gameified quality, connecting to the earlier workshops on Mydo and in the area.

Drawings and stories behind

The youth and kids got the oppurtunity to draw - as well as making models out of play doe, sticks and paper, during the workshop.
There was a variety of ideas! Some participants proposed new fences or plantation or trees, while others proposed Melusi to be transformed into a diving centre, to solve the problem of floodings.
Also some quite serious problems connected to the space were identified, shown here beneath.

Problems identified by children

Among the problems idenified by the kids can be mentioned:

- too many cars
- fear of being hit by a car
- fear of unknown cars and persons
- bad connection to the nursery/other side of the street
- fear of snakes

Figure 56: A model built by one of the participants (Zorn, 2021)

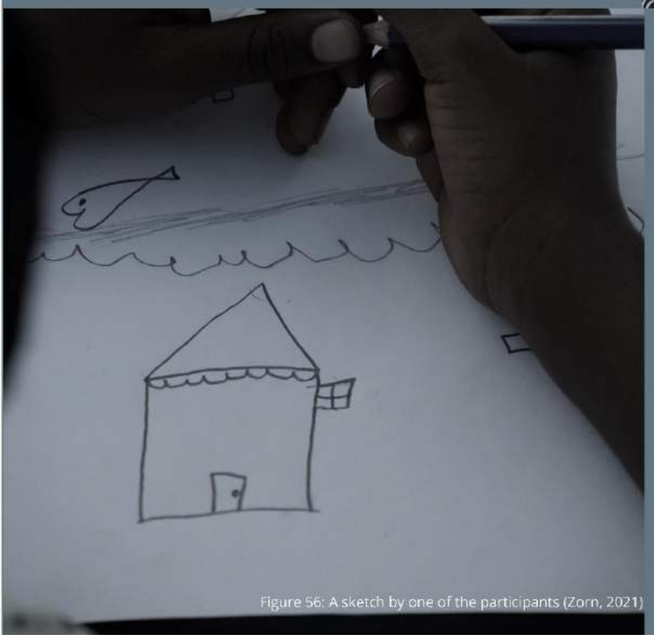


Figure 56: A sketch by one of the participants (Zorn, 2021)

The main insights and data

There where many take aways and important insights from the Play Africa.

Among the most important where:

- Many youth/kids do not like the cars and the road, because of fear of being hit by a car.
- Many youth fear kidnappings, and this is also connected to a negative view of the nearby road.
- There is a fear of trees and vegetation, because of fear of snakes - and a conceptual connection between greenery and snakes. At least this was the case for the trees at the nursery. Because of this, the youth do not enter the nursery.

ANNEXURE

C

ETHICAL CLEARANCE

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

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

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Reference number: EBIT/259/2020

Dr C Combrinck
Department: Architecture
University of Pretoria
Pretoria
0083

Dear Dr C Combrinck

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Conditional approval is granted.

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

Conditions for approval
Conditional approval on the understanding that:
- Applications from each student (including application forms and all necessary supporting documents such as questionnaire/interview questions, permission letters, informed consent form, researcher declaration etc) will need to be checked internally by the supervisor. A checklist will need to be signed off after the checking.
- All of the above will need to be archived in the department and at the end of the course a flash disc / CD clearly marked with the course code and the protocol number of this application will be required to be provided to EBIT REC administrator.
- Any personal and demographic data (eg gender, income, education) have provided the motivation that is acceptable based on the supervisor's evaluation.
- Students using organizations data not publicly available or collecting data from employees have the permissions in place.
- No data to be collected without first obtaining permission letters. The permission letter from the organisation(s) must be signed by an authorized person and the name of the organisation(s) cannot be disclosed without consent.
- Images and observation of people will require consent. Images and observation of minors are prohibited.

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

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

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

The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

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