THE STORY OF WASTE
An organic waste recycling park in Pretoria

by
Evette Boshoff

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The Story of Waste: An Organic waste recycling park in Pretoria

By Evette Boshoff

Submitted in partial fulfilment of the requirements for the degree
Master of Landscape Architecture (Professional)

Department of Architecture
Faculty of the Engineering, Built Environment and Information Technology
University of Pretoria

Study leader: Graham Young (Mr)
Course coordinator: Arthur Barker (Dr)

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Department:	Department of Architecture
Faculty:	Faculty of Engineering, Built Environment and Information Technology
University:	University of Pretoria

Project summary

Programme:	The recycling of waste and water, urban agriculture
Site description:	Berea Park sports grounds
Client:	The current owner is the Department of Land Affairs, the proposed client will be a private developer
Users:	Residents of Sunnyside and Pretoria CBD and the general public
Site Location:	Berea Park, Pretoria South CBD, Pretoria
Address:	c/o Justice Mahomed Street and Nelson Mandela Drive, Pretoria, South Africa
GPS Coordinates:	25°45'29.15"S, 28°11'40.87"E

Landscape Architectural Theoretical Premise: Creating awareness through a didactic and Hedonistic sustainable approach, turning the problem into something playful

Landscape Architectural Approach: Designing a sustainable, multifaceted waste park to contribute to the story of waste

Research field: Environmental potential

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

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

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

Boshoff

Evette Boshoff

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Thank you Lord for all your undeserved kindness and grace and giving me the opportunity and strength to finish this enormous challenge. Without You and all the loving support of my family, it wouldn't have been possible.

Thank you to everyone who carried me through this, for the support and encouragement, love you so much.

My husband, Werner Boshoff, for all your patience, love and support, love you dearly.

To the lecturers, thank you for all your guidance and the knowledge you shared.

ABSTRACT

The main focus of the project is to tell the story of waste - to improve awareness and to help people grasp the colossal problem of landfill space running out! Currently, only 5% of the 3 million tons of waste, produced by Tshwane per year, is being recycled at landfill sites and yet 80% of the waste is recyclable! (Dekker, F. 2012)

Where will we go with all of our waste when there's no space left for landfill sites? What would happen if landfill sites start to take over our parks and green open spaces?! We need to start thinking green and recycle in order to prevent this from happening.

The idea behind the design is to change the visitors' perception of waste by allowing the visitors to go through a process of discovery in order to experience and become aware of the problem and value of waste in a fun and exciting way. The project is multifaceted with a variety of activities and spaces that contribute to the story of waste being told - educating the visitors about the endless possibilities of recycled waste and how they can make a difference by recycling and using waste as a resource.

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Introduction

CHAPTER 1: Introduction

1.1 Background and context

“The Lord God took the man and put him in the Garden of Eden to work it and take care of it” (NIV, Genesis 2:15).

In the past, hard work provided just enough food to survive. Produce was consumed sparingly and no food was wasted. As time passed, food and amenities became more obtainable and abundant. The need to save or consume produce sparingly vanished.

The majority of consumers are unaware of the amount of waste they produce and throw away on a weekly basis.

According to Greenworks’ electronic article Watch your waste it was determined in the 1999 State of Environment Report of South Africa (DEAT, 1999) that over 42 million cubic metres of general waste is generated every year across the country, with the largest proportion coming from Gauteng. The report stated that a daily average of 0.7 kg of waste is generated per person in South Africa.

This waste, according to Discovery Education (2009:2), contains 35% packaging & containers; 27.4% nondurable goods; 15% durable goods; 14.3% yard trimmings and 8.3% food waste.

The statistics clearly indicate how uninformed present-day consumers are with regards to the value of waste and the ability to reduce, re-use and recycle.

Organic waste can be utilized as a valuable resource and by implementing the waste management hierarchy (Refer to Fig. 1 and Fig. 2) the amount of waste filling up landfill sites can be reduced.

For instance: by preventing and minimizing waste during production, recycling by means of re-using, recovering products and producing compost from organic materials, a significant amount of waste can be prevented from going to landfill.

Cleaner production	Prevention
	Minimisation
Recycling	Re-use
	Recovery/Reclamation
	Composting
Treatment	Physical
	Chemical
	Biological
Disposal	Landfill

Fig. 1: Waste Management Hierarchy (South African Journal of Science, 2008:242)

Fig. 2: Waste Management (Author, 2012)

1.2 Problem statement

The main problem is that people are naïve and blind to the problem consumer waste has become. They are unaware of the value of waste and that they have the ability to make a difference by reducing, re-using and recycling.

Because of our current ignorance we face two critical environmental problems according to Walker (1997:88) namely mounting waste and dwindling resources.

It is evident that we are exhausting nature's resources without replacing anything. We need to deal with our environment more responsibly and therefore there is a need to design landscapes that are sustainable and robust.

Thabiso Taaka, chief operating officer of Pikitup in Johannesburg states that "…our city is under pressure for landfill space as it simply does not have limitless airspace" (UGF June 2009:36). On average "[w]e are 'landfilling' 4 000 t of waste per day" (Refer to Fig. 3). The same problem of landfill space running out exists in Pretoria (Refer to Chapter 3).

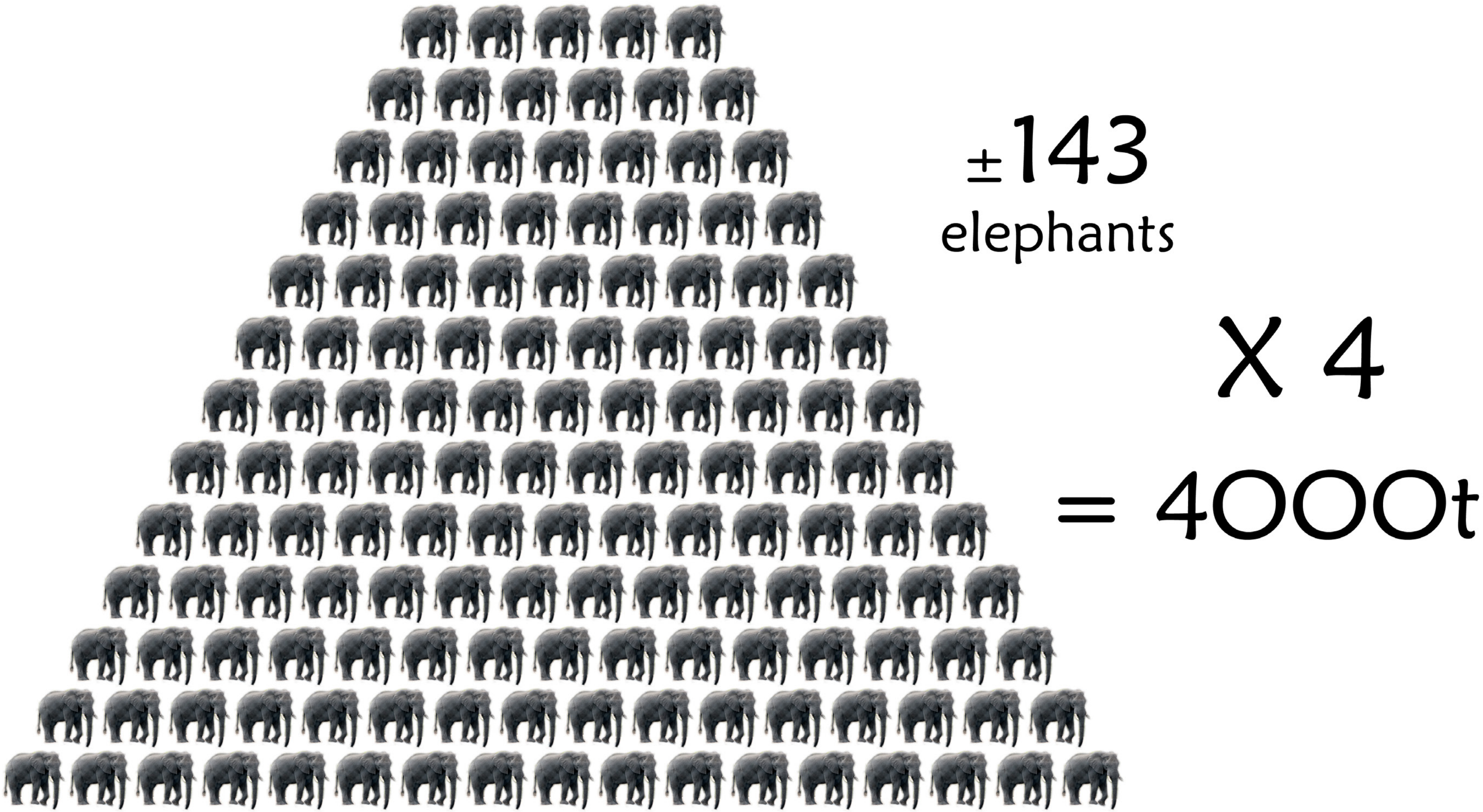

Fig. 3: Land filling 4000 t per day (Author, 2012)

Another issue is that valuable organic waste ends-up at landfill sites because there is limited, and in some areas no, access to garden refuse sites. People have no idea what to do with or where to go with their organic waste.

Existing refuse sites are usually an eyesore and work on the principle of people merely dropping off their waste, jumping back into their cars and, in this way, making their contribution to the disconnectedness of communities (Refer to Fig. 4).

Fig. 4: Mountain view Garden Refuse site (Author, 2012)

1.3 Hypothesis

By using Landscape architecture and its principles, such as the "support and execution of sound and sustainable ecological planning and management to contribute to the conservation of natural resources" (ILASA, 2013), an organic waste recycling facility can be designed in a safe and accessible park-like setting. This will create the opportunity for people from different parts of the city (townships, suburban and urban parts of Pretoria) to meet and engage with the entire recycling process in an attempt to change their perception of waste and to stimulate the desire to recycle.

"We need to incorporate in our built environment places for gathering and congregation, along with spaces for discovery, repose and privacy in our increasingly bewildering, spiritually impoverished, overstuffed, and under-maintained garden Earth" (Walker, 2002:88).

1.4 Aim and objectives

The focus of the dissertation revolves around waste and telling the story of waste to improve awareness about the waste problem, the value of waste and the recycling possibilities of waste. People can't be expected to act if they don't know.

The aim is to design the waste park as a pod system (a model or guidelines) that can be applied in different areas of the city where similar situations are found. This will aid in reducing the masses of waste that is wrongfully sent to landfill (Refer to Fig. 5).

Fig. 5: Kwaggasrand Landfill site (Author, 2012)

The waste park will be an environmental education and organic waste recycling facility where a well-thought-through waste management plan, guided by a ‘Waste Model’ (Refer to Fig. 6) will be implemented to provide a park that is safe and more accessible to the public than conventional waste dumping sites.

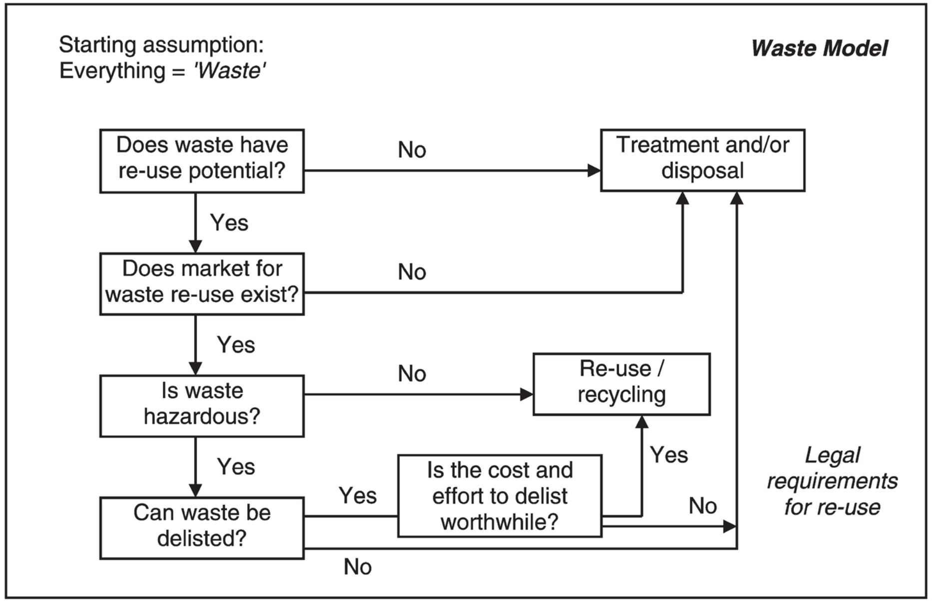

Fig. 6: Managing waste through a ‘Waste Model’ (South African Journal of Science, 2008:244)

The waste park will be located in an urban community where there is a need for job opportunities (income), education and recreation as well as waste recycling and urban agriculture.

The research will begin by looking at Pretoria and mapping the existing garden refuse and landfill sites. The origin of waste being brought to these sites will be established in order to pinpoint sites in Pretoria where there is a need for waste drop-off points.

1.5 Research questions

Research questions were formulated to set out the important aspects regarding the project that need to be investigated in order to gather all the necessary information to approach and complete the project successfully.

- Is there a need for an organic waste recycling park in Pretoria?
- How do you design a recycling park to be safe and easily accessible?
- How can this proposal change the way people view the value of waste?
- How can waste be used as a resource?
- How can people be made aware of the waste problem in a fun and exciting way?
- Will hands-on experience and allowing the public to take part in the waste recycling process lead to a deeper understanding of the problem?
- How can the problem be turned into a playful or informative experience?
- What recycled materials are available to use in the park and how can they be applied?

1.6 Assumptions and delimitations

The focus of the study is landscape architecture, improving the aesthetics, ecologically planning sustainable landscapes and “integrating man and nature’s needs for the benefit of the environment” (ILASA, 2013). The processes and facilities required for the recycling and recovering of all kinds of waste are too complex, a specialist in this domain is needed, therefore, the project is limited to the recycling and composting of organic waste, however, bins will be provided for the recycling of glass, paper, metal and plastics.

A large amount of waste is generated in Pretoria daily. This project can't be seen as the **solution** to Pretoria's waste problem, emphasising the fact that the project won't be taking over the role of the municipality, but will merely attempt to help bring relief to the problem and to educate people about reducing and reusing waste through the recycling and composting of green waste and the recycling, cleaning and re-using of hard waste.

1.7 Research and design methodology

A Descriptive and Analytical Survey method together with a study of precedents will be used in this dissertation to collect and research data (Refer to Fig. 7).

- Descriptive research method

The method is used to describe the current situation by photographing and observing the selected site and the surrounding area.

Descriptive research methods "do not make accurate predictions, and they do not determine cause and effect" (Hale, 2011), therefore it is necessary to carry out an Analytical research method as well in order to get the facts straight.

- Analytical research method

The method is used to analyse the site by means of a *Contextual analysis:* analysing the context of the site, regional connections, public transit, movement around and to the site and *Site analysis:* analysing the site by mapping and gathering data of the selected site.

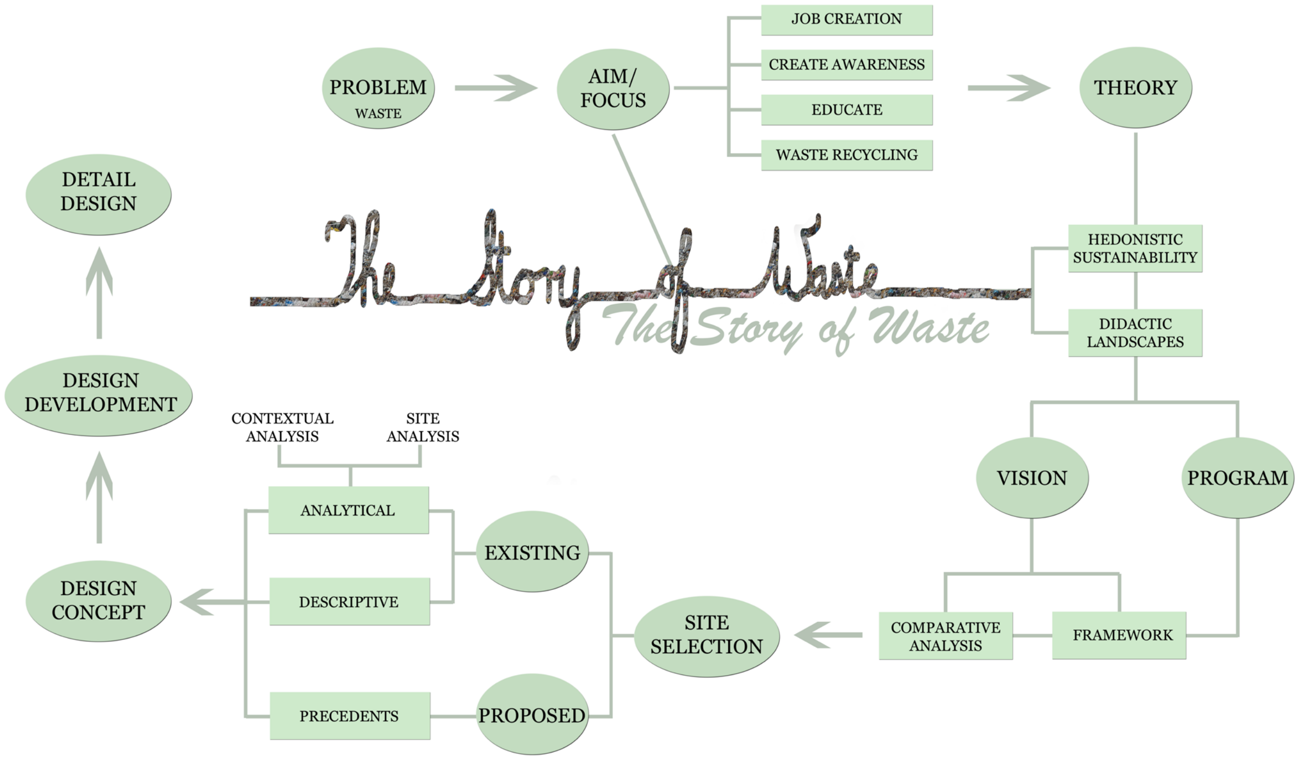

Fig. 7: Research and Design Methodology (Author, 2012)

A *Comparative analysis* of potential sites in Pretoria was also executed to determine the most suitable site for the study area (Refer to Chapter 3 section 3.5).

The "voluntary rating system" called the Sustainable Sites Initiative (SITES) will be used to guide design decisions and assess the final design. The rating system "is designed to encourage development, design, construction and operation of eco-friendly landscapes. The guidelines are fast becoming a standard for sustainability" (POST, 2010).

- Study of precedents

Different, relevant precedents will be studied and used as inspiration to aid in formulating principles and guidelines that will inform and guide the decision-making throughout the design development process.

1.8 Introduction to Site

The information provided in the next section is merely a brief introduction of the site selected for the proposed project before theoretical concepts are explored and an in-depth site selection and analysis are completed in Chapter 3 and 4.

1.8.1 Site location

The selected site is called Berea Park and it is located in Pretoria on the edge of Pretoria South CBD and Sunnyside, next to Nelson Mandela Drive, the Apies River and UNISA Sunnyside campus (Refer to Fig. 8). (For in-depth analysis of the site refer to Chapter 4).

1.8.2 Historical context

Berea Park sports ground was originally a cattle compound in 1882. As the years passed it has been used for a variety of purposes and therefore has had many different names. (Refer to Chapter 4, section 4.2 for an in-depth discussion of the site's history).

The site was known as Berea Park Cricket club or the Northerns Cricket club. Cricket players who used to play at Church Square moved to Berea Park, where they couldn't disturb councilmen, until SuperSport Park was built.

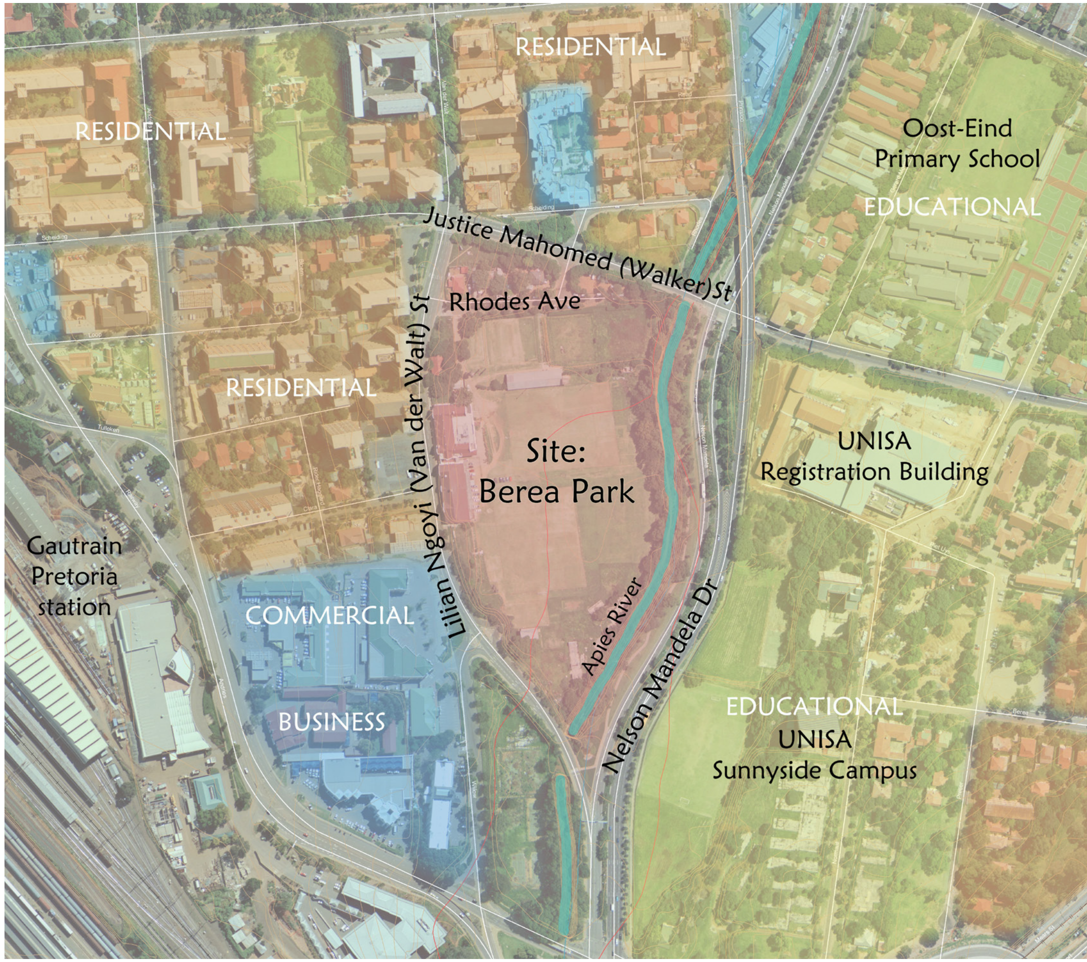

Fig. 8: Site Location (Map from ArcGIS and modifications by Author, 2012)

When the South African Transport Services became the owners of Berea Park Sports Ground, the Berea Southern Clubhouse and the Northern Club Hall were built. The buildings were used as administrative offices and conference venues (WikiUP, 2010).

Berea Park also operated as school grounds for the Founders Primary and High School, but unfortunately the grounds burnt down during a fire in April 2010 and the buildings were left vacant and have remained unoccupied to this day.

The park is currently the property of the Department of Land Affairs who have plans to develop the site into housing, consisting mainly out of a hotel and flats (Refer to Chapter 4, section 4.7).

1.8.3 Physical context

Rhodes Avenue and Justice Mahomed Street (previously known as Walker Street) (above Rhodes Avenue) runs on the northern side of Berea Park. Nelson Mandela drive runs on the eastern side and Lilian Ngoyi Street (previously known as Van der Walt Street) on the western side of Berea Park.

The site is adjacent to the Apies River (parallel to Nelson Mandela drive).

The Gautrain Pretoria station is close to the park – to the west of the park.

There are three buildings on the site: the Southern Clubhouse and the Northern Club hall, which are connected by a bridge with timber frame windows (Refer to Fig. 9). Brick walls have been built in the openings of windows and doors to keep the public out. The third building is the Bowling Greens Clubhouse, a single storey building. The entire site is derelict and closed-off as a result of the fire damage.

1.8.4 Social context

The site is located adjacent to a densely populated residential community with the lowest average income and highest unemployment rate. Residents of Berea Park community are aged between 15 and 39 – relatively young (Gauteng Census, 2001) (Refer to Chapter 3 Table 3).

There are commercial activities next to Berea Park, south-west of the site.

East of the site there are educational facilities such as UNISA Sunnyside Campus and Oost Eind Primary school (Refer to Fig. 8).

Fig. 9: Bridge between Clubhouse and Hall (Ablewiki, 2012)

1.8.5 User

The current users of the site are the residents of Sunnyside and Pretoria CBD and the general public. The study area is used for informal gatherings and soccer games; the buildings, however, are not in use because of the damage caused by the fire.

1.8.6 Land Owner

Department of Land Affairs.

1.8.7 Client

A private developer, such as Waste Group, will hire the site from the Department of Land Affairs and develop the site into the Berea Waste Park. In return the private developer will not only gain financially by operating the waste park, but will also gain waste and increase their BEE rating.

The private developer will have a social responsibility to provide job opportunities, supply Sappi and other organisations with hard waste, generate compost and vegetables and to provide a park to the Pretoria CBD and Sunnyside community.


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CHAPTER 2

Theoretical Investigation

CHAPTER 2: Theoretical Investigation

2.1 Background: When did waste become a problem?

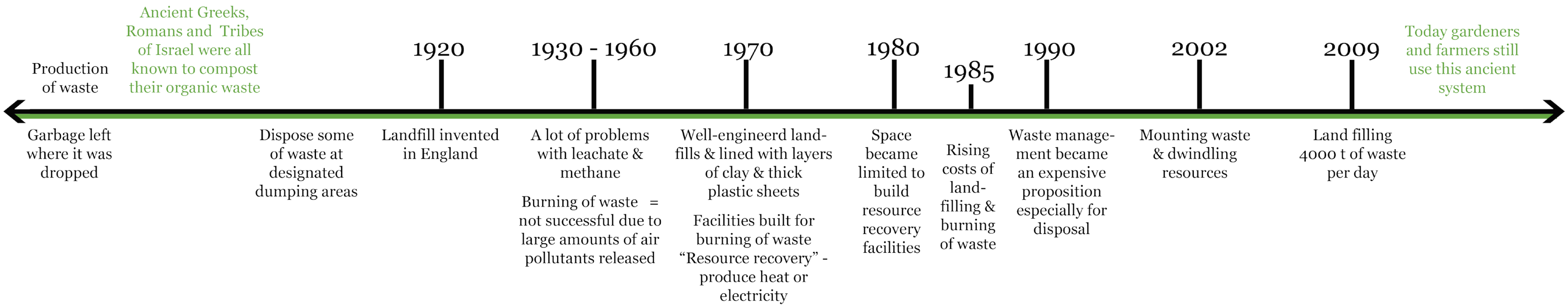


Fig. 10: Time line: History of Waste (Lerner, World of Earth Science, 2003 and Teacher's Notes. Modifications by Author, 2012)

In order to understand the current problem of waste, it is important to investigate how waste was managed through the years, the methods used and how the waste problem evolved.

The investigation was done on a broader scope, because waste is a universal problem and no one seems to grasp the value of waste and how to successfully solve the problem.

"People have always produced waste, but as industry and technology have evolved and the human population has grown, waste management has become increasingly complex" (Lerner, 2003).

Lerner states (2003) that four main methods of waste management existed throughout history, namely: dumping, burning, reuse and recycling and the prevention of waste.

In earlier days humans didn't worry too much about managing their waste; garbage was simply left where it was dropped.

However, "The process of composting organic or 'green' waste is an ancient one. The Ancient Greeks, Romans and the Tribes of Israel were all known to compost their organic waste…" (Teacher's notes, n.d:129).

It was believed that the Chinese were the first to develop larger composting sites for use in farming (Teacher's notes, n.d:129).

According to Lerner (2003), people began to dispose some of their waste at designated dumping areas as permanent communities started to develop. These "open dumps" are still being used in many parts of the world, but unfortunately they have many disadvantages – particularly in dense communities, because they represent the contamination of groundwater caused by leachate (a liquid containing toxic chemicals) that filters through the dump.

The landfill concept was invented in England during the 1920s. Leachate and methane were problematic during the early days of landfills, but since the 1970s landfills were well-engineered and lined with layers of clay and thick plastic sheets. This resolved many of the problems such as leachate contaminating groundwater (Lerner, 2003).

The burning of waste has a long history but it wasn't very successful due to the high volumes of air pollutants released during this process. During the 1970s, however, facilities were built to use the burning of waste as "resource recovery" to produce heat or electricity. Space to build these facilities became limited and the public started to oppose this idea during the mid-1980s because of air-quality issues (Lerner, 2003).

The rising costs of landfilling and burning of waste raised concerns with the public. During the last 25 years this caused local governments to insist on the reduction of waste disposed by means of landfilling and burning and to seek alternative methods for the handling of waste. Such methods include the prevention, reduction and recycling of waste and are the least expensive methods of managing waste (Lerner, 2003).

The recycling of organic waste such as yard waste, food waste and broken down paper through the process of composting is seen as a form of waste prevention. The compost can be used to improve the fertility of the soil.

Unfortunately composting organic waste is not people's most preferred method and dumping waste at a landfill site is a much easier and more convenient method to get rid of unwanted waste.

"Waste management became a particularly expensive proposition during the 1990s, especially for disposal. Consequently, waste managers constantly seek innovations that will improve efficiency and reduce costs" (Lerner, 2003).

By studying the history of waste, it is clear that waste has always been a problem and is still an on-going and growing problem. The problem needs to be addressed by an innovative and creative solution.

The correct approach and a strong theoretical foundation will yield a feasible solution.

2.2 Literary investigation of core theoretical concepts

There are many theories available that can be used to approach the problem. Four theoretical concepts will be investigated in this dissertation namely Hedonistic Sustainability, Didactic Approach, Urban Ecology and Regenerative Design.

All four of these theories have the same goal in mind and that is to find new and exciting ways to address a problem and to attempt to change the 'World's point of view' regarding that problem, in this case, waste.

2.2.1 Hedonistic sustainability

The notion *Hedonistic Sustainability* was initiated by the Danish architect Bjarke Ingels. According to Cleary he is the founding partner of Bjarke Ingels Group (BIG) and "rated as 'one of the 100 most creative people in business' by Fast Company" (Cleary, 2012).

In order to have a better understanding of the meaning of *Hedonistic Sustainability* the theory was subdivided into Hedonism and Sustainability.

He-don-ism is the "pursuit of or devotion to pleasure, especially to the pleasures of the senses." "The ethical doctrine holding that only what is pleasant or has pleasant consequences is intrinsically good", the philosophy of *hedonism* and "the doctrine holding that behaviour is motivated by the desire for pleasure and the avoidance of pain" the psychology behind hedonism (The American Heritage Dictionary of the English Language, 2009).

According to Thompson (2000:2-3) *sustainability* means much more than only "a lasting and non-destructive way to live on this Earth"; it is about "using resources without diminishing their future availability or quality", "…living within our ecological means" and "…maintaining habitat and biodiversity."

Friedman states (2007:7) that environmental, economic and social aspects are equally important and need to be considered, as well as their interrelationships, in order to create "a well-balanced, *sustainable*" development "where all concerns are addressed…" (Refer to Fig. 11).

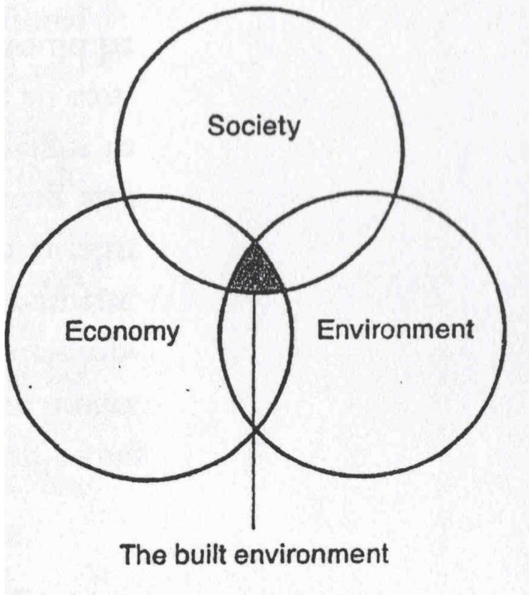


Fig. 11: Sustainable built environments are a combination of societal, economic and environmental considerations (Friedman, 2007)

In Charles Kibert's book (1999: 10-12 & 19-20) he expresses that "reduce-reuse-recycle" are strategies the realm of *sustainability* relies on. He also argues that even though humans will always use and abuse natural resources, "we will also be clever and adaptable, and we will increase efficiency, reduce material consumption, and adopt environmentally friendly behaviours."

People have the misconception that you have to sacrifice your existing quality of life in order to become sustainable and that a sustainable life is not as much fun as a normal life.

"What if sustainability actually increases life quality?" (Ingels, B. 2011) Bjarke Ingels follows the philosophy of *Hedonistic Sustainability* which represents the basic concept of pleasure being the only intrinsic focus for going green.

Sustainable development has to be a design challenge where the project is economically, environmentally, socially and aesthetically sustainable in order for it to be sustainable in the long-term.

According to Ingels (2011), sustainable life can be more fun than normal life and improves social cohesion by implementing *Hedonistic Sustainability* – taking the problem and turning it into something playful.

Hedonistic sustainability can be applied by designing didactic places (Refer to 2.2.2), taking the problem and turning it into a 'process of discovery', discovering the story of waste by allowing people to have hands-on experience and to take part in the recycling process. This will make people aware and teach them about the problem and how to make a difference in an exciting and fun way.

People have the desire for pleasure and therefore their behaviour might be influenced by making the 'experience' more enjoyable or pleasant.

If only people could realise or be made aware of the fact that "sustainability will improve their quality of life and human enjoyment" both pleasure for themselves and benefits to the environment can be attained (Ingels, 2011).

"The concept of hedonistic sustainability offers new hope that going green is not synonymous with deprivation" (Cleary, 2012).

2.2.2 A Didactic approach through storytelling

According to Random House Dictionary (2012) *di-dac-tic* is teaching or intending to teach a moral lesson.

A didactic approach through storytelling can be used to transform a space into a place with meaning (Buck & Ferrai, 2011:22) that will educate people about the problem of waste, the recycling of waste and the process of composting organic waste (Refer to 2.2.3.1).

Developing different "spaces that reveal stories as you walk through them" (Buck & Ferrai, 2011:22), taking 'the reader' on a journey of discoveries and exploration, encouraging 'the reader' to engage with and experience the waste recycling process, in an attempt to change their perception of waste.

According to Treib "[t]he didactic approach dictates that forms should tell us, in fact instruct us, about the natural workings … of the place." "A design didactically conceived, is both informative – possibly normative – and certainly directive. A Didactic landscape is supposedly an aesthetic textbook on natural, or in some cases urban, processes" (Treib, 1995:95-96).

Didactic landscapes can also be implemented to help promote educational and intellectual growth through stimulating play areas that also communicate the story of waste, where the experience and the story itself becomes the teacher.

2.2.3 Urban ecology

In the book U*rban ecology: an international perspective on the interaction between humans and nature*, the authors define Urban Ecology as "the study of ecosystems that include humans living in cities and urbanizing landscapes. It […] aims to understand how human and ecological processes can coexist in human-dominated systems and help societies with their efforts to become more sustainable" (Marzluff et al, 2008:vii).

Urban Ecology's nature is interdisciplinary and focuses on both humans and natural systems; therefore the term "has been used variously to describe the study of humans in cities, of nature in cities, and of the coupled relationships between humans and nature" (Marzluff et al, 2008:vii).

The ecological approach to urban landscape design developed over time and today different ways to protect and enhance natural features and processes are embraced. This means that city dwellers can also enjoy and experience them (Makhzoumi & Pungetti, 1999:188).

Different methods to be applied within the Berea Waste Park to embrace natural features and processes will be investigated. This will form part of the story of waste being told and the experience thereof.

2.2.3.1 Using waste as resource

People need to realize what the value of waste is and its potential to be used as a resource. "Waste from one system may become a valuable resource for another system" (Birkeland, 2002:43).

People can "create valuable products from waste, making money and solving the pollution problem at the same time" (Gladstone, & Hesse, 1998:1).

According to Oelofse and Godfrey in the South African Journal of Science (2008:245) there has been a paradigm shift towards waste as resource, and a resultant change in the governance of waste from protection to re-use (Refer to Fig. 12).

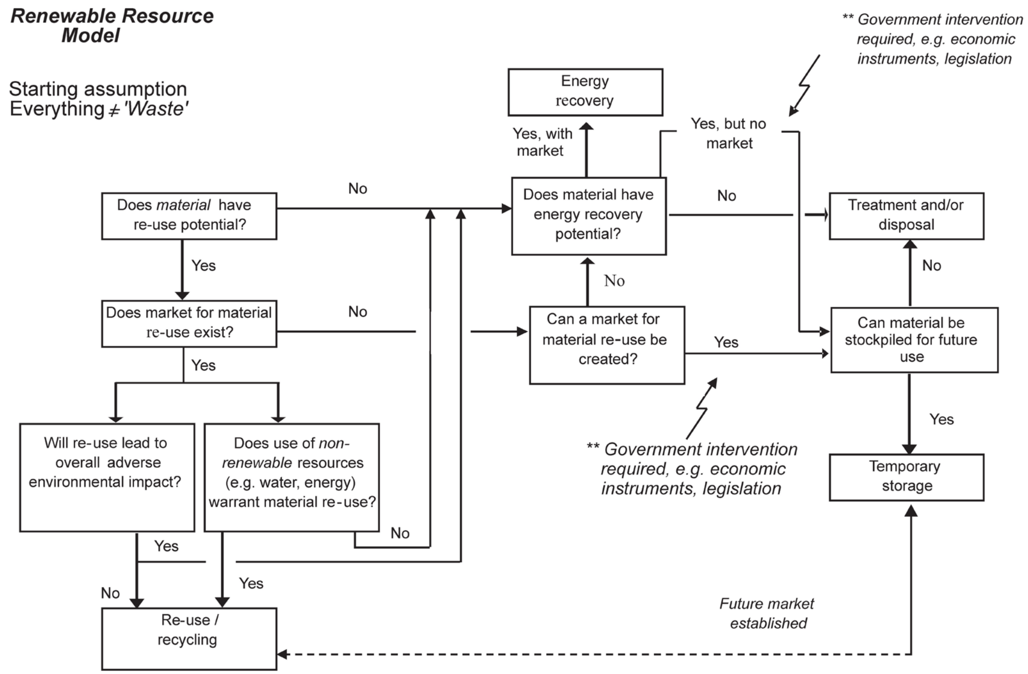


Fig. 12: Managing waste through a 'Renewable Resource Model' (South African Journal of Science, 2008:245)

Waste re-use can be encouraged by seeing materials regarded merely as waste as renewable resources and this can lead to a resource-based hierarchy replacing the waste hierarchy (as illustrated in Fig. 3).

There are different systems of using waste as resource, for example the recycling of organic waste through the composting of green garden waste and vermicomposting and the recycling of hard waste.

2.2.3.1.1 Recycling organic waste

Wherever there is human habitation, organic waste will be generated and according to Practical Action's article *Recycling of Organic Waste* the amount of organic waste produced is dramatically increasing each year. In the United States of America "as much as 50% - 60% of the total waste that is disposed into landfills is organic waste" (Edwards, Arancon, & Sherman, 2011:1).

The Teacher's notes article Composting and Organic Waste (n.d:133) states that "[o]ne third of the waste found in a typical dustbin could be composted; this would save time and money in refuse collection and save valuable space in landfill sites."

A limited amount of organic waste recycling facilities exist and this results in valuable waste being dropped at landfill sites. There are several refuse sites in Pretoria where the waste is also taken to landfill sites and not recycled. What a waste?!

There is a great need for 'refuse sites' that recycle garden and organic waste into compost. Composting, according to Teacher's notes (n.d:129), is a natural 'rotting down' process during which nutrients from organic materials are recycled.

Two methods of composting waste will be studied in the next section.

Composting green waste

The composting of green waste can be achieved by following the 'Windrow System'. The Windrow System starts when garden waste is collected and delivered to a waste park. The waste is shredded and chipped with a chipper. According to Teacher's Notes (n.d:132), the shredded waste is then stacked in long piles of approximately 5 metres high, called windrows.

The piles of waste are turned every six weeks to let air in, while being irrigated regularly, during which the waste is broken down through a natural process of rotting and decay. "Organisms such as bacteria, fungi and algae feed on the organic waste material and reproduce" (Teacher's notes, n.d:130). The air is very important for the micro-organisms to survive.

The final pile is sifted and the end-product is compost; the left-over material taken back to the beginning to go through the process again.

Fig. 13: Composting Green Waste at University of Witwatersrand by Servest Landscaping (Author, 2012)

A good example of the Windrow System is the composting facility at the University of Witwatersrand operated by Servest Landscaping (Refer to Fig. 13).

Vermicomposting

According to the Mosby's Medical Dictionary (2009) "*Vermis*" is the Latin term for 'a worm' therefore Vermicomposting is the process during which organic material is broken down by earthworms. The worms ensure the acceleration of the decomposition of the organic materials like food scraps and garden waste.

The end-product is Vermicompost: a "mix of worm castings and decomposed food scraps… full of beneficial microbes and nutrients" (CalRecycle, 2011).

Vermicompost also known as worm compost, vermicast, worm castings, worm humus or worm manure according to Dunn (2007) is very similar to normal compost except for the important fact that worms are used to turn the organic waste into a nutrient-rich fertiliser instead of using microbes and bacteria.

Two species of worms are usually used for vermicomposting because of their relatively high tolerance to environmental variations, these are Red Wigglers (*Eisenia foetida*) (Refer to Fig. 14) and Red Earthworms (*Lumbricus rubellus*) (Dunn, 2007).

Fig. 14: Red Wigglers (van der Walt, no date)

2.2.3.1.2 Recycling hard waste: glass, paper, metal and plastic

Recycling in the long run is beneficial to all living creatures on earth. It creates job opportunities, alleviates poverty, extends the life of landfill sites, reduces the costs to local authorities and it leads to a cleaner environment.

Apart from the above mentioned, one of the main benefits of recycling is that the amount of new materials required is reduced and because less raw material is required, it is further economically, socially and/or environmentally beneficial for materials that is costly to extract or to produce.

Hard waste can be recycled by providing litter bins marked specifically for each form of material such as glass, paper, metal and plastic. According to Gladstone and Hesse in their 'Reduce re-use recycle'-article, glass and cans are 100% recyclable (1998:3).

As a result, job opportunities are created by employing people to sort the unsorted waste into the different categories. Schools can also earn money by participating in the collection of recyclable materials and delivering it to allocated collection points.

At the educational workshops and demonstration projects both children and adults will be encouraged to “make use of recycled materials to make sculptures – wire cars, African masks, waste trophies, plastic bowls, bead work, waste paper animals, tin furniture” and to “weave plastic bags into beautiful mats, hats and handbags.” Through these workshops people will be “encouraged to develop artistic creativity and environmental awareness” (Gladstone & Hesse, 1998:7).

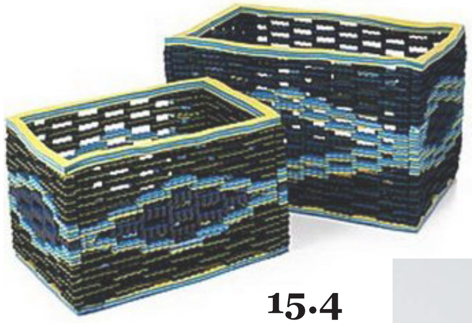
Examples of products made from recycled materials:


15.1


15.2


15.3

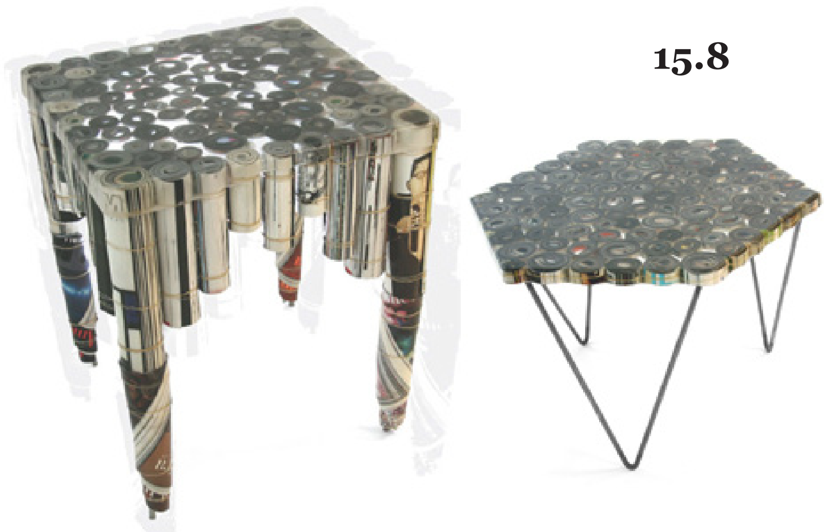

15.5


15.4

- A Tree sculpture out of green aluminium cans by Devon Ashley & Brooke LeFevre, 2009. See Fig. 15.1
- Seat from knitted plastic bags by Malene Lund Rasmussen, Copenhagen, 2011. See Fig. 15.2
- Green Wire Cars Exhibition by Children of Ghor al Mazara, 2012. See Fig. 15.3
- Flip-flop storage boxes handmade in the Philippines with scrap foam rubber from flip-flop factories, 2009. See Fig. 15.4
- Green Wire Cars Exhibition by Children of Ghor al Mazara, 2012. See Fig. 15.5
- Basket made from recycled materials by Miriam Gray, 2011. See Fig. 15.6
- Chair from recycled wine corks by Gabriel Wiese, 2006. See Fig. 15.7


15.6


15.7


15.8


15.9


15.10


15.11


15.12

- Newspaper Furniture (Papa, 2009). See Fig. 15.8
- Bowls made from telephone wire by Earth Alley, 2008. See Fig. 15.9
- CD Case Chandelier by Josh Owen, 2009. See Fig. 15.10
- Handbags from recycled trash by ECOIST (Helen & Jonathan Marcoschamer), 2009. See Fig. 15.11
- Handbag from recycled trash by ECOIST (Helen & Jonathan Marcoschamer), 2009. See Fig. 15.12

2.2.4 Regenerative / Ecological design

Regenerative design, as defined by the Regenerative Design Group (2009) is: Design that mimics and strengthens the patterns and processes of healthy ecosystems; and design of human habitats that revitalize and support ecological health through the sustainable production of energy and material goods.

"Ecological landscape design is based on an ecological understanding of landscape which ensures a holistic, dynamic, responsive and intuitive approach" (Makhzoumi & Pungetti, 1999:209).

According to Stitt (1999:6-7), applying ecological design principles has many benefits such as reduced resource consumption, affordability, productivity and human health.

In the previous chapter, different methods were explored on how to reduce the 'mounting of waste' (mentioned in Chapter 1, section 1.2). In the following section, urban agriculture, methods on how to 'give back to nature' and how to prevent the 'dwindling of resources' will be discussed.

2.2.4.1 Urban agriculture

What is urban agriculture? According to RUAF's article, urban agriculture is described, in short, as "the growing of plants and the raising of animals within and around cities".

What makes urban agriculture different from rural agriculture is the fact that it is integrated into the urban economic and ecological system, which means that it is “embedded in -and interacts with- the urban ecosystem” (RUAF).

Usually, typical urban resources are used like organic waste as compost and urban wastewater for irrigation. As the city grows, urban agriculture will continue to increase.

Unique examples of how agriculture can be integrated into the urban ecosystem in a prosperous way are discussed in the precedent studies chapter (Refer to Chapter 5).

Urban agriculture not only promotes community development, but also acts as learning spaces where high-quality, safe, healthy, affordable and locally-grown produce is provided for all residents of the community while supporting the urban farmers who grow them. It also gives struggling families access to the healthiest food for the lowest cost.

2.2.4.2 Giving back to nature

“*Look deep into nature, then you will understand everything better.*” *-Albert Einstein (1879-1955)*

There are various ways of giving back to nature and protecting what is left, for instance by promoting ecological design through the implementation of natural processes such as the decomposition of organic waste and the cleansing of water through a wetland and bioswales.

By changing people’s perception of waste we can all take responsibility for our environment and play an important role in solving this environmental problem. “Man is that uniquely conscious creature who can perceive and express. He must become the steward of his biosphere. To do this, he must design with nature” (McHarg, 1969:173).

By reconnecting and designing with nature, for example using plants in an aesthetical and functional way, will help bring nature back into the cities. “We need nature as much in the city as in the countryside” (McHarg, 1969:173).

Nature also exists in the in-between areas (the matrix) and should not be forgotten. The ecological connectivity can be increased by strengthening the qualities of nature in the matrix.

The interaction between different values of nature such as the “ecological connectivity, identity of the cultural landscape and recreational values of the landscape” can be strengthened when the social benefits of nature are increased by encouraging “social involvement with nature” (Heukels & Franssen, 2007).

Even children can play a role in giving back to nature by teaching and helping them in the educational play areas to recycle, build bird or bat houses, or bird feeders. In this way children can have fun while learning carpentry and artistic skills.

2.3 Summary

To summarize, the essence of the four theoretical concepts:

Hedonistic sustainability has the ability to enhance our quality and enjoyment of life by turning the problem of waste into something playful, a discovering process, a story unfolding and therefore experiencing the process hands-on in a fun and exciting way;

A *Didactic* approach will teach and educate people about waste and waste recycling by telling the story of waste. By telling this story, the park will be transformed into a place with meaning, where ‘the reader’ can go on a journey of discovery, exploration and engaging with the waste recycling process;

Applying *urban ecological* principles by investigating methods on how humans and ecological processes can coexist in a human-dominated system. Protect and enhance natural processes so city dwellers are able to enjoy and experience them. This can be accomplished by using waste as a resource through recycling organic and hard waste; and

To give back to nature through the implementation of *regenerative and ecological design* principles. Designing with nature and appreciating the beauty and value of nature and its resources. Designing sustainable human habitats through the application of urban agriculture.

By applying these theories and combining their elements successfully the following can be achieved:

- Make people aware of the waste problem, the value of waste and waste recycling;
- Change people's perception of waste;
- Use waste as a resource;
- Reduce the amount of waste filling up landfill sites; and
- Create a safe and accessible waste park with a multitude of activities


Aucor
FLEET&REPO
AUCTION
BAKKIES BUSES
CARS LDV s MPV s
SUV s 4x4 s
EVERY SATURDAY
0861282846
TSHWANE
8888
MUKOSI 25

CHAPTER 3

Context Analysis

CHAPTER 3: Context Analysis

3.1 Introduction

The Analytical Research method will be used for the Contextual analysis to analyse the context of the site, the regional connections to the site (such as connections to local parks, schools, hotels, flats, etc.), public transit and movement to- and around the site.

The method also includes mapping and data gathering to determine the location of existing garden refuse and landfill sites, the origin of waste, existing local parks and sports grounds, population and unemployment rates.

This will result in the identification of potential sites in Pretoria.

3.2 Location

It is important to study the problem within its larger context. This aids in understanding the milieu of the problem and in finding the most suitable site for the design proposal.

Pretoria will be explored as the city context (Refer to Fig. 16). Hereafter, Pretoria south CBD and Sunnyside will be explored as the study area to identify potential sites (Refer to Fig. 31). Once the best possible site has been discovered, it will be focused on in more depth.

3.2.1 City Context

It is necessary to study the city of Pretoria's context with respect to the problem in order to determine the locations of existing landfill sites and the origin of garden refuse—more plainly—the origin and destination of waste in Pretoria.

The study of Pretoria will extend to the outskirts of Akasia, Roodeplaat, Mamelodi, Centurion and Elandsfontein.

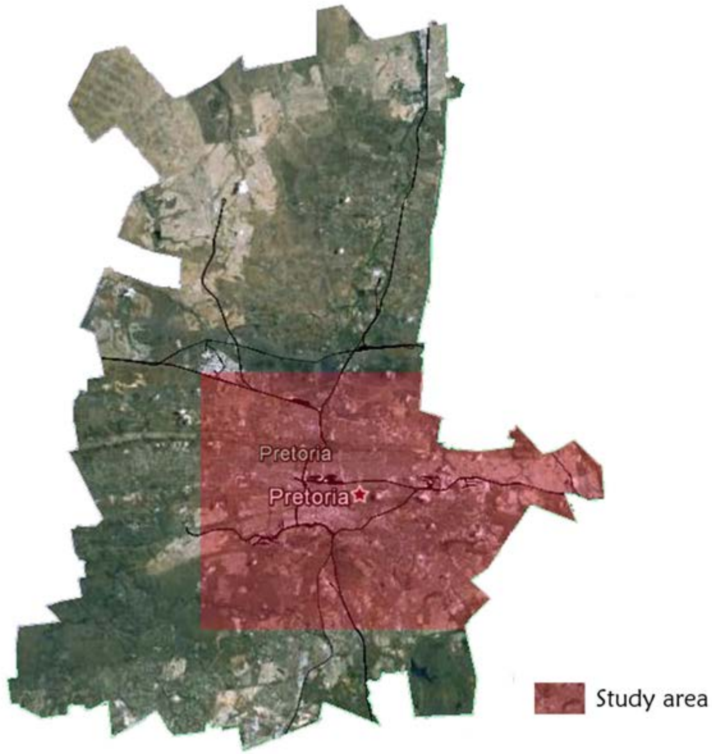


Fig. 16: Map of Pretoria (Map from Google Earth and modified by Author, 2012)

3.2.1.1 Existing Garden Refuse and Landfill sites

Existing garden refuse and landfill sites in Pretoria were mapped, they include: Kwaggasrand Landfill site; Valhalla Landfill site; Garstkloof Landfill site; Derdepoort Landfill site; Onderstepoort Landfill site; Hatherley Landfill site; Philip Nel Park Garden Refuse Site (GRS); Mountain view GRS; Eersterust GRS; Waltloo GRS; Menlo park GRS; Dorandia GRS; Claudius GRS and Magalieskruin GRS.

The map marked with the existing garden refuse and landfill sites clearly indicate that no provision has been made for the organic waste in Sunnyside or Pretoria CBD area (Refer to Fig. 17).

The following sites were visited and analysed in terms of their size, level of activity and origin of the waste:

Kwaggasrand Landfill (Refer to Fig. 18 and 19);
Philip Nel Park Garden refuse site (Refer to Fig. 20 and 21);
Mountain View Garden refuse site (Refer to Fig. 22 and 23);
Eersterust Garden refuse site (Refer to Fig 24 and 25);
Waltloo Garden refuse site (Refer to Fig. 26 and 27); and
Menlo Park Garden refuse site (Refer to Fig. 28 and 29).

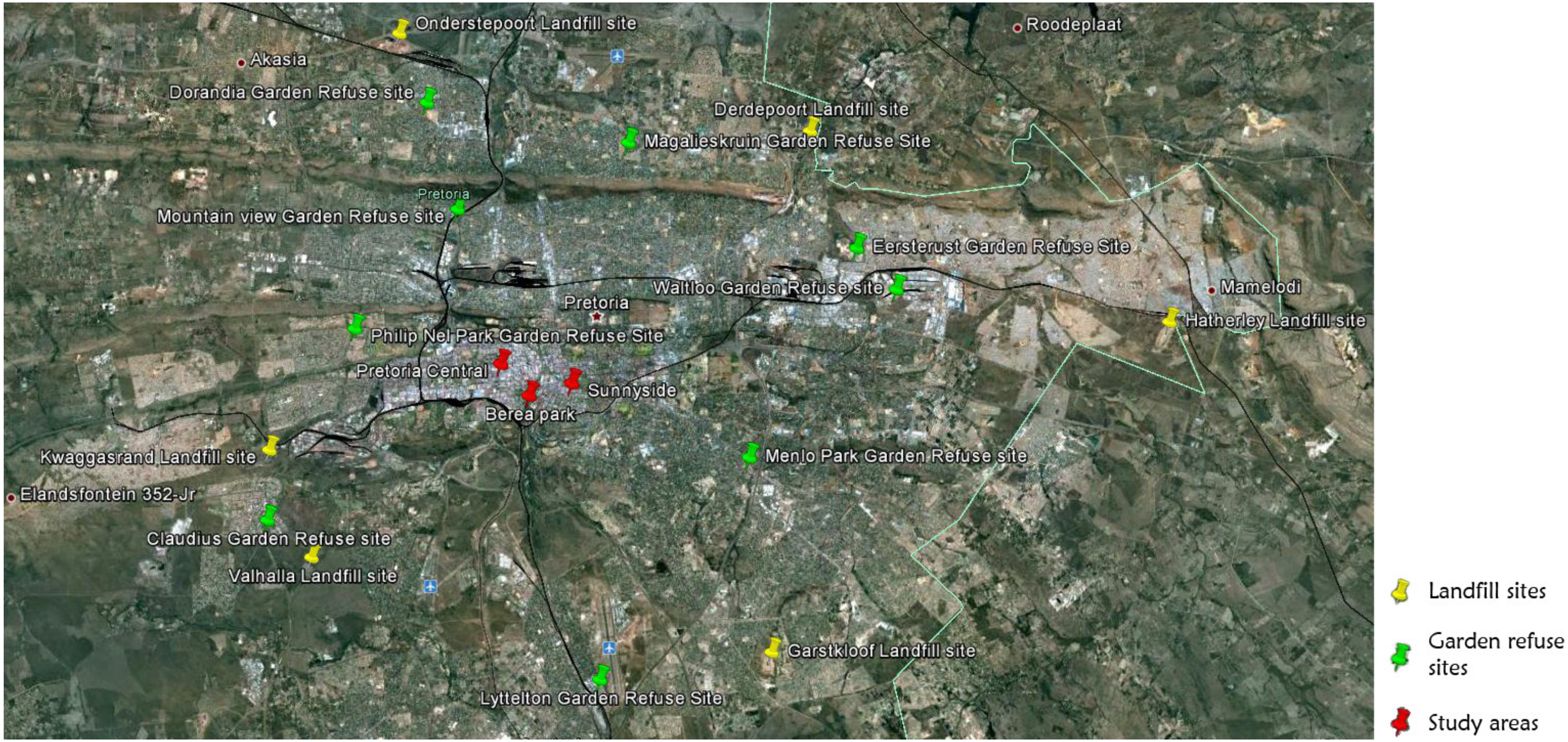


Fig. 17: Existing Garden Refuse and Landfill sites in Pretoria (Map from Google Earth and modifications by Author, 2012)

Fig. 18: Kwaggasrand Landfill Aerial photo (Google Earth, 2012)

Fig. 19: Kwaggasrand Landfill Site (Author, 2012)

Fig. 20: Philip Nel Park Garden Refuse Aerial photo (Google Earth, 2012)

Fig. 21: Philip Nel Park Garden Refuse site (Author, 2012)

Fig. 22: Mountain View Garden Refuse Aerial photo (Google Earth, 2012)

Fig. 23: Mountain View Garden Refuse Site (Author, 2012)

Fig. 24: Eersterust Garden Refuse Aerial photo (Google Earth, 2012)

Fig. 25: Eersterust Garden Refuse Site (Author, 2012)

Fig. 26: Waltloo Garden Refuse Aerial photo (Google Earth, 2012)

Fig. 27: Waltloo Garden Refuse Site (Author, 2012)

Fig. 28: Menlo park Garden Refuse Aerial photo (Google Earth, 2012)

Fig. 29: Menlo park Garden Refuse Site (Author, 2012)

Size and Capacity of Dumping sites

Kwaggasrand landfill site was opened in 1965 and takes in an average of 1 800 tons of waste per day. Kwaggasrand has merely 1 or 2 years left in its operational lifetime, Valhalla Landfill site is already closed, Garstkloof has 3 months left, Derdepoort is also closed, Onderstepoort has 3 to 7 years left and Hatherley Landfill site (opened the most recent, in 1998) has approximately 20 years left.

All garden refuse sites are roughly the same size; it was, however, noted that some sites were more active than others (Refer to Table 1).

3.2.1.2 Origin of Waste

A survey was carried out on the 10th of March 2012 at the identified dumping sites. Dumping site users were asked where they came from (origin of the waste). The need for an additional drop-off site was also assessed.

The results are displayed in Table 2 and indicate that a large area is currently being served by the existing dumping sites. It is also clear that there is no central drop-off point in the Pretoria South CBD and Sunnyside area (Refer to Fig. 30).

3.2.1.3 The destination of waste

Garden Refuse sites: These sites act as garden transfer stations. Once all the bins (30 m³ each) on site have reached their limit, the waste is transferred to landfill sites (Refer to Table 1 for the allocated landfill site for each of the garden refuse sites).

Landfill sites: The waste transported to landfill sites is evaluated at the entrance for approval. Data capturing and payment transactions take place, after which the vehicle is allowed to unload waste onto the operational front.

The waste is processed on the operational front and the recyclable materials are separated from the rest. The remaining waste is compacted into a waste cell and covered with a 150 mm layer of soil.

As stated in section 3.2.1.1 two of the identified landfill sites are already closed and Kwaggasrand is currently running on its reserve. The problem can't be emphasised enough – we are running out landfill space.

	Dumping site	Year open	Size (ha)	Capacity	Activity Level	Life Time	End-destination
1	Kwaggasrand Landfill site	1965	27.2	32 340 000 ton	Busy	1 - 2 years	Rehabilitation
2	Valhalla Landfill site	1964	11.7			Closed	Rehabilitation
3	Garstkloof Landfill site	1980	43.6	11 610 000 ton		3 months	Rehabilitation
4	Derdepoort Landfill site	1995	12.4			Closed	Rehabilitation
5	Onderstepoort Landfill site	1996	51.82	23 460 000 ton		3 - 7 years	Rehabilitation
6	Hatherley Landfill site	1998	96	20 400 000 ton		20 years	Rehabilitation
7	Philp Nel Park Garden Refuse site		1.2	150 m³/day	Quite		Kwaggasrand Landfill
8	Mountain View Garden Refuse site		1.4	210 m³/day	Very busy		Onderstepoort Landfill
9	Eersterust Garden Refuse site		1.2	150 m³/day	Very quite		Derdepoort
10	Waltloo Garden Refuse site		1.2	150 m³/day	Busy		Derdepoort
11	Menlo Park Refuse site		2	450 m³/day	Very busy		Garstkloof Landfill
12	Dorandia Garden Refuse site			300 m³/day			Onderstepoort Landfill
13	Claudius Garden Refuse site			90 m³/day			Kwaggasrand Landfill
14	Magalieskruin Garden Refuse site			300 m³/day			Derdepoort

Table 1: Size and Capacity of Dumping sites (Dekker & Booysen, modifications by Author, 2012)

	Kwaggasrand Landfill	Philip Nel Park Garden Refuse	Mountain view Garden Refuse	Eersterust Garden Refuse	Waltloo Garden Refuse	Menlo Park Garden Refuse
Arcadia						
Brooklyn						
Capital Park						
Centurion						
Constantia Park						
Daspoort						
East Lynne						
Eersterust						
Groenkloof						
Kilnerpark						
Koedoespoort						
Lynnwood						
Mayville						
Meyerspark						
Montana						
Monument Park						
Môregloed						
Moreleta Park						
Mountain view						
Newlands						
Philip Nel Park						
Pretoria Gardens						
Pretoria North						
Proclamation Hill						
Queenswood						
Rietfontein						
Silver lakes						
Silverton						
Suiderberg						
Val de Grace						
Wapadrand						
Waterkloof						
Waverley						
West Park (Pta West)						
Wonderboom South						

Table 2: Origin of Waste (Author, 2012)

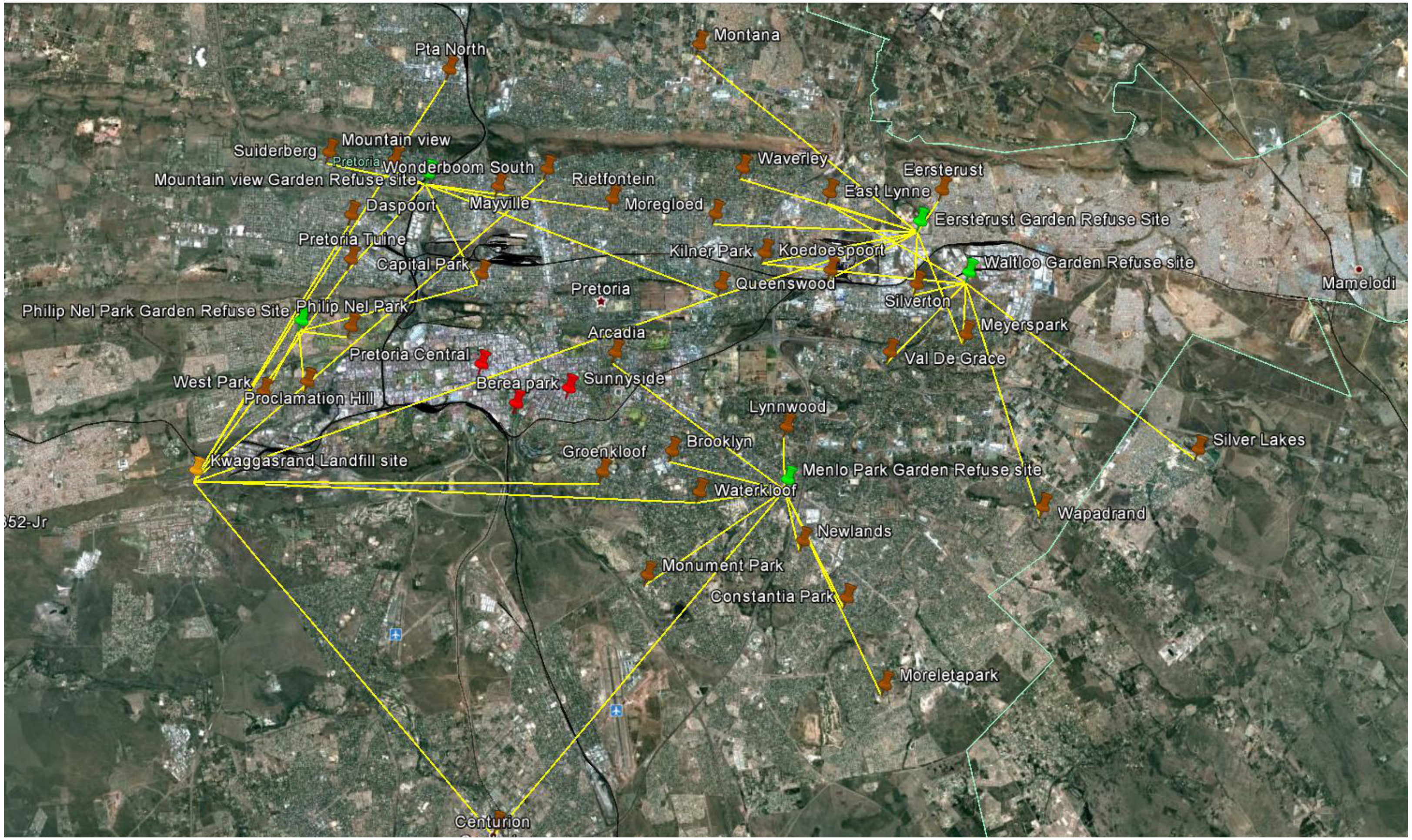


Fig. 30: The Origin of Waste in Pretoria (Map from Google Earth and modifications by Author, 2012)

3.2.1.4 City context conclusion

Pretoria South CBD and Sunnyside have no garden transfer stations or landfill sites in close proximity to which waste can be taken. This exemplifies the need for a centralised waste drop-off point in the Pretoria South CBD and Sunnyside area, therefore these two areas will be investigated as the study area in order to identify potential sites for a waste park (Refer to Fig. 31).

3.2.2 Pretoria South CBD and Sunnyside context

The context of Pretoria South CBD and Sunnyside was analysed due to the need for a centralised waste drop-off point in the area. Even though several residents of Pretoria South CBD and Sunnyside live in apartments and don't have any garden waste, they do produce organic food waste and hard waste which can be recycled.

The aim of analysing different key factors such as the land use and activities, population, employment and transportation of Pretoria South CBD and Sunnyside is to identify potential sites for a waste park.

A group framework for Sunnyside was formulated (Refer to section 3.2.2.5). The framework points out existing open spaces, sports grounds as well as lost spaces (Refer to Fig. 37). This will guide the identification of possible sites.

Fig. 31: Study area in context (Map from ArcGIS and modifications by Author, 2012)

3.2.2.1 Land use and activities

Pretoria South CBD and Sunnyside's land use is categorised mainly into residential, business, commercial, open space (public and private) and industrial (Refer to Fig. 32).

3.2.2.2 Existing open space, local parks and sports grounds

The map indicates existing open spaces, local parks and sports grounds (Refer to Fig. 33) and the following well-known sites (labelled number 1 – 11 on the map) were identified:

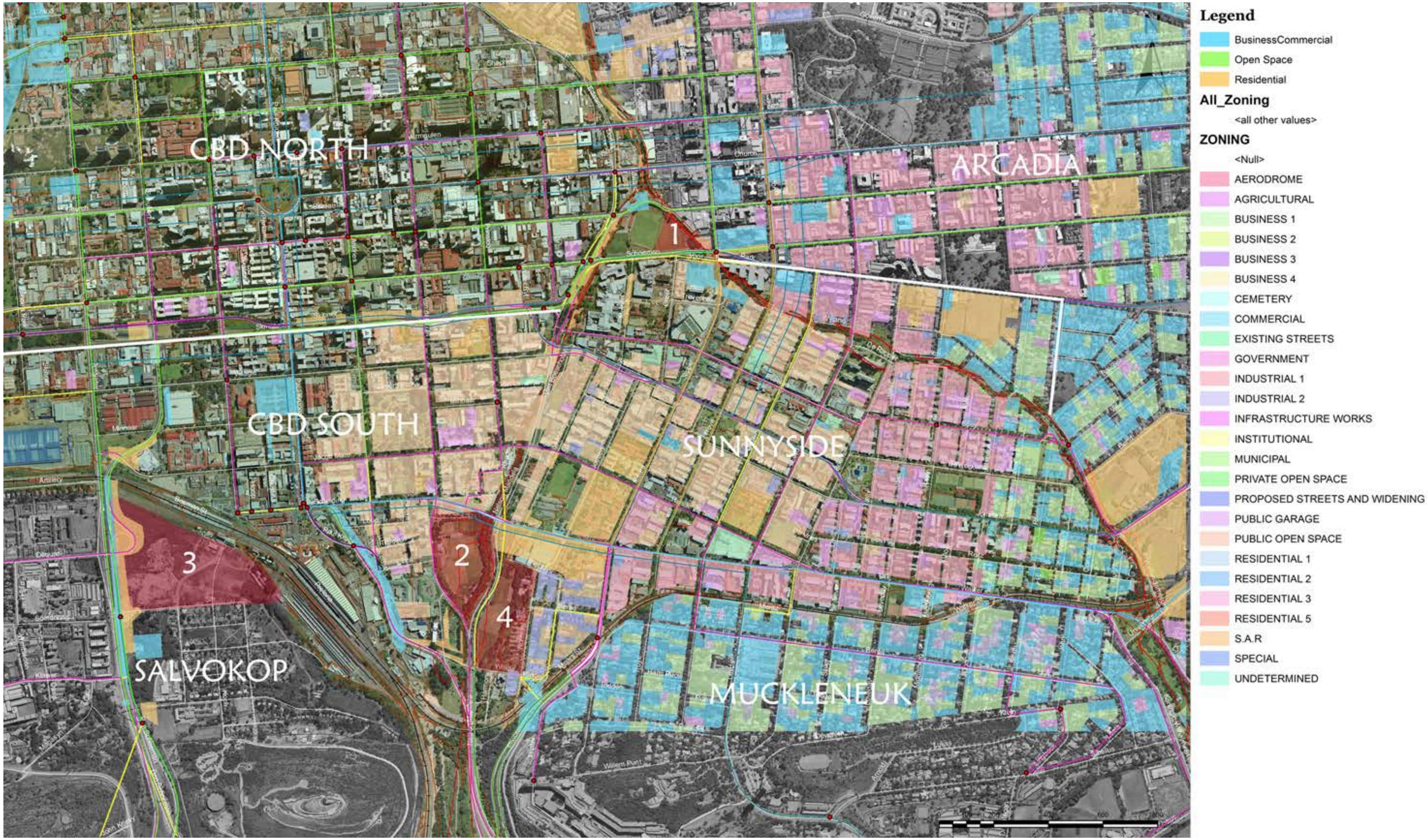


Fig. 32: Zoning of Pretoria CBD and Sunnyside (Map from ArcGIS and modifications by Author, 2012)

1 – Union Buildings
2 – Church Square
3 – Caledonian Sport Club
4 – Pretoria Art Museum
5 – Sports grounds
6 – Pretoria City Hall
7 – Burgers Park
8 – Melrose House Museum
9 – Sunnyside Swimming pool
10 – Sports grounds
11 – Berea Park Sports grounds

Fig. 33: Existing open space and local parks (Capitol Consortium, 1999 modifications by Author, 2012)

3.2.2.3 Employment and population rate

Both Pretoria CBD and Sunnyside are densely populated residential communities. The average household income of Pretoria CBD is high when set against Sunnyside's low average household income. Sunnyside has a higher unemployment rate than Pretoria CBD with relatively young residents in both of these residential communities (Refer to Table 3).

The information implies that there is a need for job creation in these areas to provide young unemployed residents with opportunities to make a living.

3.2.2.4 Transportation

Existing bus stops are illustrated on the transportation map as well as several bus routes, such as the Putco bus route, the Municipality bus route, etc. (Refer to Fig. 34).

As seen on Fig. 34, numerous bus routes exist in and around Pretoria CBD and Sunnyside; making it possible for residents to travel through these areas, however bus stops are limited in some of the areas, making them difficult to reach – not in a "walking distance".

UNISA Sunnyside Campus		Berea Park		Caledonian Sport Club		Salvokop	
sp_name	Sunnyside	sp_name	Pretoria CBD	sp_name	Trevenna	sp_name	Salvokop
employed	12158	employed	10423	employed	711	employed	5082
unemployed	1781	unemployed	2506	unemployed	153	unemployed	701
avg_hinc	95815	avg_hinc	71517	avg_hinc	86897	avg_hinc	77382
no_income	177	no_income	210	no_income	22	no_income	100
avmincome	8019	avmincome	5326	avmincome	10857	avmincome	8648
male	13019	male	11891	male	789	male	7564
female	13753	female	12860	female	842	female	1735
age_15_19	2585	age_15_19	2757	age_15_19	177	age_15_19	702
age_20_24	7129	age_20_24	6545	age_20_24	488	age_20_24	1601
age_25_29	4742	age_25_29	4865	age_25_29	373	age_25_29	2101
age_30_34	2580	age_30_34	2665	age_30_34	177	age_30_34	1615
age_35_39	1487	age_35_39	1463	age_35_39	69	age_35_39	1073
totpop	26773	totpop	24754	totpop	1631	totpop	9299

Table 3: Income, unemployment and Population rate comparison (Gauteng Census, 2001 and modifications by Author, 2012)

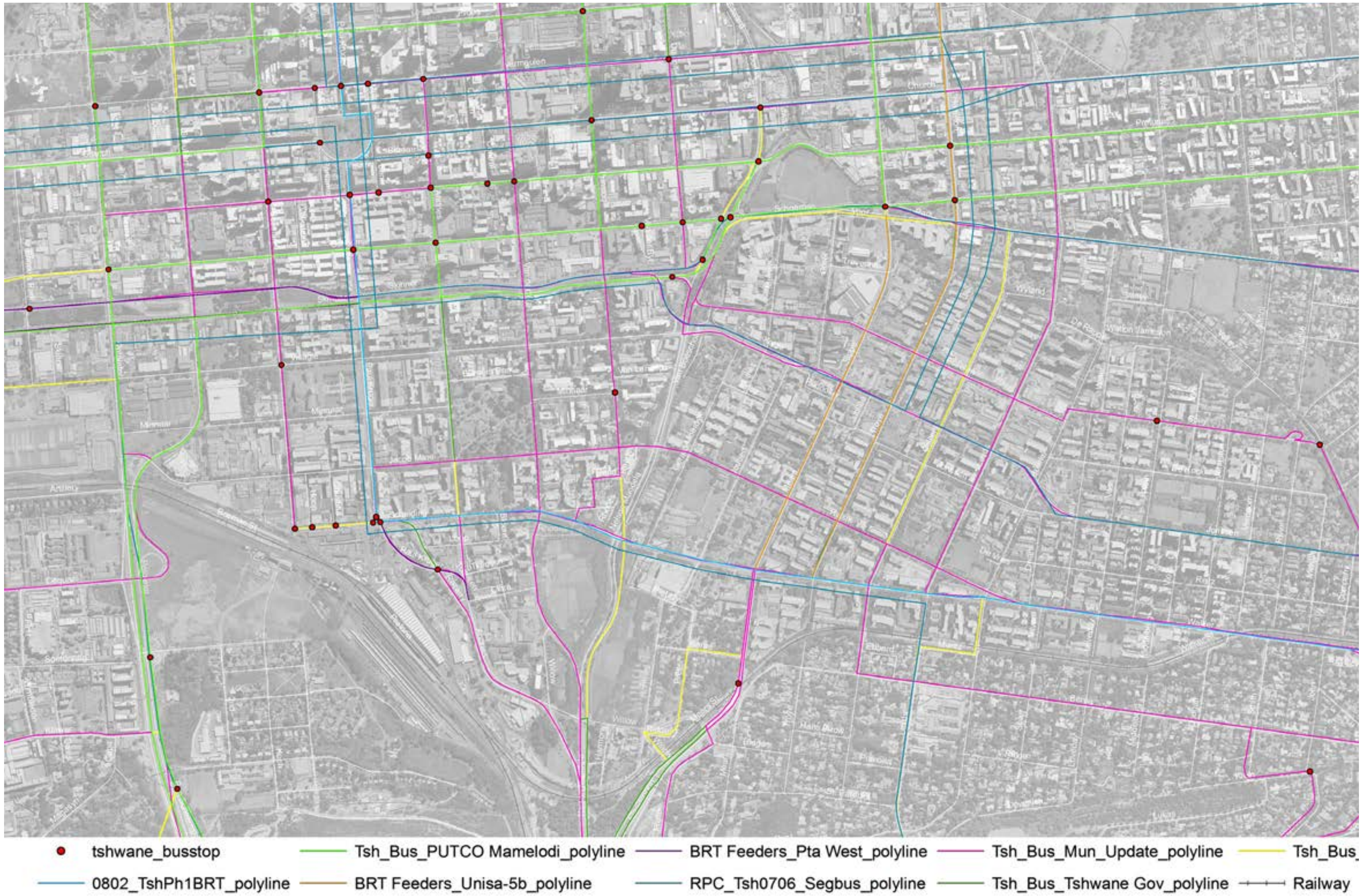


Fig. 34: Transportation (Map from ArcGIS and modifications by Author, 2012)

3.2.2.5 Sunnyside group framework

New frameworks to revitalize the inner city are proposed, but don't succeed in reconnecting Sunnyside to the Pretoria CBD, resulting in Sunnyside to remain separated from the inner city.

The masters class was divided into groups of students working in similar areas and had to propose a framework for that area. Our group worked in Sunnyside.

The group's aim was to create a framework that would reconnect Sunnyside to the inner city by bringing life to it and activating what already exists (Refer to Fig. 35): "revitalize the whole by healing the parts" (Group Framework, 2012). In essence: to activate the "sleeping areas" in the city with our individual interventions (Refer to Fig. 36).

The concluding framework proposal's approach is sensitive and "highly applicable in an era of constrained budgets, limited resources, and urban sprawl" (Group Framework, 2012) (Refer to Fig. 37).

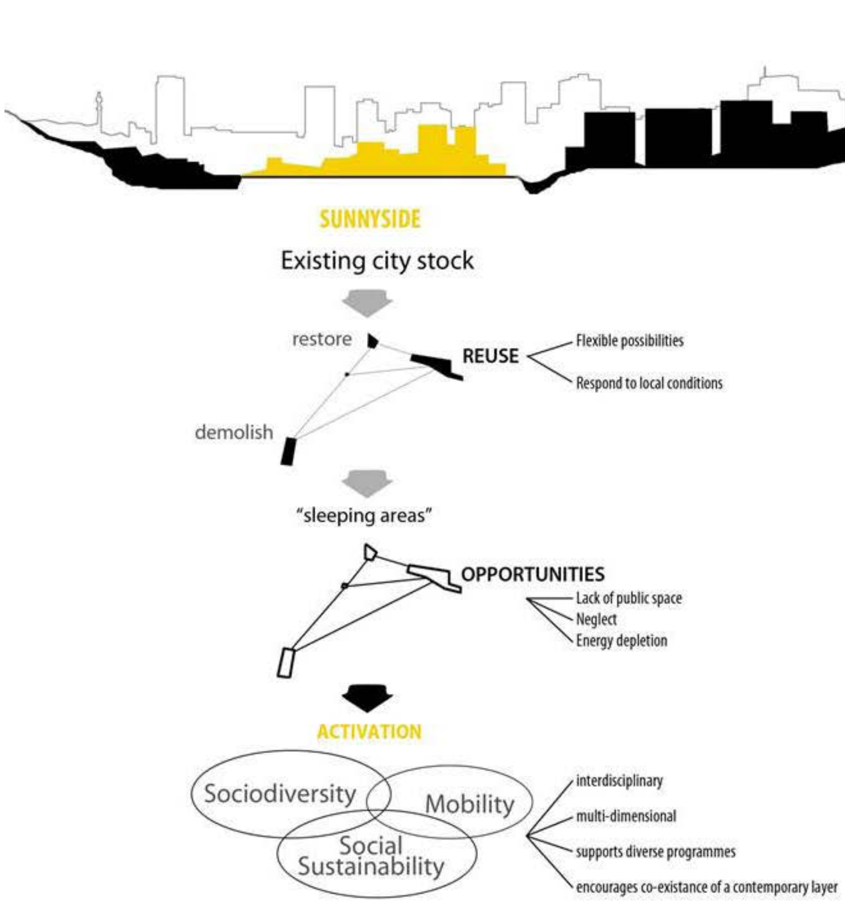


Fig. 35: Aim of the Sunnyside Group Framework (Group Framework, 2012)

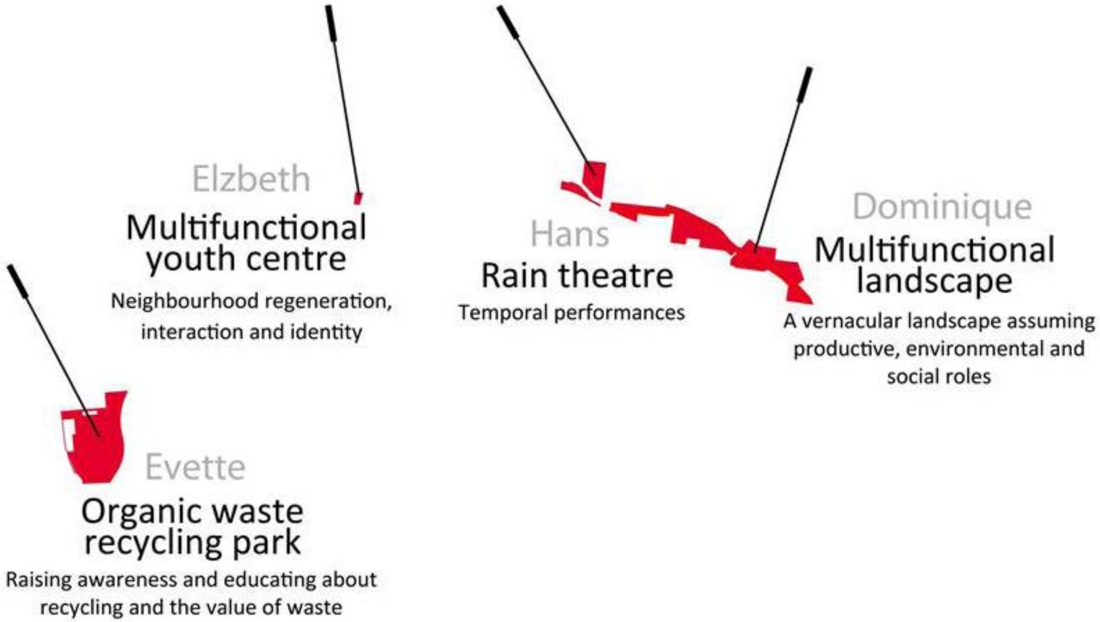


Fig. 36: Individual Interventions (Group Framework, 2012)

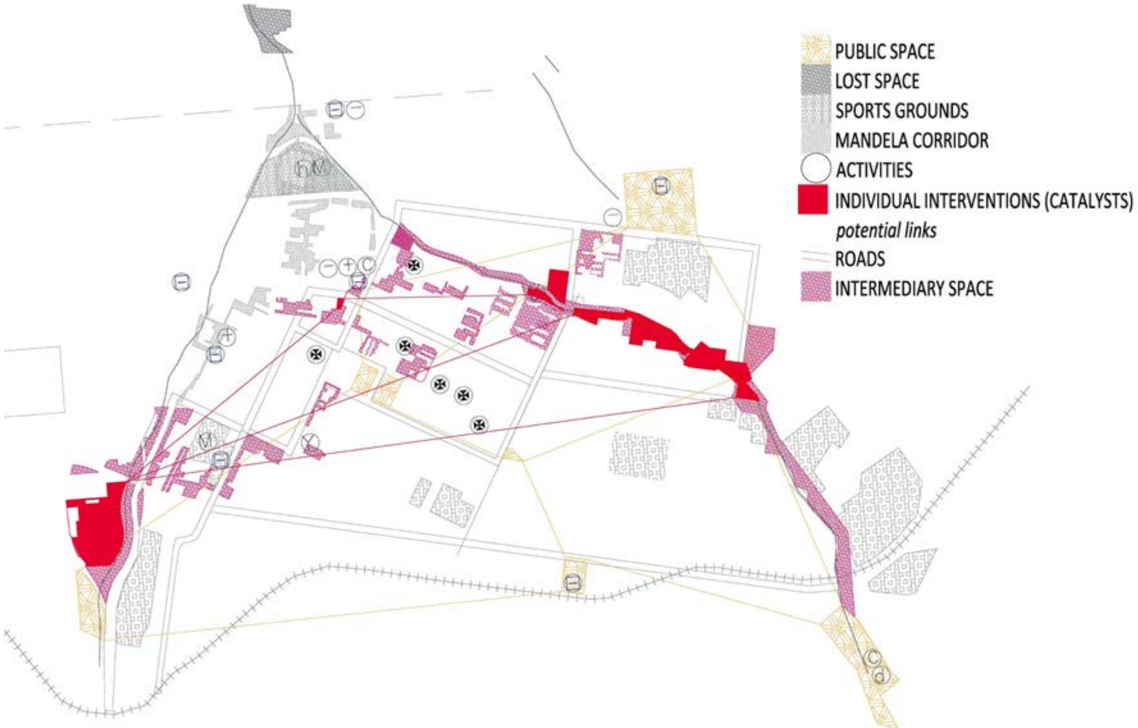


Fig. 37: Concluding Framework Proposal (Group Framework, 2012)

3.3 Site selection criteria for potential sites

The outcome of studying the city's context as well as the Pretoria CBD and Sunnyside context brought forth the possibility to set up criteria, considering the gathered information, to evaluate the potential sites. The criteria explore different factors that measure the suitability of sites for the proposed waste park, namely:

- The site's location – the site:

Should not be in close proximity to existing garden refuse sites – in other words, where there is a need for a garden refuse or waste recycling facility;

Needs to be close to both Pretoria South CBD and Sunnyside to cater for both of these areas;

Must be located in an area with a low average household income, high unemployment rate and relatively young age group – where there is a need for job creation;

Should be able to relieve pressure from existing (busy) dumping sites;

Has to be easily accessible to the public;

Must be near (within ± 250m) a densely populated residential area, tertiary education institution, schools (educational purposes), Gautrain stations (transport) and hotels (food waste); and

Should be close to a natural source of water (e.g. river).

- Brownfield site – regeneration;
- Dormant buildings on site – restoration; and
- The size of the site must be sufficient for the proposed program activities.

3.4 Potential sites in Pretoria

Four potential sites (labelled number 1 - 4 on Fig. 38) were identified that complied with the Site selection criteria namely:

1. Caledonian Sport Club (Refer to Fig. 39)
2. Berea Park (Refer to Fig. 40)
3. Salvokop (Refer to Fig. 41)
4. UNISA Sunnyside Campus (Refer to Fig. 42)

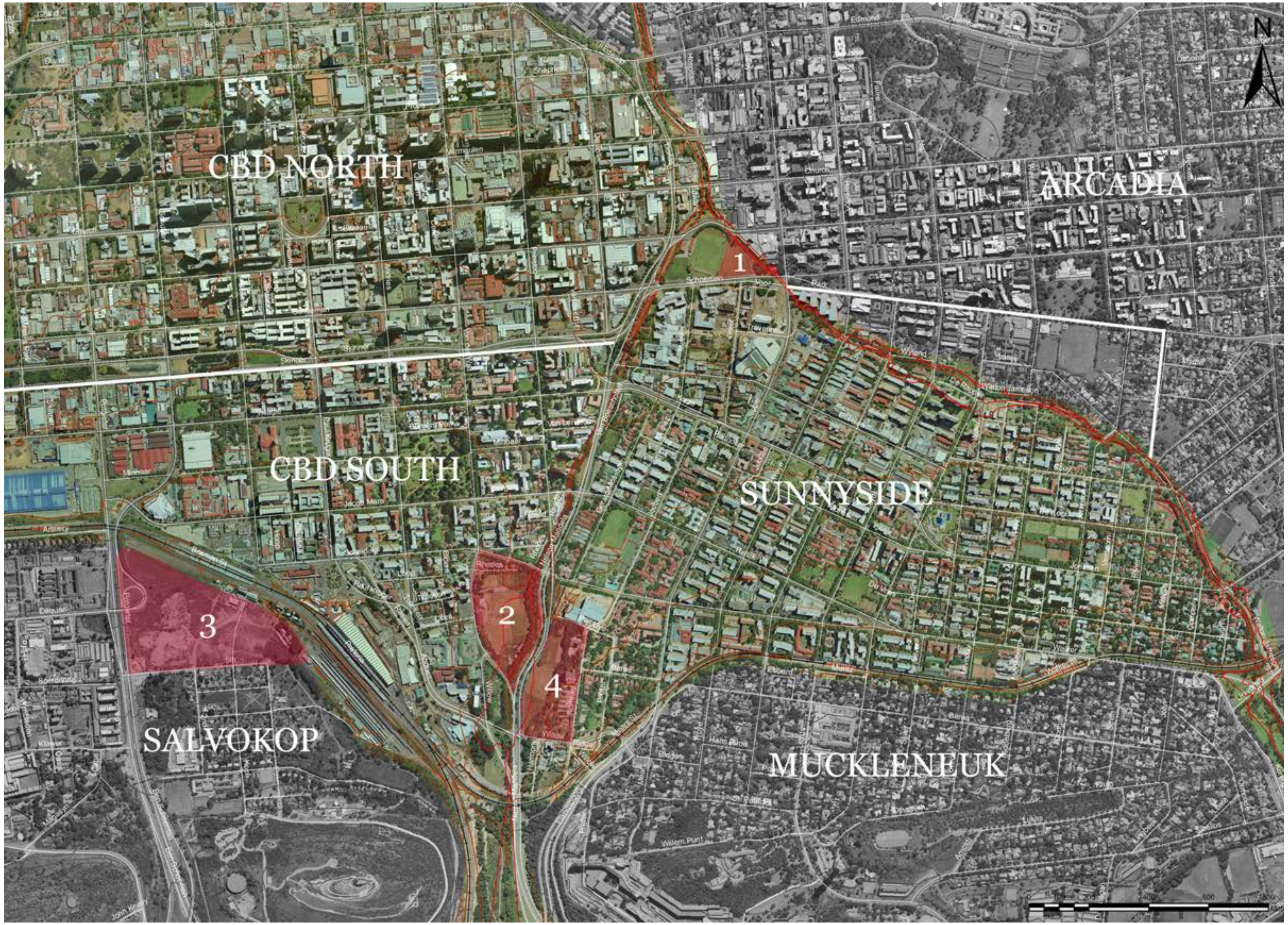


Fig. 38: Potential sites (Map from ArcGIS and modifications by Author, 2012)

Fig. 39: Caledonian Sports Club (Author, 2012)

Fig. 40: Salvokop (Google Maps Streetview, 2012)

Fig. 41: Berea Park (Author, 2012)

Fig. 42: UNISA Sunnyside Campus (Google Maps Streetview, 2012)

3.5 Comparison of potential sites

These four sites were compared to determine the most suitable site for the proposed waste park.

The comparison of the potential sites was done by using a site selection matrix (Refer to Table 4) containing all the factors of the selection criteria. These factors were chosen to measure the potential of the sites, with the problem, current conditions and program in mind, for the proposed waste park.

The average household income, unemployment rate and population density of the potential sites were also compared (Refer to Table 3) to determine where the biggest need for job creation exists.

No.	Site Selection Criteria	Potential sites			
		Sunnyside Campus	**Berea Park**	**Caledonian Sport Club**	**Salvokop**
1	Not in proximity of existing Garden Refuse sites	X	X	X	X
2	Not in proximity of existing Landfill sites	X	X	X	X
3	Close to Sunnyside neighbourhood	X	X	X	X
4	Close to Pretoria South CBD	X	X	X	X
5	Located in area with low average household income		X		X
6	Located in area with high unemployment rate		X		
7	Located in area with relatively young age group	X	X	X	X
8	Relieve pressure from existing dumping sites	X	X	X	X
9	Easily accessible to public		X	X	X
10	Near densely populated residential area (within 250m)		X	X	
11	Close to Tertiary education (within 250m)	X	X		
12	Close to Schools (within 250m)	X	X	X	X
13	Close to a Gautrain Pretoria station (within 500m)	X	X		X
14	Close to Bus stop (within 200m)	X		X	X
15	Close to Hotels (within 500m)	X	X	X	
16	Close to a natural source of water (e.g. river)		X	X	
17	Greyfield site - regeneration	X	X	X	X
18	Dormant buildings on site - restoration		X		
19	Historical value	X	X		
	Total	**14**	**19**	**13**	**13**

Table 4: Site selection matrix (Author, 2012)

3.6 Conclusion

The site that best complied with the selection criteria was Berea Park (Refer to Table 4) because:

- The site isn't in the proximity of existing garden refuse sites;
- The proposed site is close to both Pretoria South CBD and Sunnyside and will relieve pressure from surrounding garden refuse sites;
- Berea Park's residents have a low average household income, high unemployment rate and are relatively young;
- Berea Park is:
  - Easily accessible to the public;
  - Adjacent to a densely populated residential community, next to (within ± 250m) UNISA Sunnyside campus, Oost-Eind Primary school (for educational purposes), Pretoria train station, Gautrain Pretoria station, Manhattan Hotel and Holiday Inn; and
  - Next to the Apies river.
- Existing buildings on site – not in use.

The selected site, Berea Park, will be analysed in the next chapter.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PEDESTRIAN SAFETY PROJECT
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CHAPTER 4

Physical Site Analysis

CHAPTER 4: Physical site analysis

4.1 Introduction

In the previous Chapter Berea Park was selected as the most suitable site amongst the four potential sites as established using the Site Selection Criteria (Refer to Chapter 3, Table 4).

A descriptive and analytical research method (Refer to Chapter 1 section 1.7) will be used to perform an in-depth analysis of Berea Park. This includes gathering data, maps, photographs – such as different views and the current state of Berea Park (Refer to Fig. 43 and 44) and observing the current situation.

Fig. 43: Berea Park - view from Lilian Ngoyi Street (previously known as Van der Walt Street) (Author, 2012)

4.2 Site location

Berea Park is situated on the edge of Pretoria South CBD and Sunnyside; between Lilian Ngoyi Street (previously known as Van der Walt Street) (West) and Nelson Mandela Drive (East). The Apies River is adjacent to the site (parallel to Nelson Mandela Drive). (For a full description of the site's location refer to Chapter 1 section 1.8 and Fig. 8)

Fig. 44: Panorama view of Berea Park - Lilian Ngoyi Street (previously known as Van der Walt Street) (Author, 2012)

4.3 Historical background of Berea Park (Refer to Fig. 45)

Berea Park sports grounds originated as a cattle compound in 1882. It was the first sport grounds in Pretoria and hosted a cricket match against the English (Northern Cricket Club) in 1888.

Before SuperSport Park was built in 1986 to replace Berea Park, according to South Africa.info, cricket players who used to play at Church Square moved to Berea Park, where they couldn't disturb councilmen (WikiUP, 2010).

The Berea sports club was built during 1897. Mercedes Benz showcased the first automobile in South Africa to Paul Kruger (who was president at the time) on the Berea Park sports grounds.

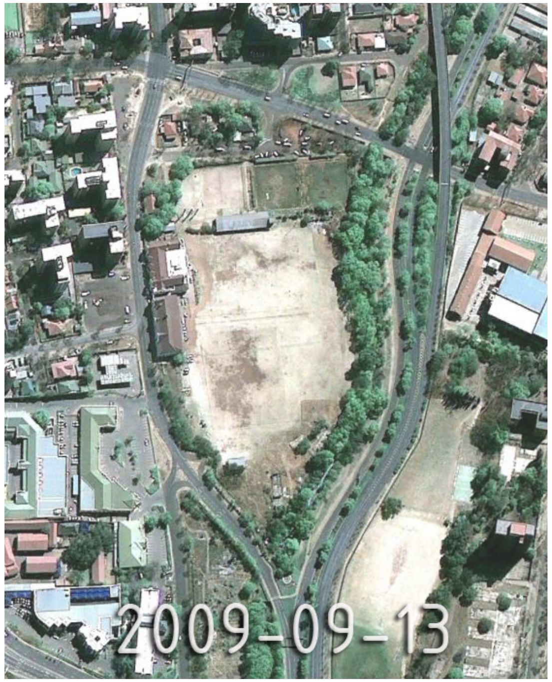
In 1903 the Berea Club was sold to the Central South African Railways (CSAR) (later known as South African Transport Services SATS), after which the Club was used by the railway staff as one of the first sport facilities in Pretoria (WikiUP, 2012).

Fig. 45: Berea Park timeline (Aerial photos from Google Earth and modifications by Author, 2012)

The Berea Southern Clubhouse was completed in 1907 (Refer to Fig. 46 and 47). The Northern Club Hall, designed in Edwardian style, locally referred to as 'Neo-Cape Dutch' style (Pretoria Historical Dictionary, 2000:19) (Refer to Fig. 48) was added and the Berea Rugby Club opened during 1926 (WikiUP, 2012). The two buildings were connected by a bridge with timber frame windows (Refer to Fig. 49).

The Bowling greens clubhouse was built during 1955 and used by the members of the bowling club until 1965 (Naude, 2006:19).

The clubhouse and club hall were used as administrative offices and conference facilities during the 1990s. The Clubhouse was occupied by Founders Primary and High School until the grounds burnt down in a fire in April 2010. The fire "caused considerable damage to the buildings." (WikiUP, 2010)



Today, Berea Park Sports Grounds are the property of the Department of Land Affairs. According to WikiUP (2010) the sport grounds as well as the Berea Southern Clubhouse and Northern Club Hall are protected by Section 34(i) of the National Heritage Resource Act because they are older than 60 years and therefore have high cultural heritage value.

Berea Park sports grounds was and still is considered an important landmark to the southern gateway of Pretoria but lost its identity and became only a memory in the minds of old Pretorians. According to Naude (2006:11) Berea Park "used to be a core of social activities and leisure time action over weekends. This role has now become redundant."

The implementation of the design proposal of a waste park can also contribute to the regeneration of Berea Park as a core of social activities, restoring the sports grounds as an important and noticeable landmark in Pretoria. Acknowledging the historical significance of the site and reminding Pretorians thereof.

Fig. 46: Club House Front (Le Roux, 1992:155)

Fig. 48: Club Hall Front (Le Roux, 1992:156)

Fig. 47: Club House Back (Le Roux, 1992:156)

Fig. 49: Bridge connecting the Club House and Club Hall (Le Roux, 1992:156)

4.4 Current conditions of Berea Park

4.4.1 Transportation

An adequate number of transportation routes exist around Berea Park with various bus stops and train station such as Mears and Pretoria station available (Refer to Fig. 50).

None of the bus stops or train stations are in close proximity of the site and therefore the necessity for a bus and taxi drop-off on the northern side of the site for example to accommodate people travelling to and from the Gautrain Pretoria Station.

There is an existing informal taxi rank in Rhodes Avenue which can be modified into a formalised bus and taxi drop-off system.

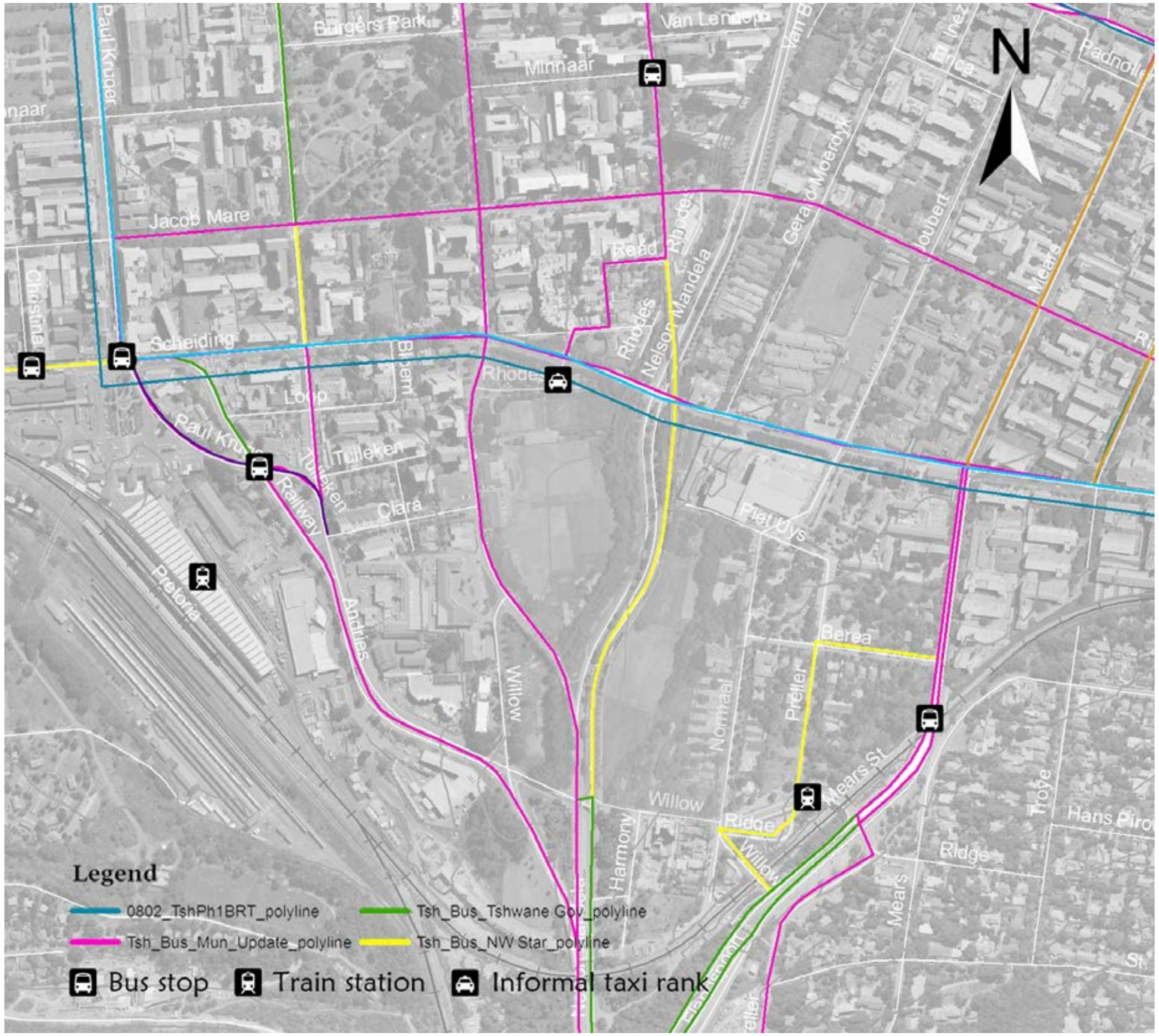


Fig. 50: Berea Park Transportation (Map from ArcGIS and modifications by Author, 2012)

4.4.2 Land use

The most prominent land use around Berea Park is residential, mainly on the northern and western sides of the site, with a few commercial activities and businesses to the south-western side (Refer to Fig. 51).

A significant amount of land is used for educational purposes east of the site, such as UNISA Sunnyside campus and Oost-Eind Primary school. This provides an enormous opportunity for students to attend educational tours at Berea Waste Park.

- Petrol station
- Hotels
- Berea SDA Church
- Melrose House Museum
- Breytenbach Theatre
- Mens Clinic Int.
- Kia-Ora Backpackers
- KFC
- Residential
- Educational
- Commercial and Business

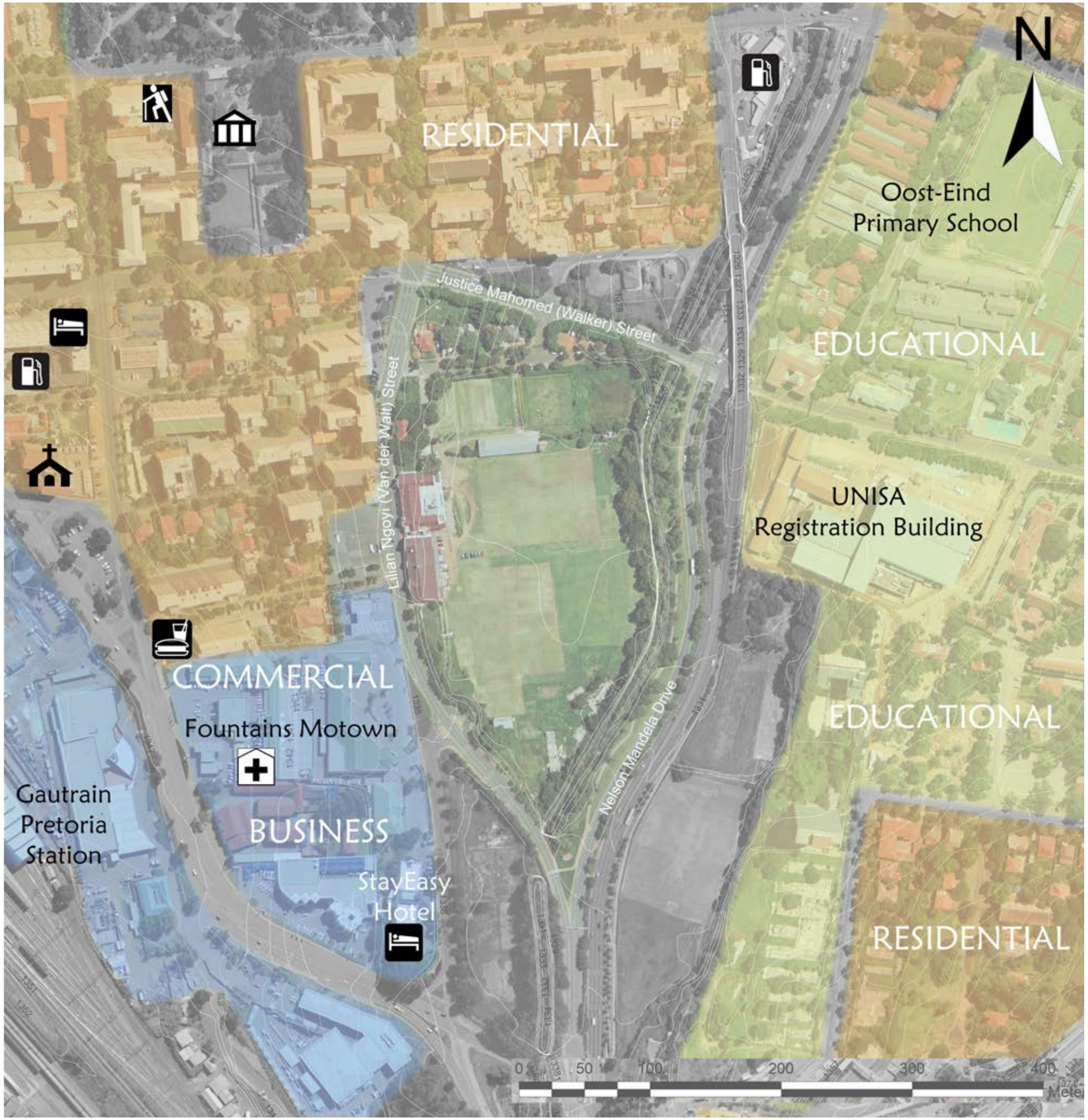


Fig. 51: Existing Land Use (Map from ArcGIS and modifications by Author, 2012)

4.4.3 Surrounding buildings

To the north and west of Berea Park residential buildings, mostly flats, surround the site (Refer to Fig. 51 and 52). Some of the buildings near the site are Oost-Eind Primary School in the north-east, UNISA Registration Building in the east, StayEasy Hotel in the south (Refer to Fig. 53), the Gautrain Pretoria Station in the south-west and Fountains Motown shopping centre in the West (Refer to Fig. 54).

Fig. 52: Residential Buildings (Author, 2012)

Fig. 53: StayEasy Hotel (Author, 2012)

Fig. 54: Fountains Motown Shopping Centre (Author, 2012)

4.4.4 Movement and access

It is important to know how the site is currently being accessed and used. Pedestrian movement around the site and access to the site were mapped as illustrated in Fig. 55.

Main access to the site is from the northern side with no access to the site from the eastern side (along the Apies River, refer to Fig. 56), there is also limited access from the western side due to the closed off buildings.

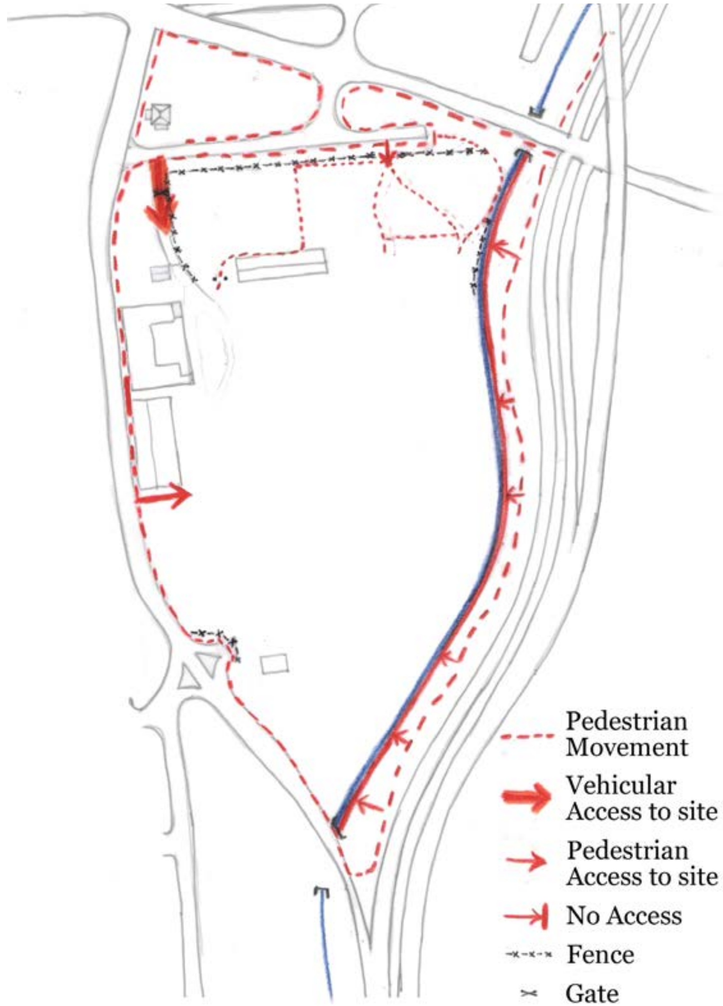


Fig. 55: Movement and Access (Author, 2012)

Fig. 56: No Access along Apies River (Author, 2012)

4.4.5 Existing buildings, structures and activities

The two existing buildings as described in section 4.3 are older than 60 years and of high historical significance. According to Naude (2006:11) the buildings need to be recorded, protected and re-used. Another building on site is a single storey building called the Bowling Green Clubhouse (Naude, 2006:19-20) (Refer to Fig. 60). The building isn't older than 60 years, therefore not of high historical significance and can be demolished.

Fig. 57 & 58: Existing Buildings (Author, 2012)

Fig. 59: Existing Buildings (Author, 2012)

Fig. 60: Bowling Green Clubhouse (Author, 2012)

Fig. 61: Foundations of Demolished Buildings (Author, 2012)

The existing buildings (Refer to Fig. 57, 58, 59 and 60), structures and activities were mapped (Refer to Fig. 62). The buildings are not currently in use due to the damage caused by the fire. Foundations of the demolished buildings and pavilions are still visible on site as well as the building rubble thereof (Refer to Fig. 62, 63 and 64).

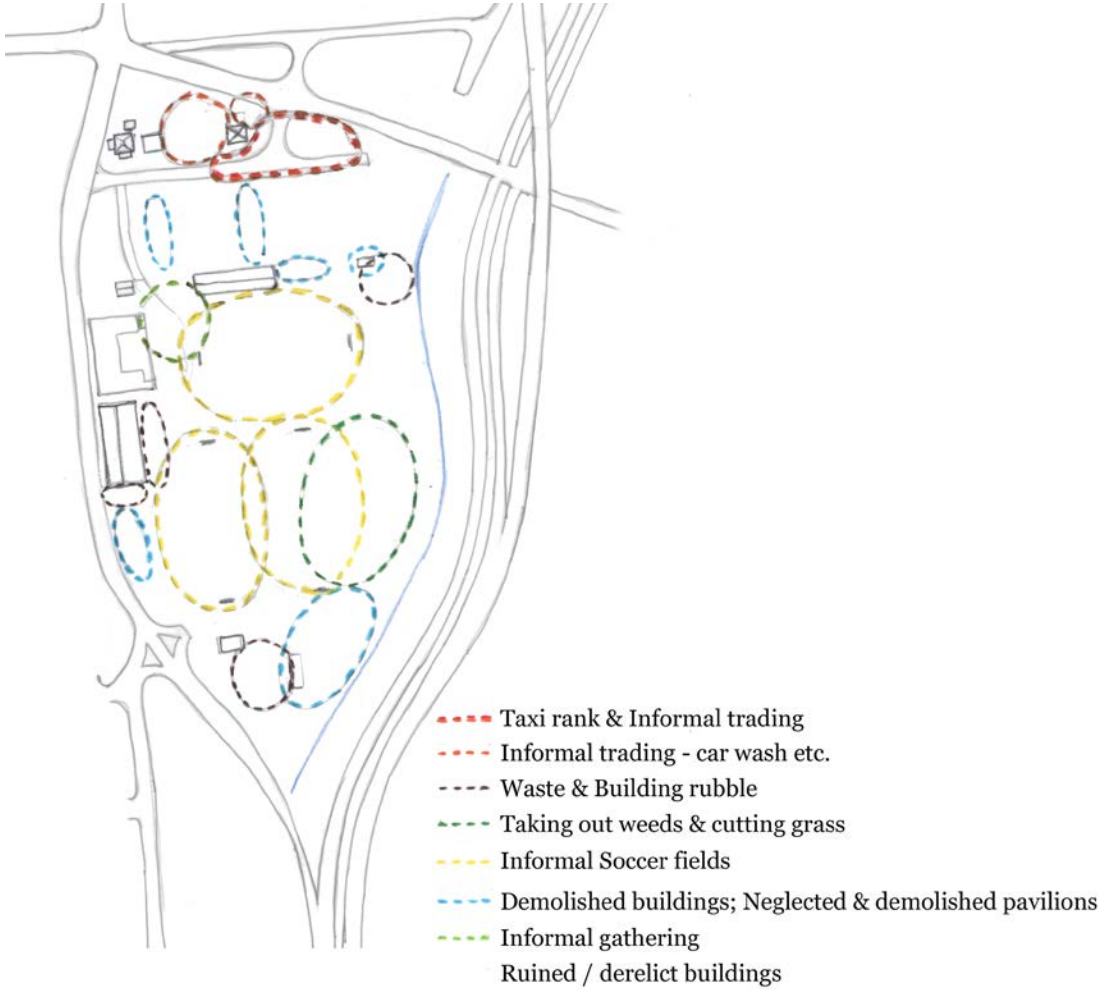


Fig. 62: Activities on Site (Author, 2012)

Fig. 63 & 64: Foundations of Demolished Buildings (Author, 2012)

An informal taxi rank has formed to the immediate north of the site that includes informal trading and businesses (Refer to Fig. 65 and 66).

Even though there is very little activity on the site, informal soccer fields are maintained on a regular basis, which indicates that games take place there.

Fig. 65: Informal Trading (Author, 2012)

Fig. 66: Informal Taxi Rank (Author, 2012)

Existing servitudes were also mapped (Refer to Fig. 67). The servitude along the Apies River is 16.55m wide according to information gathered from ESRI ArcGIS software (2010). All the existing servitudes have the right of access for municipal purposes.

Fig. 67: Services (Author, 2012)

4.4.6 Vegetation

A limited amount of vegetation exists on site. The original vegetation of the site according to AGIS Atlas was Marikana Thornveld but the site is environmentally disturbed and is now described as disturbed urban temperate Bushveld.

Fig. 68: Vegetation (Author, 2012)

Planted vegetation does occur on site with the most dominant being Kikuyu grass. *Acacia karroo* and *Jacaranda mimosifolia* are present next to Lilian Ngoyi Street (previously known as Van der Walt Street). Tall trees such as *Celtis Africana* and Oak trees (*Quercus robur* – English Oak) occur along the western banks of the Apies River (Refer to Fig. 68).

The possibility to enhance the environmental condition of Berea Park exists by vegetating the river banks of the Apies River and planting indigenous trees on site.

4.4.7 Geology

"It would seem that this area was either built up and the area was filled with soil from another area or that the area was flattened to level it for the sports fields that exist there today" (Naude, 2006:6).

The following information regarding the geology of the site was gathered from the AGIS Atlas (2006):

Sedimentary rock: Shale
Soil formation: Hu 34% Av 22%
Soil pattern description: PT1 - Red, yellow and/or greyish soils with low to medium base status
Water-holding capacity: 41 – 60mm
Land capability: Moderate potential arable land

The possibility to enhance the environmental condition of Berea Park exists by vegetating the river banks of the Apies River and planting indigenous trees on site.

4.4.8 Climate

Pretoria's average annual rainfall is between 650 - 700mm. The average rainfall for each month is illustrated in Table 5.

The maximum and minimum temperatures in Pretoria for each month have also been included (Refer to Table 5).

On a later stage the data can be used to formulate a water budget in terms of the amount of water that can be harvested and the water requirements of the waste park (Refer to Chapter 8, section 8.1.3.2).

Berea Park's climatic data is consolidated in Fig. 69.

Month	**Precipitation** (mm)			**Temperature** (˚C)			
	Average Rainfall	**Number of Rain Days**	**Highest 24hr Rainfall**	**Average Daily Maximum Temperature**	**Average Daily Minimum Temperature**	**Highest Temperature**	**Lowest Recorded Temperature**
January	136	14	160	29	18	36	8
February	75	11	95	28	17	36	11
March	82	10	84	27	16	35	6
April	51	7	72	24	12	33	3
May	13	3	40	22	8	29	-1
June	7	1	32	19	5	25	-6
July	3	1	18	20	5	26	-4
August	6	2	15	22	8	31	-1
September	22	3	43	26	12	34	2
October	71	9	108	27	14	36	4
November	98	12	67	27	16	36	7
December	110	15	50	28	17	35	7
Average rainfall per year	**674**	**87**	**160**	**25**	**12**	**36**	**-6**
per week	12.96						

Table 5: Pretoria's Annual Rainfall and Average Temperatures, 1961 - 1990 (Weather SA, 2003)

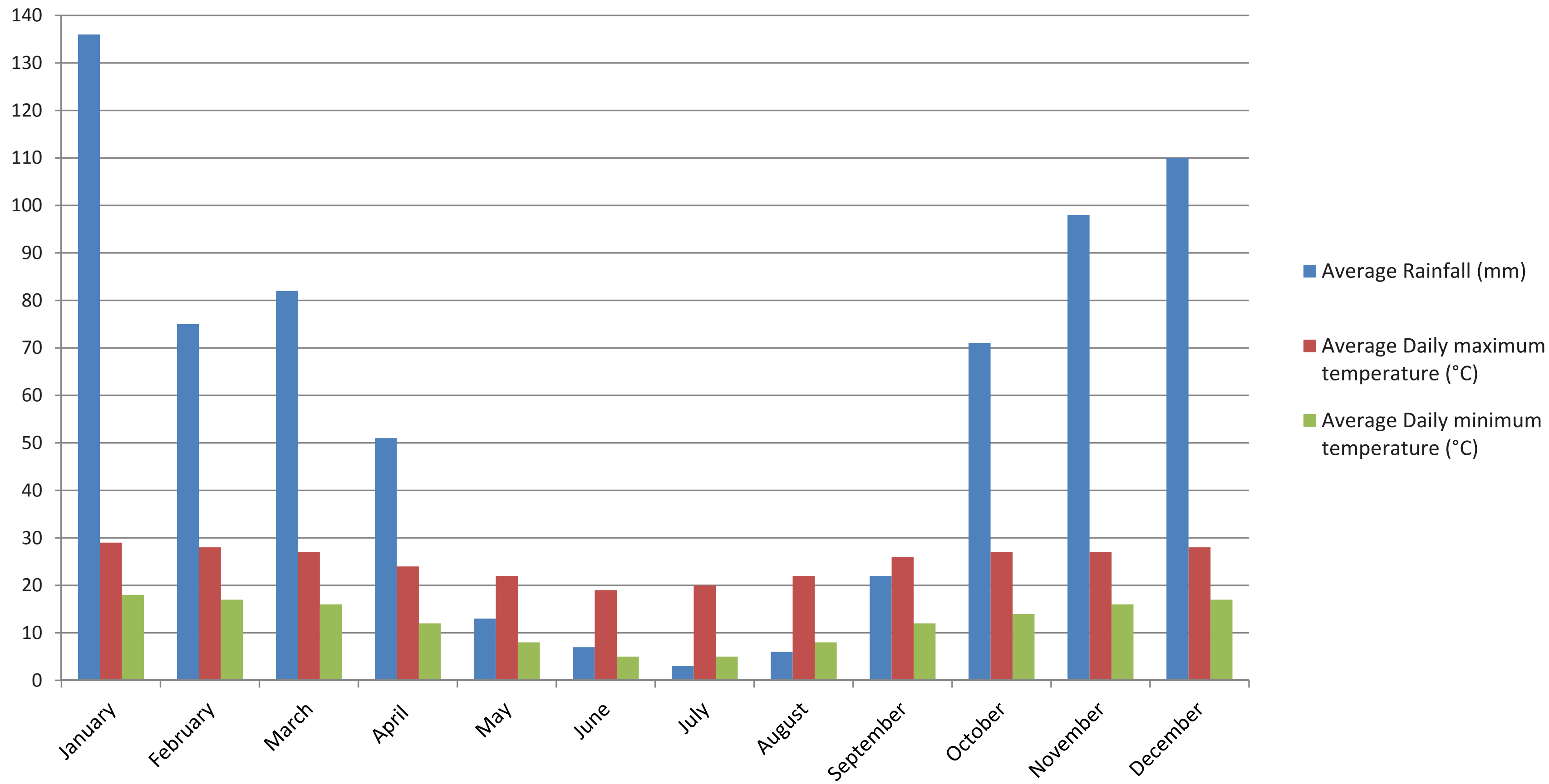


Fig. 69: Consolidated Climatic Data of Berea Park (Weather SA, 2003)

4.5 SWOT analysis

After analysing the physical site, mapping the existing land use, surrounding buildings, transportation and all the existing activities, the findings on Berea Park's current condition and physical characteristics were synthesised by means of a SWOT analysis after which the site could be spatially explored, nodes and connections to the existing environment proposed, a concept developed and the design development started (as per Chapter 6).

The SWOT analysis is used to determine the site's strengths and weaknesses as well as the opportunities and threats the site entails.

4.6 Consolidated Analysis

By executing the SWOT analysis (Refer to Table 6) it was found that numerous opportunities exist to revitalise and "plug" Berea Park into the surrounding urban context such as the regeneration of Berea Park as the core of social activities, where people from different parts of the city can come together and socialize – a place where communities come together; creating awareness of the site's historical significance and restoring the derelict buildings.

SWOT Analysis				
	Strengths	**Weaknesses**	**Opportunities**	**Threats**
1	Location - Gateway to Pretoria	Lost identity	Regenerate Berea Park as a core of social activities	
2	Historical value - site and building older than 60 years	Derelict buildings	Create awareness of historical significance	
3			Restoration of derelict buildings and give new and applicable functions	
4	Close to natural water source = the Apies River	No activities along the Apies River - unsafe	Activating the Edge of the Apies River to ensure maximum security for pedestrians	Security
5		Site is environmentally disturbed	Enhance environmental status of Berea Park	
6	Land capability: Moderate potential arable land		Urban agriculture	
7		Not in the proximity of existing garden refuse sites	Develop a waste park - relieve pressure from surrounding garden refuse sites	
8		Site not visible from the road - awareness	Enhance visual attraction and visibility from the streets	
9	Easily accessible to public	No defined entrance to site	Provide more than one well-defined entrance	
10	Adjacent to densely populated residential communities (Sunnyside and Pretoria South CBD); Residents relatively young	Residents have low average household income; high unemployment rate	Job Creation - collection and sorting of waste	
11	Close to public transport routes	No bus stop in close proximity (within 200m)	Existing informal taxi rank in Rhodes avenue can be modified into a formalised bus and taxi drop-off system	
12	Close to UNISA Sunnyside Campus and Oost-Eind Primary school		Educate students (visitors) about reducing and reusing waste (recycling)	

Table 6: SWOT Analysis of Berea Park (Author, 2012)

Another opportunity is to allow visitors and people passing by to move along the Apies River in a secure environment by providing a well-lit walkway all along the Apies River.

There is also an opportunity to enhance the environmental condition of the site and introduce urban agriculture; to create jobs and to educate visitors about the story of waste.

All the maps of the current conditions of Berea Park were layered on top of each other to condense the findings into a consolidated analysis (Refer to Fig. 70).

Fig. 70: Consolidated Analysis (Author, 2012)

4.7 Current future plans for Berea Park

Several frameworks have been proposed for Berea Park for instance the Department of Land Affairs (landowner) is planning to develop the site into housing, consisting mainly out of a hotel and flats (Refer to Fig. 71).

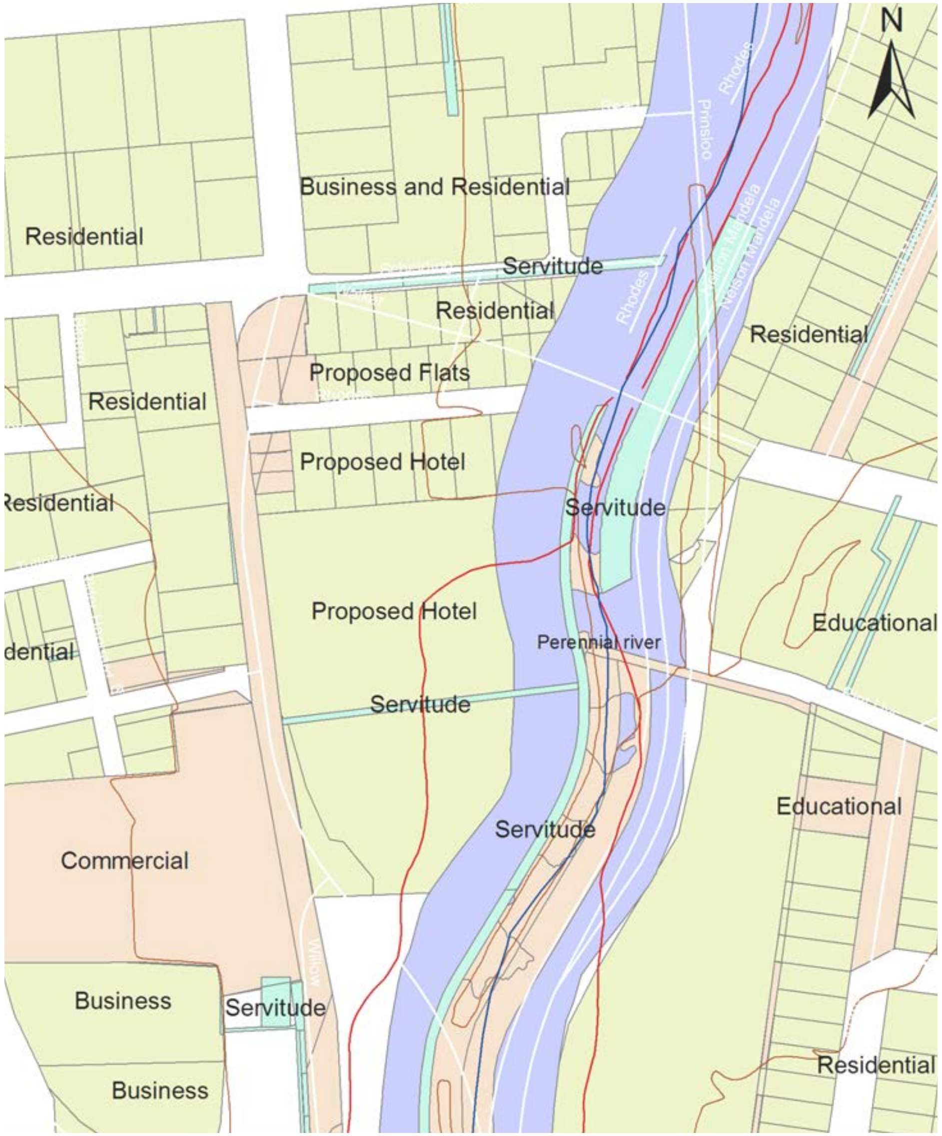


Fig. 71: Department of Land Affairs Framework for Berea Park (ArcGIS, 2012)

Capitol Consortium proposed during 1999 in their Pretoria Inner City integrated spatial development framework that the valuable open space of Berea Park should be preserved and further developed as open space (Capitol Consortium, 1999:24).

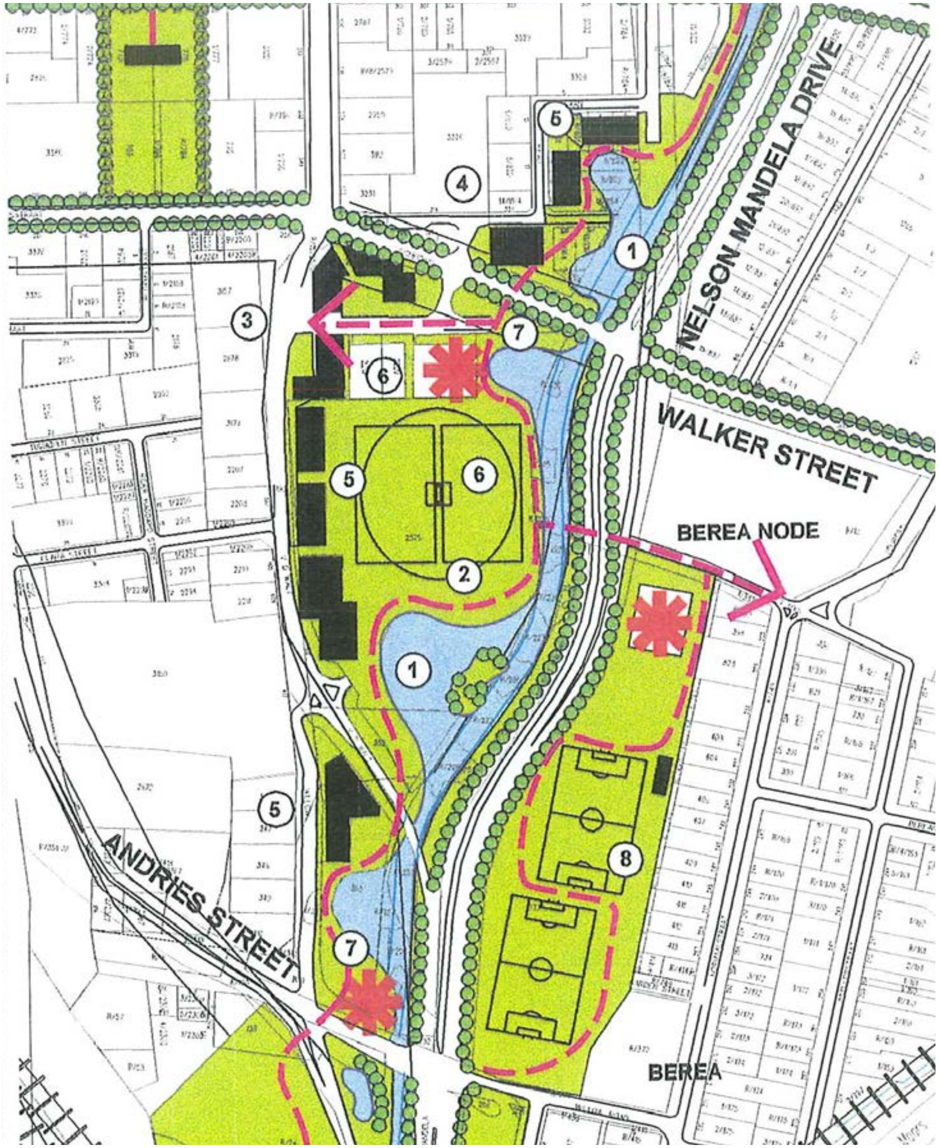


Fig. 72: Pretoria Inner City ISDF for Berea Park (Capitol Consortium, 1999)

Some of the proposed development opportunities (Refer to Fig. 72) were to widen the Apies River and introduce a series of fountains; a circulation route penetrating the site; extending the surrounding urban grid; new building fabric on the edge of the open space; freely and publicly accessible open space activities such as informal play fields and children play environments need to be developed; Fauna and Flora display gardens along the Apies River activity spine. Lastly Capitol also proposed informal play fields and children play areas on the area east of Mandela Drive (UNISA Sunnyside Campus) (Capitol Consortium, 1999:24-25).

In another framework from Rekopane Consortium designed by Grosskopff, Lombart, Huyberechts & Associates Architects in 2009 it was proposed that historical elements of the site such as the granite kerbs, historic alignment of the walkways, historic fence etc. be retained as far as possible. This framework proposes two new buildings, an outdoor amphitheatre, parking area, riverside walkway and garden.

According to the author the most suitable proposal of the three mentioned is the proposal from Capitol Consortium to embrace Berea Park as an open space and further celebrate and develop Berea Park as open space. Many of the suggestions made in the proposal match the activities and ideas proposed by the author (Refer to Chapter 6).

Developing valuable open space into buildings and parking lots, as suggested by the other two proposals, was not found to be agreeable.

Safe and public accessible parks are limited in Pretoria and therefore another reason why Berea Park needs to be conserved and protected.

4.8 Conclusion

The physical factors mentioned in Chapter 3, section 3.6, confirm that Berea Park is the most appropriate site for the proposed program – developing a waste park.

In short, the current condition of Berea Park can be described as quiet and neglected with little activity on site. Two of the buildings are of historical importance but stand unutilised. The soccer fields are maintained for informal soccer games. There is no diversity of vegetation - there are only trees along the Apies River. The soil is suitable for urban agriculture.

The proposed future plans for Berea Park include developing the valuable open space into housing or buildings with a parking area. Another plan, resembling the author's idea, is to preserve and further develop Berea Park as open space.

Berea Park is an important landmark to the southern gateway of Pretoria, because it has the potential to contribute to the image of the city, making the park's location ideal. The site is a valuable, ecologically viable open space because it has the potential to be developed into something much greater than proposed in other frameworks – not only respecting what the site once meant to the community, but also giving the site new meaning by designing a biodiverse 'hybrid' that considers both the history and future plans of the site.

Not only will the waste park uplift the community by enhancing the quality of life, providing job opportunities and education, it will also influence the residence of Pretoria CBD and Sunnyside to be more environmentally conscious.

The program for Berea Park and the reasons for the different activities proposed will be discussed in Chapter 6.

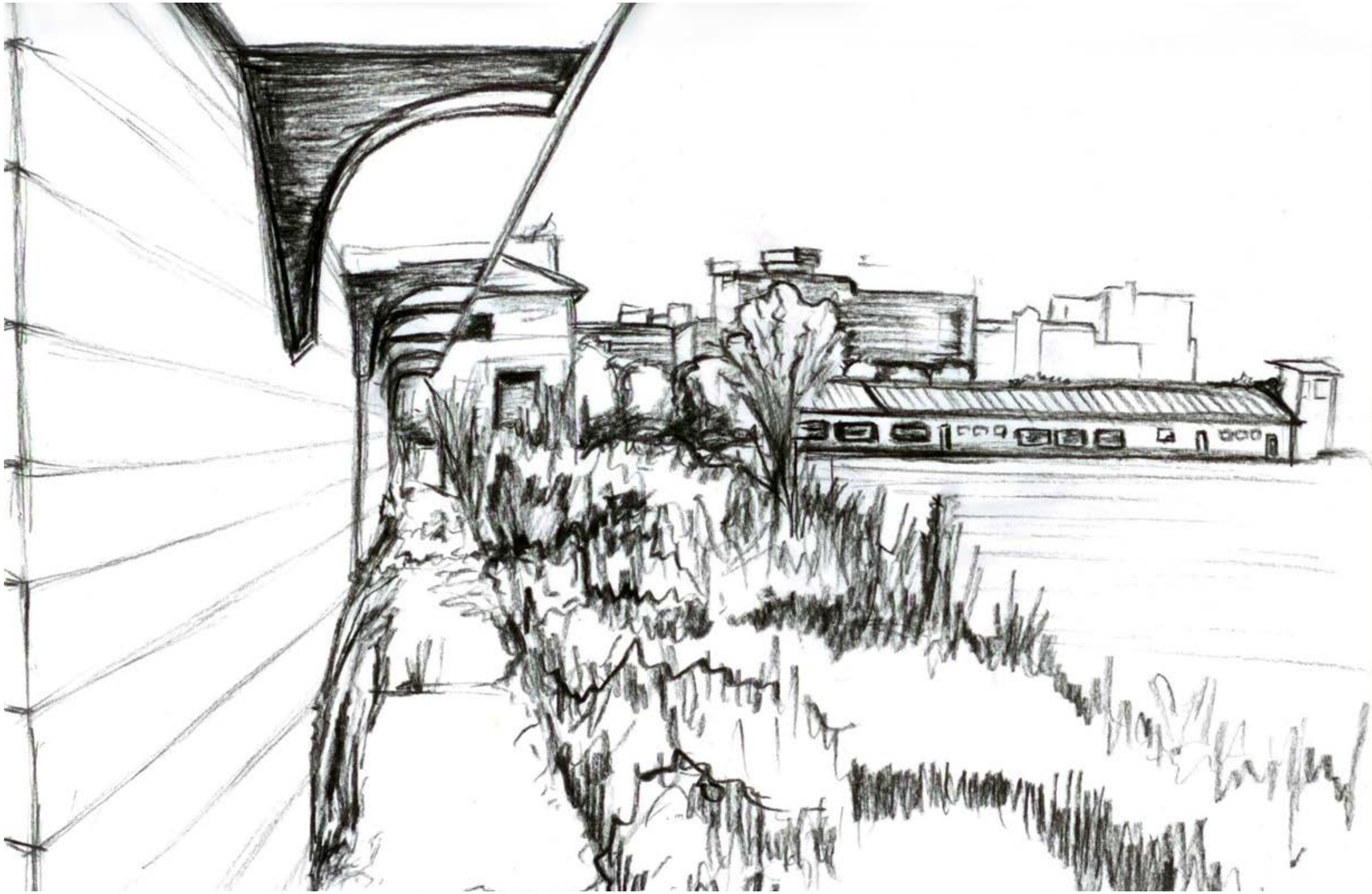


Fig. 73: Sketch of Site - from the Southern building looking in Northern direction (Author, 2012)

CHAPTER 5

Precedent Studies

CHAPTER 5: Precedent Studies

5.1 Introduction

The following relevant precedents will be studied and used as inspiration to aid in formulating principles and guidelines that will inform and guide the decision-making throughout the design development process.

By studying different successful precedents, ideas on how to design creative educational facilities and encourage sustainability and recycling by means of innovative landscape design methods will be discovered.

5.2 Evergreen Brick Works

Evergreen Brick Works (Refer to Fig. 74) is a community environmental centre "featuring innovative programs that are inclusive and accessible to anyone wanting to explore how to live, work and play more sustainably" (Evergreen, 2012).

Location: 550 Bayview Ave, Toronto, Ontario, Canada
Designers: Master Plan: Toronto-based planning Alliance
Detailed design: du Toit Allsopp Hillier and du Toit Architects Limited (architecture and landscape architecture) (project lead); Claude Cormier Architects Paysagistes Incorporated (Landscape architecture)

Description: Evergreen Brick Works, previously known as Don Valley Brick Works, functioned as a brickyard from 1889 to the 1980s. The factory was closed during 1984 and after numerous restorations opened as a community environmental centre in 1996, managed by Toronto Parks, Forestry and Recreation (Evergreen, 2012).

The Environmental Centre (Evergreen, 2012) offers a wide variety of innovative programs and facilities such as:

- **The Young Welcome Centre** exhibits of art and the environment takes place in the entrance facility of Evergreen Brick Works;
- **Evergreen Garden Market** is located directly next to the Welcome centre and is a sheltered outdoor space where 13 garden beds (demonstration mounds) showcase different 'themes' such as wildflowers, edible plants etc. (Refer to Fig. 75). This garden centre and market provides an interactive and educational experience;
- **The Kilns** building are is rich in industrial heritage and houses the Holcim Gallery where large-scale art installations are displayed;
- **Koerner Gardens** also acts as a demonstration space where visitors are inspired to create their own gardens at home (Refer to Fig. 76). The visitors are also encouraged to take part in the "planting, care and maintenance of the garden mounds";

Fig. 74: Evergreen Brick Works (Young, 2011 modified by Author, 2012)

Fig. 75: Evergreen Garden Market (Young, 2011)

Fig. 76: Koerner Gardens (Young, 2011)

- **The Pavilions** - gatherings and festivals take place in this centralised outdoor space. The pavilions are covered and host Evergreen Brick works' Farmers' Market on Saturdays and Sundays;

- **The Centre for Green Cities** - the LEED rated building consists of meeting and office space, a large kitchen, classrooms and a green roof;

- **Café Belong** is about "creating a connection between the natural food from our land, the farmers that nourish and harvest it, and ultimately, the people who enjoy it" (Long, 2012) (Refer to Fig. 77);

- **Chimney Court** is a dynamic outdoor space (Refer to Fig. 78) where creativity, hands-on play and discovery are encouraged during the unique programs and workshops offered at the Chimney Court.

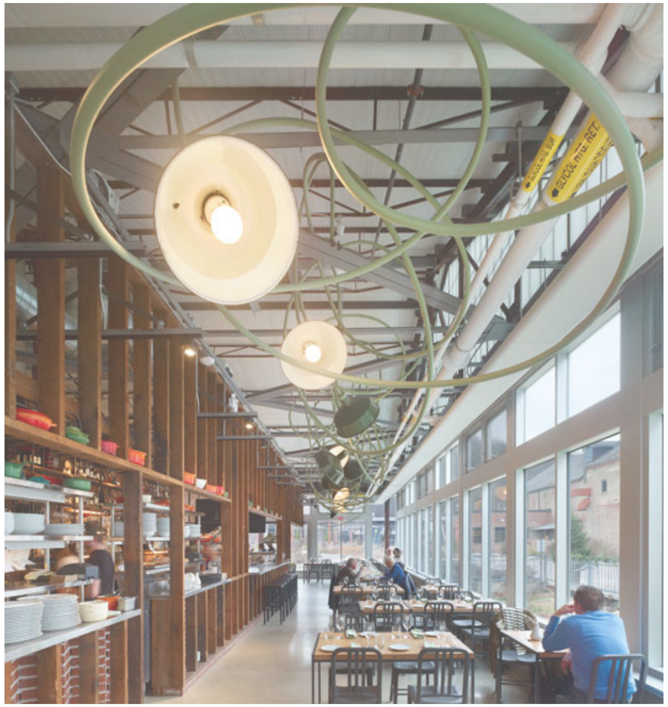


Fig. 77: Cafe' Belong (Evergreen, 2012)

Fig. 78: Chimney Court (Young, 2011 modified by Author, 2012)

Fig. 79: WEST Parking lot at Evergreen Brick Works (Young, 2011)

Opportunities and ideas:

Evergreen Brick Works (EBW) is a very successful and inspiring precedent study with various activities, elements and functions applicable to Berea Park.

The landscape architectural role in the project is evident in the planning and strategic development of EBW in terms of the enhancement of the environment by reducing the carbon footprint of the project.

This was achieved, for example, by adaptively reusing older buildings as far as possible and collecting water from parking lots by using greenways (swales) (Refer to Fig. 79 and 80).

Above-ground cisterns with the capacity of 20 000 litres are used to harvest rainwater running off the buildings' rooftops (Refer to Fig. 81). The water is then reused in the gardens and toilets.

Fig. 80: Greenways at Evergreen Brick Works (Young, 2011)

Fig. 81: Water tanks (Young, 2011)

These ideas can be applied at Berea Park by collecting water from parking lots and other hard surfaces and 'transporting' the water by means of swales and channels to wetlands (retention dam in EBW's case) in order to filter the sediments from water before it is sent back to a storage dam.

EBW used demonstration mounds to showcase native plants, edible plants etc (Refer to Fig. 82). It is an effective way of creating awareness and interest in the natural environment and its processes.

EBW is proof that outdoor workshops and activities work well to create an interactive and educational experience.

Another achievement of EBW was to transform a clay and shale quarry into a thriving green space known today as the Weston Family quarry garden (Refer to Fig. 83). This was accomplished by planting native species and wildflower meadows, contributing to the protection and restoration of this important ecosystem (Evergreen, 2012).

Fig. 82: Demonstration mounds (Young, 2011)

Fig. 83: Retention dam at Evergreen Brick Works (Young, 2011)

5.3 The Owl House (Helen Martins)

The Owl House, according to SA-venues (2012), is a Karoo cottage and yard set deep in the Sneeuberg Mountains in the small village of Nieu-Bethesda in the Eastern Cape. The cottage and yard were transformed into a glass-encrusted wonderland and statue garden between 1950 and 1976 by Helen Martins.

Location: Nieu-Bethesda, Eastern Cape, South Africa
Designers: Helen Martins

Description: Helen Martins inherited the house in December 1897 after her parents died. During 1945 she started an "obsessive project to decorate her home and garden" she wanted "to transform the environment around her" (Hanekom, 2010) (Refer to Fig. 84).

Fig. 84: Helen Martin's Owl House (Williams, 2011)

Fig. 85: Inside Glass walls (Boddy-Evans, 2006)

Fig. 86: Sculptures (Boddy-Evans, 2006)

She decorated the interior of her house, the walls and ceilings, using wire and decorative coloured glass (Refer to Fig. 85).

Helen Martins also built sculptures of owls, camels and people out of cement and recycled materials such as glass bottles and vehicle headlights for her garden (Refer to Figs. 86 - 90).

Sadly, she committed suicide on August 8, 1976 and today her house is a well-known museum called the Owl House (Hanekom, 2010).

Fig. 87 - 90: Owls, camels and people out of cement and recycled materials (Boddy-Evans, 2006)

Opportunities and ideas:

Even though Helen Martins' work received very little support and enthusiasm while she was still alive, the museum is very popular today. This could be ascribed to her unique creativity and ability to build something, an artwork, from what most would view as waste.

There's an opportunity to apply Helen Martins' creative ideas to Berea Park, for example: visitors can use recycled waste as a resource and create artworks during workshops. The crushed glass idea can be used by artists as a finish or to 'paint' pictures against retaining walls. Recycled materials can be used to create street furniture and signage throughout the park. It might also be used for paving and building blocks. The fencing around the agriculture can also be made from recycled objects such as old bicycles, plastic pipes, etc.

5.4 Somarelang Tikologo

Somarelang Tikologo is a community park and "showcase for sustainable urban living and environmental technologies. It includes a recycling facility, Green Shop, community vegetable garden, new play area and drought-tolerant indigenous planting" (Askew Nelson, 2012).

Location: Gaborone, Botswana
Designers: Initiated in 1991 by three lecturers of the University of Botswana. Somarelang Tikologo is a member-based environmental non-governmental organization (NGO).

Max Askew, managing director of Askew Nelson Landscape Architecture also worked closely with Somarelang Tikologo to create a new Eco Park in Gaborone (Askew Nelson, 2012).

Fig. 91: Somarelang Tikologo (Somarelang Tikologo website, 2012)

Description: Somarelang Tikologo, meaning 'Environment Watch Botswana', is an Ecological Park located in Gaborone, Botswana.

The park is determined to educate, demonstrate and encourage best practices in environmental planning, resource conservation and waste management with the aim to promote sustainable environmental protection in Botswana (Wikipedia, 2012).

Opportunities and ideas:

The park provides the opportunity for environmentally friendly initiatives to be showcased in one location while "providing a public space for all citizens of Gaborone to learn about how easy it is to adopt sustainability and go green" (Somarelang Tikologo, 2009).

The park is made up of different components, namely: An ecological garden to educate the public on how to grow their own vegetables, an Eco Café offering guests a wide selection of organic and all-natural snacks, a Green Shop that sells products made from recycled materials provided by local people in Gaborone and a recycling drop-off centre (Refer to Fig. 91).

Somarelang Tikologo Community Park has very good intentions, but unlike Evergreen Brick Works it is still lacking creative and innovative methods of applying and dealing with important programs such as environmental planning, resource conservation, environmental education and recycling.

5.5 The University of Witwatersrand recycling and composting facility

The University of Witwatersrand has a well-functioning, fully equipped recycling and composting facility on their premises (West campus) for the recycling of all the waste (hard and green waste) produced on campus.

Location: The University of Witwatersrand, Johannesburg, South Africa
Designers: ORICOL Environmental Services: Recycling Facility & Servest Landscaping: Composting Facility

Every six weeks a chipper is brought in to chip the green waste. The chipped waste is thrown on heaps, forming five long lines (Refer to Fig. 96).

The lines of waste are constantly watered and turned every six weeks. The last heap of waste is sifted. The sifted material, or compost (Refer to Fig. 97), is then used throughout the campus.

Fig. 92: WITS Recycling Facility (Author, 2012)

Fig. 93: Loading waste on conveyor belt (Author, 2012)

Fig. 94: Sorting at Recycling Facility (Author, 2012)

Description: The recycling and composting facility of the University of Witwatersrand is process driven. All the waste produced on campus, except for the green waste, is taken to the recycling facility where the waste is hand-sorted and thrown into demarcated bins for glass, plastic, metal and paper (Refer to Fig. 92-94).

The green waste (Refer to Fig. 95) produced on campus is transported to the composting facility (Refer to Chapter 2, Fig. 13), managed by Servest Landscaping.

WITS also recycles food waste by using two different methods, allowing the food waste and some leaves to decompose in an enclosed container (Refer to Fig. 98) and the decomposition of the waste with the help of earthworms (Refer to Fig. 99), but these two methods are still very new and developing concepts at the recycling facility.

Opportunities and ideas:

The recycling and composting facility at WITS is a wonderful initiative and ought to be an inspiration to all the campuses in South-Africa.

Berea Park has a big opportunity to act as a recycling facility where all the waste, except for green waste, can be recycled and reused in workshops. Green waste could be transformed into compost. The compost produced on site can be used in the vegetable gardens.

Fig. 95: Green Waste (Author, 2012)

Fig. 96: Heaps of chipped waste (Boshoff, 2012)

Fig. 97: WITS Composting Facility (Boshoff, 2012)

Fig. 98: Decomposition of food waste in enclosed container (Author, 2012)

Fig. 99: Decomposition of food waste with the help of earthworms (Author, 2012)

5.6 Urban agriculture precedents

The following precedents are unique examples of how agriculture can be integrated into the urban ecosystem in a harmonious way, promoting community development and creating learning spaces where high-quality, safe, healthy, affordable and locally-grown produce can be provided.

Skinner City Farm

"The Skinner City farm is a public agricultural site involving the Eugene community in the process of designing and operating the garden" (Skinnercityfarm, 2013) (Refer to Fig. 100).

Location: Skinner Butte Park, Eugene, United States
Designers: Jan Vander Tuin – site coordinator; Joanna Lovera – garden project manager; Eugene community

Description: The requirements of the Skinner City farm project were to meet the needs of the community, benefit the environmental system of the Willamette River Greenway and express the sites cultural history (Skinnercityfarm, 2013).

The project not only provides hands-on education for young and old on how to grow and preserve healthy food, but also contributes to maintaining a healthy ecosystem.

Agriculturally-based programs are offered to the community and plot holders, involving them in the design and operation of community garden areas and providing them access to grow great food.

In the patchwork of community plots of the Skinner City farm is a box with thousands of red wigglers (Refer to Fig. 100) "that can turn table scraps into 'gold', in the words of the farm's coordinator, Jan Vander Tuin" (Ross, 2010). All the food waste from area markets and restaurants are thrown into this box where the worms chew through the waste and turn it into castings – the process is called Vermicomposting (Refer to Chapter 2, section 2.2.3.1.1).

Fig. 100: Skinner city community farm (Skinnercityfarm, 2013)

Fig. 101: Hands-on agricultural educational programs (Skinnercityfarm, 2013)

Fig. 102: Eugene's soil secret (Ross, 2010 photo by Clark, K.)

Opportunities and ideas:

The Skinner City farm has several goals in mind, for example to "demonstrate and educate the general public about sustainable and ecologically-sound agriculture, agricultural ecosystems, and ecologically appropriate agricultural techniques and technologies" (Skinnercityfarm, 2013).

Another goal is to involve everyone, local public and private schools, people from different ethnic backgrounds, young and old to become part of this self-reliant community garden and participate in the hands-on agricultural educational programs.

The vermicomposting process practised at the Skinner City farm teaches the residents of Eugene to use their organic waste wisely. The soil-producing worms are also sold by Skinner City farm.

Rooftop Haven for Urban agriculture

Rooftop Haven is the roof garden of the Gary Corner Youth Centre in Chicago. The roof garden acts as a haven for the residents who have little access to safe outdoor environments. It's an after-school learning space that provides the students and local restaurants with fresh organic food. "Sleek and graphic, it turns the typical working vegetable garden into a place of beauty and respite" (ASLA, 2010).

Location: Chicago, USA
Designers: Hoerr Schaudt Landscape Architects

Description: For the roof garden to be multi-functional and successful, the landscape architect had to work closely with the architect. The Rooftop Haven is developed to be much more than only a green roof; it is used for horticultural learning, to create environmental awareness and to produce food.

Fig. 103: Rooftop Haven for Urban agriculture (ASLA, 2010 photo by Shigley, S.)

Fig. 104: Rooftop Haven - flower and vegetable garden (ASLA, 2010 photo by Shigley, S.)

Not only does the roof garden act as "a model for using traditionally underutilised space for urban agriculture" (ASLA, 2010) (Refer to Fig. 103 and 104), it also satisfies various practical needs such as the reduction in the costs for climatic control, provision of an outdoor classroom (Refer to Fig. 105) as well as a flower and vegetable garden where children can cut flowers and dig for vegetables with garden tools, at the same time (Refer to Fig. 106).

Opportunities and ideas:

The Rooftop Haven is an elevated courtyard, because it is built on the roof of the gymnasium, on the second floor. One year the vegetable garden produced almost 460 kg of vegetables for the school children.

The roof garden is designed in such a way that it turns a normal working vegetable garden into a place of beauty with skylights and linear paving strips (made from recycled tires) in-between the different planting rows, framing the garden (ASLA, 2010).

Educational opportunities are created in terms of gardening – cultivating vegetables and fruits and basic business skills by providing the local restaurants with vegetables.

5.7 Story board

Several other precedents were considered for inspiration (Refer to Chapter 11, Fig. 131) with regards to the creative application of recycled materials, the success and aesthetics of green walls, arrival plazas and environmental centres.

5.8 Summary

Scores of knowledge and insight can be gained by studying successful precedents with similar scenarios and goals in mind.

By implementing the different elements identified in each of the above-

Fig. 105: Outdoor classroom (ASLA, 2010 photo by Shigley, S.)

Fig. 106: Children planting vegetables (ASLA, 2010 photo by Shigley, S.)

mentioned precedents all or most of the objectives of the design proposal for Berea Park could be achieved.

For example, adaptive reuse, the same opportunity as mentioned at Evergreen Brick works, where the two derelict buildings on site can be restored and given new purposes. The use of storage tanks to harvest rainwater from the buildings' rooftops. The stored rainwater can be reused in the vegetable gardens and toilets.

The use of recyclable materials, inspired by Helen Martins' creative ideas applied to The Owl House, for park furniture, paving, artworks and finishes.

There is also an opportunity at Berea Park to have a restaurant or cafeteria in the existing Northern Club Hall. It would function in a similar way as Somarelang Tikologo's Eco Café: not only catering to the businessmen meeting in the conference hall (above the restaurant), but also the visitors at the workshops. The restaurant could also be supplied with fresh produce by the community vegetable gardens.

The existing southern building can be used as exhibition space and green shop to display and sell the artworks made at the workshops.

Similar to Somarelang Tikologo, Skinner City farm and Rooftop Haven, environmental education, urban agriculture and recycling are very important aspects in the design proposal for Berea Park.

In essence: designing an all-encompassing waste recycling park where adaptive reuse, rainwater harvesting, environmental education, awareness generation, urban agriculture and recycling are implemented.

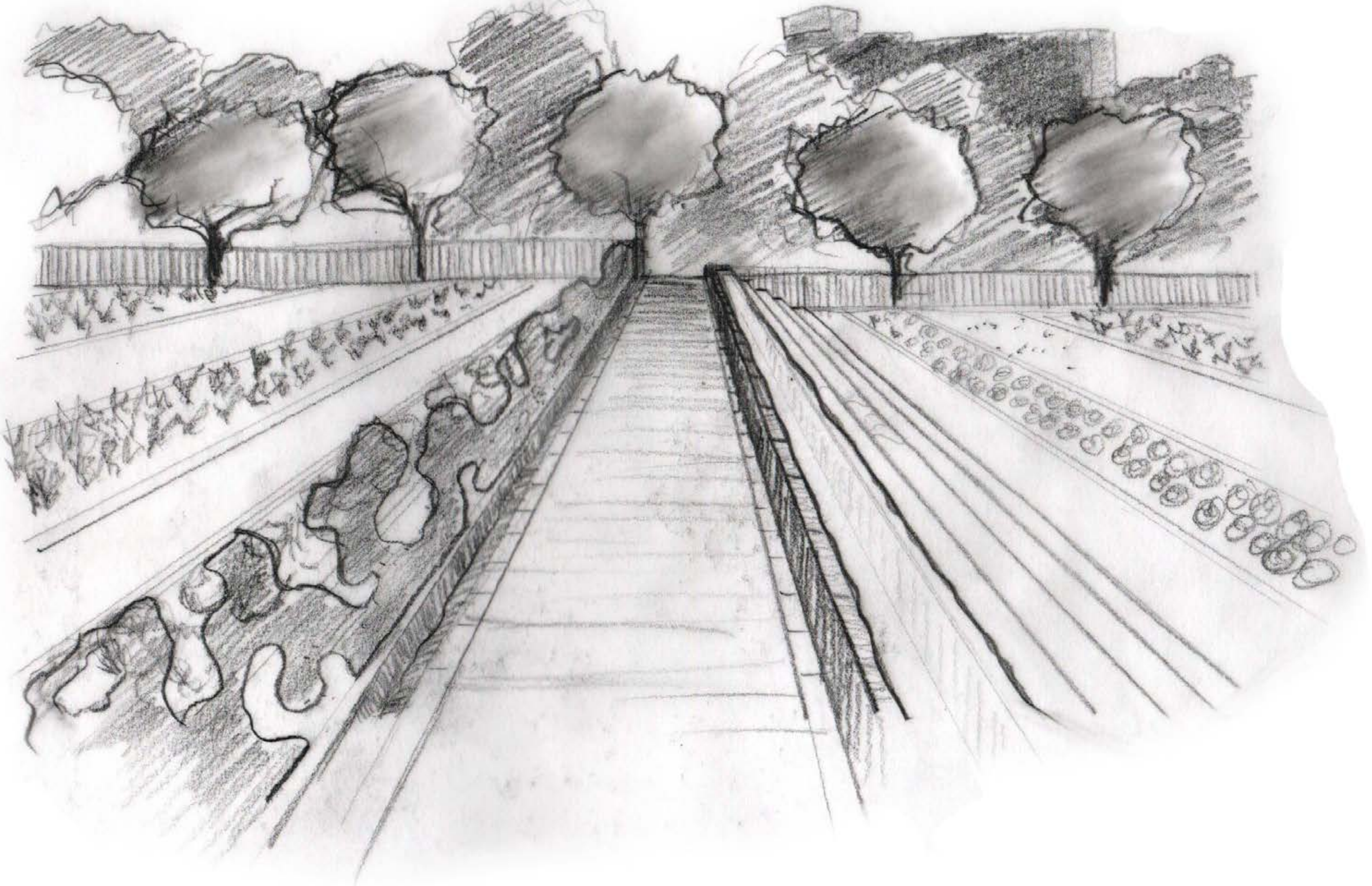


Fig. 107: Conceptual sketch of the park's entrance (Author, 2012)

CHAPTER 6

Design Development

CHAPTER 6: Design Development

6.1 Introduction

The development of a design is a time consuming and reiterative process. Often times it is necessary to go back a few steps to find the best possible solution.

The extensiveness of the design development process will be discussed in this chapter; taking a closer look at the development of a master plan for the site.

Before this process can commence it is important to, firstly, clarify the vision, objectives and approach of the design after which the site program can be developed and the design development can commence with the help of design guidelines derived from the theoretical investigation in Chapter 2 as well as the findings from the site analysis completed in Chapter 4.

6.2 Design guidelines

The following design guidelines were formulated by the theoretical concepts investigated in Chapter 2 and will guide the conceptualisation process of the design:

- Use resources without diminishing their future availability;
- Maintain biodiversity;
- Project should be economically, environmentally, socially and aesthetically sustainable;
- Turn the problem into something playful, a process of discovery;
- Transform a space into a place with meaning through storytelling;
- Embrace natural features and processes;
- Reuse waste as renewable resources and
- Design sustainable human habitats that revitalize and support ecological health.

These design guidelines together with the design objectives will act as design drivers and will guide the design development process.

6.3 Analysis summary

A SWOT analysis was conducted in the site analysis chapter (Refer to Chapter 4, section 4.5) to determine the current strengths and weaknesses of Berea Park.

As a summary of the analysis, the following strengths were observed: The park was once regarded as the gateway to Pretoria; has historical value because of the site and buildings that are older than 60 years; the park is close to a natural water source, the Apies river; the land is arable making it suitable for urban agriculture; the park is adjacent to densely populated residential communities; close to public transport routes; and close to educational facilities.

The following weaknesses of Berea Park were observed: The park has lost its identity during the past few years; derelict buildings on site; there are no activities along the Apies river, causing it to be quiet and under-observed, making it unsafe; the site is environmentally disturbed; not in the proximity of existing garden refuse sites; poor visibility from the road; no identified entrance to the site; no bus stop in close proximity and the residents have low average household income and a high unemployment rate.

These findings, even the weaknesses, can be used as opportunities in the development of Berea Park as a waste park. The opportunities will help formulate design objectives.

6.4 Vision

The vision is to provide Pretoria South CBD and Sunnyside with a waste park where visitors will be informed about the enormity and significance of the waste problem, the impact they have and could have on the earth and how they can contribute to and cooperate with this attempt to make a difference.

It will not only be a place where people's perception of waste will be challenged and the value of waste appreciated, but also a place where:

visitors and locals can interact socially and enjoy themselves in the recreational areas, where they can take part in workshops, make their own artwork or grow their own vegetables. They will also have the opportunity to sell their produce and buy vegetables and artwork.

6.5 Design objectives

The design intervention will strive to accomplish the following objectives:

- Design a waste park that will relieve the pressure from the surrounding garden refuse sites (as identified in Chapter 3, section 3.2.1.1) with the main theme being "the recycling of waste" where waste is recycled into different forms throughout the park by using various methods such as the recycling of organic waste, composting green waste, vermicomposting and recycling of hard waste as described in Chapter 2, section 2.2.3.1;
- Design a multifaceted park that provides a variety of activities, for example telling the story of waste throughout the park by means of recycling and educating visitors regarding the recycling methods, the reuse of waste and growing their own vegetables;
- Allow visitors to interact with and experience the processes of recycling and urban agriculture;
- Reuse the recycled waste at the workshops offered in the park;
- Practice different sustainable methods (according to the Sustainable Sites Initiative)
- Introduce the three main design strategies on site, namely the waste, water and agriculture strategies;
- Reinstate Berea Park as a core of social activities;
- Create awareness of the historical significance of the site;
- Enhance the environmental condition of Berea Park and
- Make the park more accessible and visible from the streets.

6.6 Design approach

To initiate the design development process it is important to establish how the design intervention intends to achieve these different objectives. The design will be approached by:

- Following the design guidelines set out in section 6.2;
- Carefully considering the findings of the site analysis (Refer to section 6.3);
- Following the design vision and objectives set out in section 6.4 and 6.5;
- Establishing the site program and program requirements (Refer to section 6.7);
- Developing a design concept by taking the program of the site into consideration (Refer to section 6.8);
- Spatially exploring (Refer to section 6.9):
  - connections to surrounding buildings and activities and
  - the layout of the site program and the different relationships between the activities;
- Developing a master plan (Refer to section 6.9);
- Developing the three main design strategies (waste recycling, water recycling and urban agriculture, Refer to Chapter 7) as well as the recreation strategy;
- Developing a sketch plan (Refer to Chapter 8) and
- Technically resolving the design for that specific section (the sketch plan area) of the site (Refer to Chapter 8).

6.7 Site program

The program for the site derived from the design objectives and the initial concept: to produce the 'ideal' place: a multifaceted park where all the activities successfully work together in a sustainable manner with the ability to maintain economic, environmental, social and aesthetically sustainable practices.

Originally, the program for the site was limited to recycling of garden waste, but with time the program evolved into much more, a park that deals with different important issues revolving around the story of waste.

Berea Park will be the 'storybook' in which the story of waste will be told…

The program of the site includes the following:

- Restoring derelict buildings and allocating new and appropriate functions to the restored buildings;
- Providing a bus and taxi drop-off, modifying the existing informal taxi rank in Rhodes avenue into a formalised bus and taxi drop-off system;
- Providing a market area;
- Creating a well-lit river walk all along the Apies River and allowing access to the site over the Apies River;
- Practicing urban agriculture;
- Providing more than one well-defined entrance;
- Creating job opportunities;
- Educating students (visitors) about reducing and reusing waste (recycling);
- Providing exhibition space for artwork made during workshops and
- Provide a functional recreation area to allow for various park activities with an interactive play area in close proximity.

The design revolves around three main strategies and the following is a breakdown of the facilities and activities required to support the program:

6.7.1 Waste strategy

Recycling of organic waste

The organic waste recycling facility will require a drop-off point, a sorting area, a chipper (every six weeks), area for chipped garden waste, a concrete base (with a slight slope for the composting lanes), sufficient water, a compost sifter, area for sifting the material and a compost heap.
Requirements:

- Drop-off point
- Sorting
- Mulching
- Composting
- Water
- Security – supervision, fenced-off and gates closed at night

The operation and functionality of the waste management area was also investigated (Refer to Fig. 108 and 109) and developed (Refer to Fig. 110).

The relations between the different phases of the waste management process of green waste were explored in order to find the most functional layout (Refer to Fig. 108).

The waste management area started to evolve into functional spaces; mainly addressing the recycling of green waste (Refer to Fig. 109). The

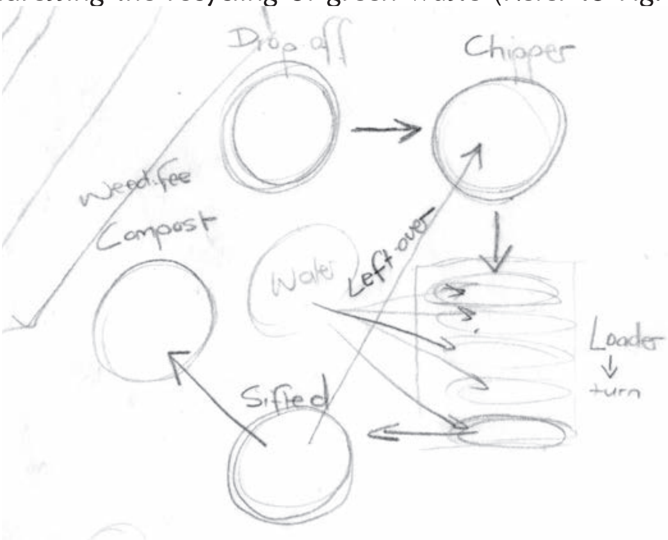


Fig. 108: Spatial Exploration of Waste Management Area (Author, 2012)

recycling of hard waste, which comprises of the sorting and cleaning of the waste, was included in Fig. 110. The waste management process in terms of the operation and layout of the green waste recycling was also finalised.

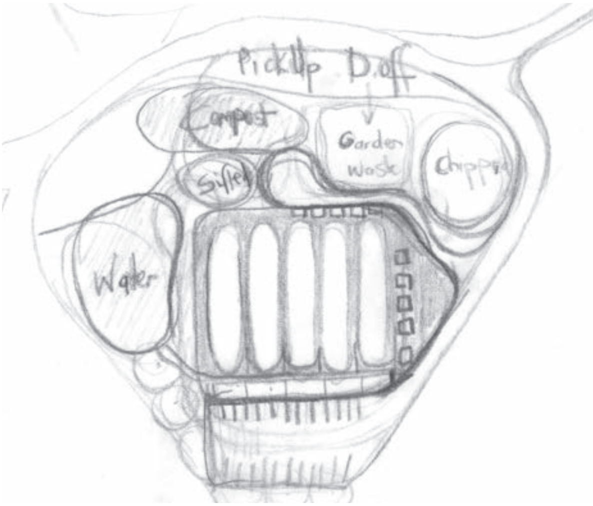


Fig. 109 Waste Management Area (Author, 2012)

This process is explained more comprehensively in Chapter 7 (Refer to section 7.2).

Composting of organic waste – Vermicompost

Vermicomposting will be incorporated at the waste park where containers with working worms (red wigglers) will be used to break down food and garden waste into Vermicompost and 'tea' (Refer to Chapter 2, section 2.2.3.1.1). This will allow the public to come into contact with the interesting process of working worms and how they operate. Demonstration projects will illustrate how this form of 'composting' can be integrated at the people's homes.

The Vermicompost and 'tea' produced by the worms will be used for the vegetables grown on-site. The public will be able to buy the plants and compost from the park.

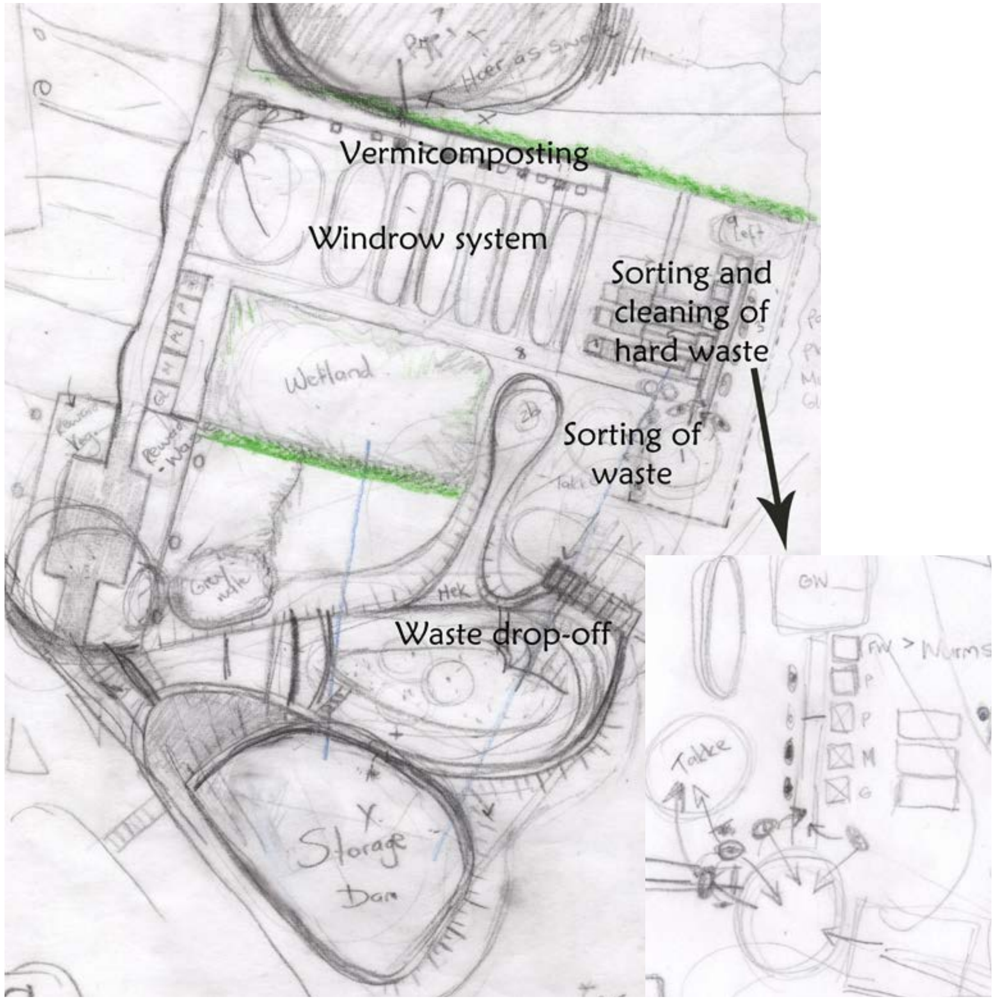


Fig. 110: Waste Management (Author, 2012)

Requirements:

- Red Wiggler worms
- Bins (stacked bin worm farm)
- Bedding material
- Water
- Organic waste

Recycling of Hard waste

Even though the main focus will be on organic waste recycling and the provision of an inner city park to host these activities; bins will be provided for the recycling of glass, paper, metal and plastics. The hard waste will be sorted and cleaned on site for reuse (Refer to Fig. 116).

The application of recycled materials throughout the park, for example as paving, retaining walls, wall finishes, etc., will be considered as far as possible.

"There are many opportunities for using reclaimed materials in landscape design, and many more emerge with a bit of lateral thinking.... Reclaimed materials can stimulate the creative process much more effectively than new products." (Porter, 1999:9)

The following are some of the applications that could be considered:

Glass

One way of using recycled glass (cullet), because of its compatibility and permeability, is as construction aggregate for improved drainage systems, base course materials and backfill applications.

Glassphalt (glass mixed with asphalt) (Gagnon and Ryder, 1995:28), or glass aggregate mixed with concrete are other uses of recycled glass in the landscape, for example as a paving material and to create artwork.

Paper

Recycled paper can be used in the landscape as mulch which is environmentally friendly. The mulch contains a minimum of 85% recycled paper, 13% moisture and 2% ash.

Plastic

Park benches, roof insulation (for the restored buildings) and plastic lumber (wood) are only a few of the applications recycled plastics are used for. Plastic lumber is used for wood applications outdoors because it won't rot and doesn't require any preservatives.

Requirements:

- Drop-off point (Waste management area)
- Area for the sorting of waste (conveyer belt system, similar to the University of Witwatersrand recycling facility)
- Area for the cleaning of recyclable waste
- Recycled water from storage dam to be used at the waste cleaning area
- Security - supervision, fenced-off and gates closed at night
- Demarcated recycling bins for glass, plastic, metal and paper at more than one location

Workshops

The value of waste and how to recycle hard waste will be illustrated and taught at the workshops. The visitors will have the opportunity to develop skills and to experience the recycling of hard waste hands-on by making artwork from the recycled waste.

Annual competitions and events will be hosted in the park where the artworks can be exhibited or sold; this will help to motivate visitors to take part in the workshops.

Requirements:

- "Teachers"/tutors (Job opportunities)
- Equipment for making artwork
- Clean recycled material (glass, paper, metal and plastic) from the waste management area
- Storage for tools and artwork

6.7.2 Agriculture strategy

Urban agriculture

Urban agriculture will be introduced on site through demonstration vegetable gardens to teach visitors how to design their own sustainable human habitats at home by growing their own vegetables.

Residents of Sunnyside and Pretoria CBD will also have the opportunity to become land owners of the community farm and take part in growing their own vegetables. Only the land owners will have access to the

community farm.
Requirements:

- Community farm
- Demonstration vegetable gardens
- Gravity-fed irrigation
- Process & packaging area
- Water
- Compost & fertilizers
- Storage
- Equipment
- Security - supervision, fenced-off

6.7.3 Water strategy

Recycling of water

Water will be recycled throughout the site. There will be four catchment areas capturing the rainwater to be used in specified areas. The runoff will be collected in wetlands and pumped to a storage dam (The water strategy is discussed in more depth in Chapter 8, section 8.1.3).

Storage tanks will be used to harvest rainwater from the buildings' rooftops. The stored rainwater can be reused in the vegetable gardens and toilets.

Requirements:

- Storage dam
- Storage tanks
- Bioswales
- Wetlands

6.7.4 Activities supporting the three design strategies

The following activities relate to either two or all three design strategies, stipulating general requirements to ensure the three strategies and all the activities work together successfully.

Creating job opportunities

Not only will the waste park create job opportunities by employing people to go around and collect waste, or to sort the unsorted waste into different categories, or by growing and selling their own vegetables, but it will also provide different workshops and demonstration projects and appoint "teachers" or tutors to illustrate and teach people the value of waste, how to recycle organic waste and how to use recycled waste.

Requirements:

- Accommodation for workers (existing buildings)
- Service pathway
- Golf cart for the collection and delivering of waste, artworks and vegetables
- Equipment for growing vegetables
- Storage for equipment and vegetables

Environmental education

Several activities will be hosted to educate the visitors about waste recycling, water recycling, composting and growing vegetables. The demonstration gardens will be interactive, allowing for social interaction and skills development.

Requirements:

- Gardening shop (environmental centre)
- Demonstration gardens
- Informative signage
- Workshops

Vegetables, compost and artworks sold from the park

The vegetables produced on site will be sold in the market area and restaurant on site. The compost produced on site will also be sold in the market area and at another allocated area on site. The artworks created during the workshops will be sold at the workshops itself or in the market area.

Requirements:

- Workshops
- Restaurant (sells organic food)
- Market area (fresh produce)

Reward system – reward public with vouchers or food when they deliver waste

A reward system will be implemented on site as motivation for visitors to bring waste to the site to be recycled. The visitors will be rewarded with a food voucher at the restaurant or with a package of fresh produce when they deliver waste.

Requirements:

- Drop-off and collection point (demonstration centre)
- Supervisor
- Vegetables (stored packages)
- Storage

Leisure and recreational activities

Every park has the need for leisure and functional recreational areas allowing for various park activities where visitors can socially interact and enjoy themselves. A soccer field, river walks, interactive play areas, etc. can be incorporated.

Requirements:

- Park furniture
- Pathways
- Enough shade (trees)
- River walk
- Picnic/Braai areas
- Toilets
- Soccer field
- Play area
- Interactive play structures
- Security - supervion and sufficient lighting

6.7.5 Further requirements

- The use of recycled materials for park furniture, paving, retaining walls, etc.;
- Guided tours explaining the different processes on site – especially for school kids;
- Informative signage and
- More than one well-defined entrance.

6.8 Concept development and spatial exploration

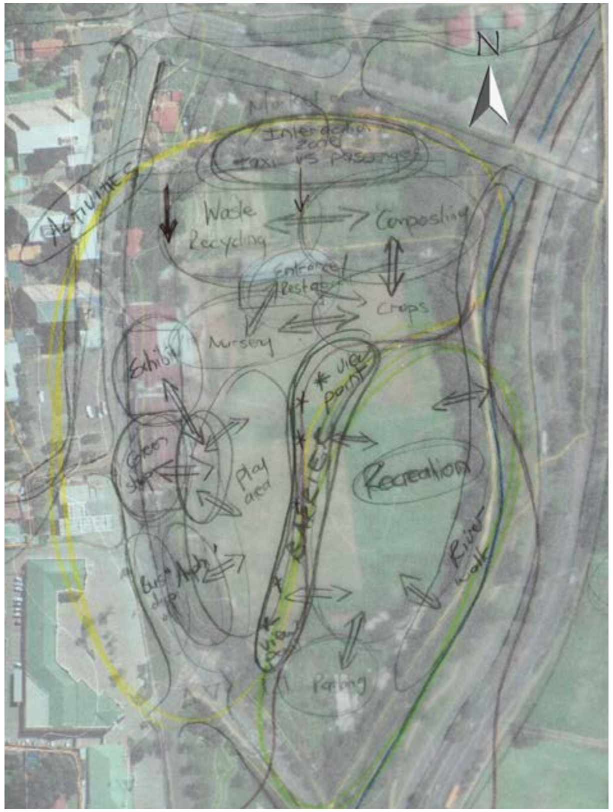


Fig. 111: Concept Development 1 (Author, 2012)

After developing the program it is possible to further develop the concept of the park – to introduce the problem to the public in a fun and playful manner and - being multifaceted - carefully consider and review all the facets and characteristics thereof.

The connections and relationships between different spaces and activities, such as waste recycling and composting, the entrance building, nursery and crops, recreation area and river walk, exhibition space and green shop in the buildings and play area/activities, were explored and different scenarios for these relationships were considered. The most suitable scenarios were selected to be designed and further developed into possible master plan proposals (Refer to Figs. 111 – 114).

The scenarios comprise of: an arrival plaza, a northern entrance, vegetable gardens at the entrance, an orientation point, recreation and leisure area, separated with an earth mound from the rest of the activities on site and a waste recycling area.

The waste recycling and composting facility were initially situated at the entrance to the site for everyone to see as they enter the site (Refer to Figs. 111 – 113), but as illustrated in Fig. 114 it was moved to the southern side of the site because of the general direction of the wind and solicitude that the waste area will cause a smell at the entrance. Vegetable gardens (urban agriculture) were proposed to be placed at the entrance instead.

Fig. 112: Concept Development 2 (Author, 2012)

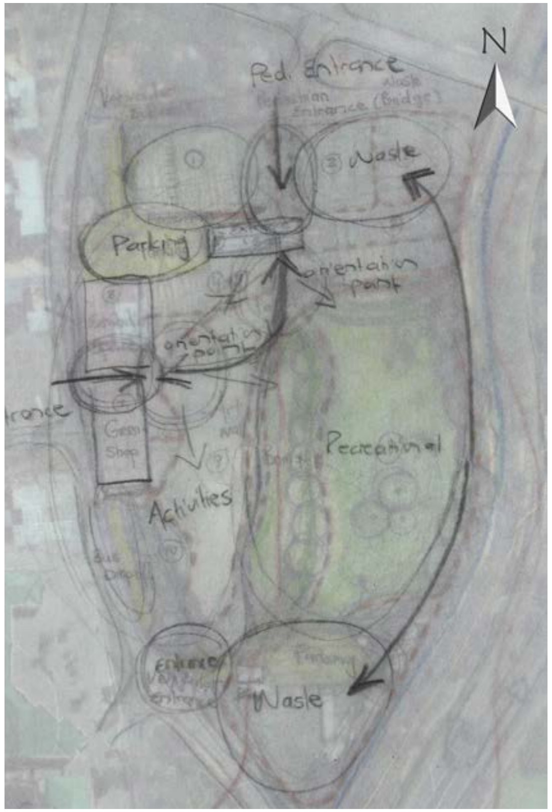


Fig. 113: Spatial Exploration 1 (Author, 2012)

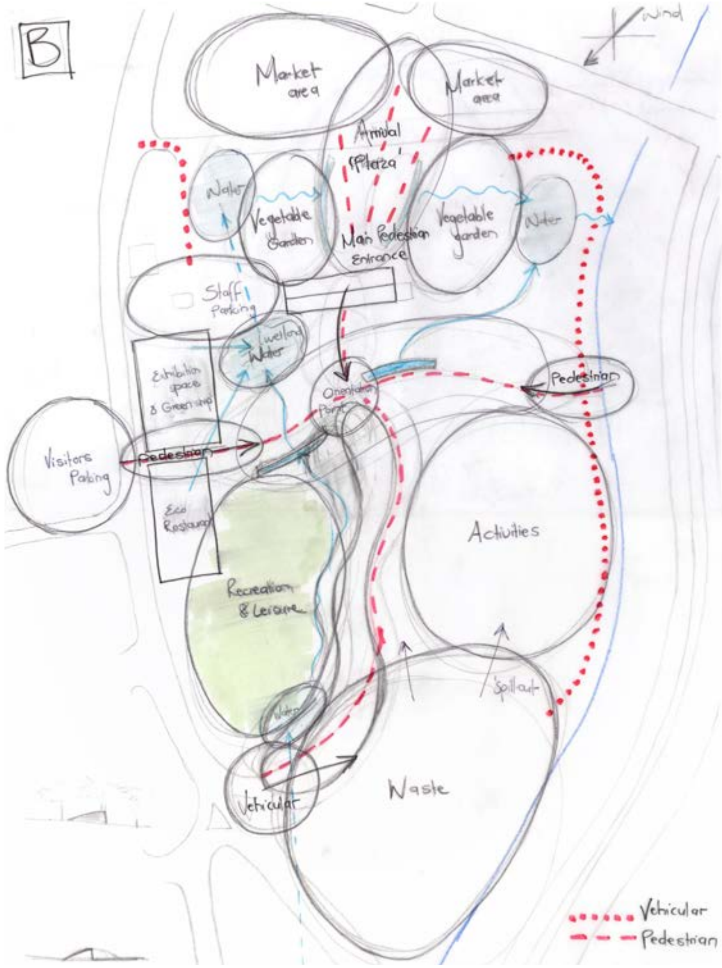


Fig. 114: Spatial Exploration 2 (Author, 2012)

6.9 Landscape Master plan development

Similar to the proposed concept in Fig. 114, the vegetable gardens (urban agriculture) remain at the entrance of the site. The activities such as outdoor workshops, interactive play areas and performance/demonstration areas are located next to the Apies River in an attempt to activate the river edge. The recreational area is next to the restored buildings (western side of the site). In this diagram this space was proposed to be restaurants and exhibition space. Visitors will be able to buy picnic baskets at the restaurant. The entrance building, also an existing building, will be restored and used as an entrance gate to the site. The vegetable gardens, recreational and waste management areas are provided with water from their own wetland (Refer to Fig. 115).

The next diagram illustrates that the composting facility moved to the entrance of the site and the waste drop-off remained at the southern side of the site. This was done to prevent the waste recycling process from being separated from the rest of the site. The activities, outdoor workshops, interactive play areas and performance/demonstration areas moved away from the river to be closer to the restaurant and other activities in the buildings while the recreation area moved next to the river - providing a more serene and relaxing atmosphere along the river walk (Refer to Fig. 116).

The following diagrams indicate that the waste recycling and composting facility of the waste management area was kept at the southern side of the site, to reduce the handling of waste. The initial idea of agriculture at the entrance of the site changed into a big arrival plaza where visitors can socialize and wait for a bus or taxi. The taxis are kept out of the park by providing a bus and taxi drop-off. Demonstration gardens are proposed to introduce urban agriculture to the visitors. The agriculture is now located next to the waste management area and workshops are proposed next to the buildings. An earth mound still functions as a barrier and a viewing platform that separates the recreation area from the waste management area. One big storage dam provides the entire site with water. A vehicle entrance is proposed at the southern side of the site to drop off waste (Refer to Fig. 117 and 118).

Fig. 115: Master plan development 1 (Author, 2012)

Fig. 116: Master plan development 2 (Author, 2012)

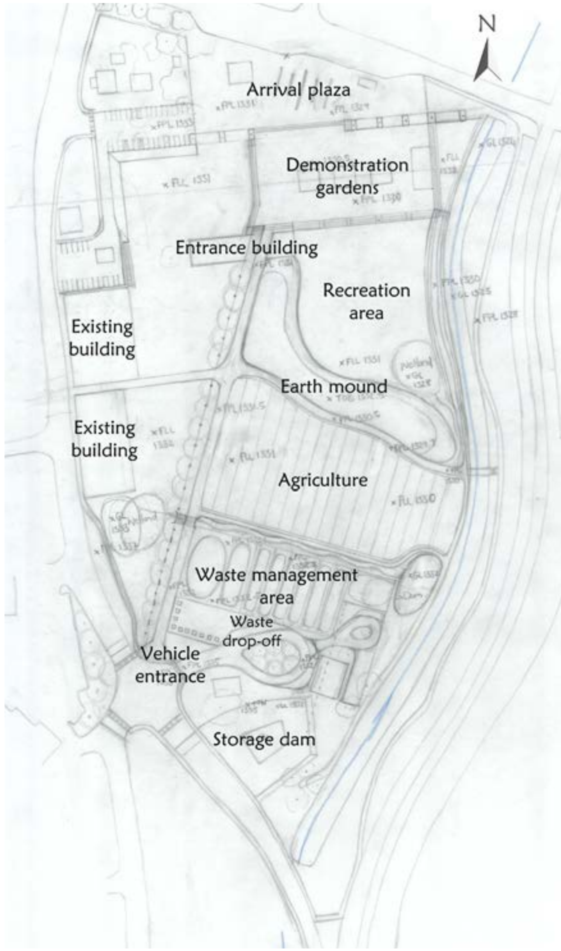


Fig. 117: Master plan development 3 (Author, 2012)

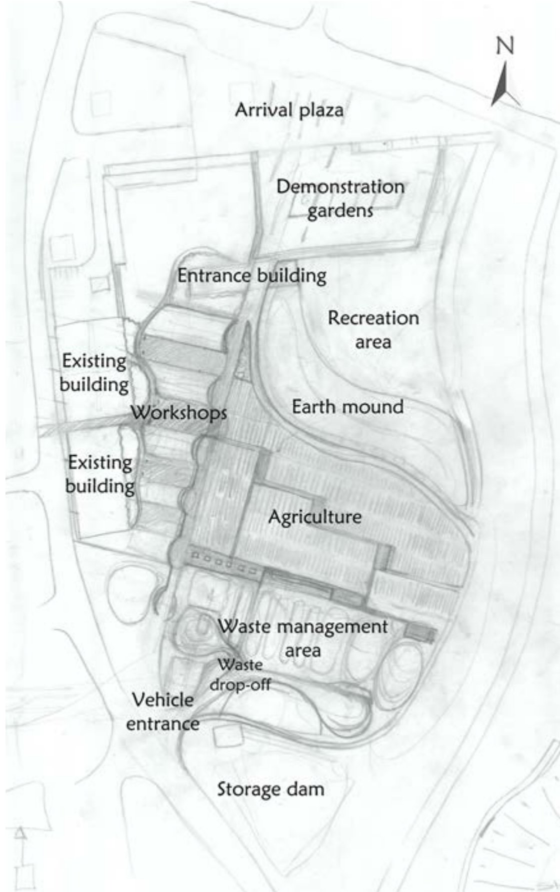


Fig. 118: Master plan development 4 (Author, 2012)

All the ideas and possible solutions obtained from the master plan development diagrams (Refer to Figs. 115 - 118) were consolidated and synthesised into a diagram that illustrates the final layout proposed for the master plan consisting of different nodes and connections to the surrounding environment (Refer to Fig. 119 and 120).

A northern node as main entrance to the site and southern node for vehicular entrance was proposed in Fig. 121 with a physical link – a pedestrian boulevard serving as the main route through the site (moves through the entrance building) – between the northern and southern nodes. On the western side, parking with a physical and visual link to UNISA registration building and an orientation point where the two pathways meet was proposed as well as a pedestrian bridge where the pathway crosses the Apies River.

Functional relationships between the different activities such as the drop-off area, market and arrival plaza, arrival plaza and demonstration gardens, recreation, river walk and retention dam, agriculture and demonstration gardens, agriculture and workshops, buildings and agriculture and waste management and water storage were explored and the most sensible connections were proposed as shown in Fig. 122. For instance, a connection between UNISA registration building and the northern node was proposed. It comprises a drop-off and pick-up area for all the students from UNISA and a market area for visitors. Connections from the commercial and business areas and the Gautrain Station to the park's southern node were also proposed.

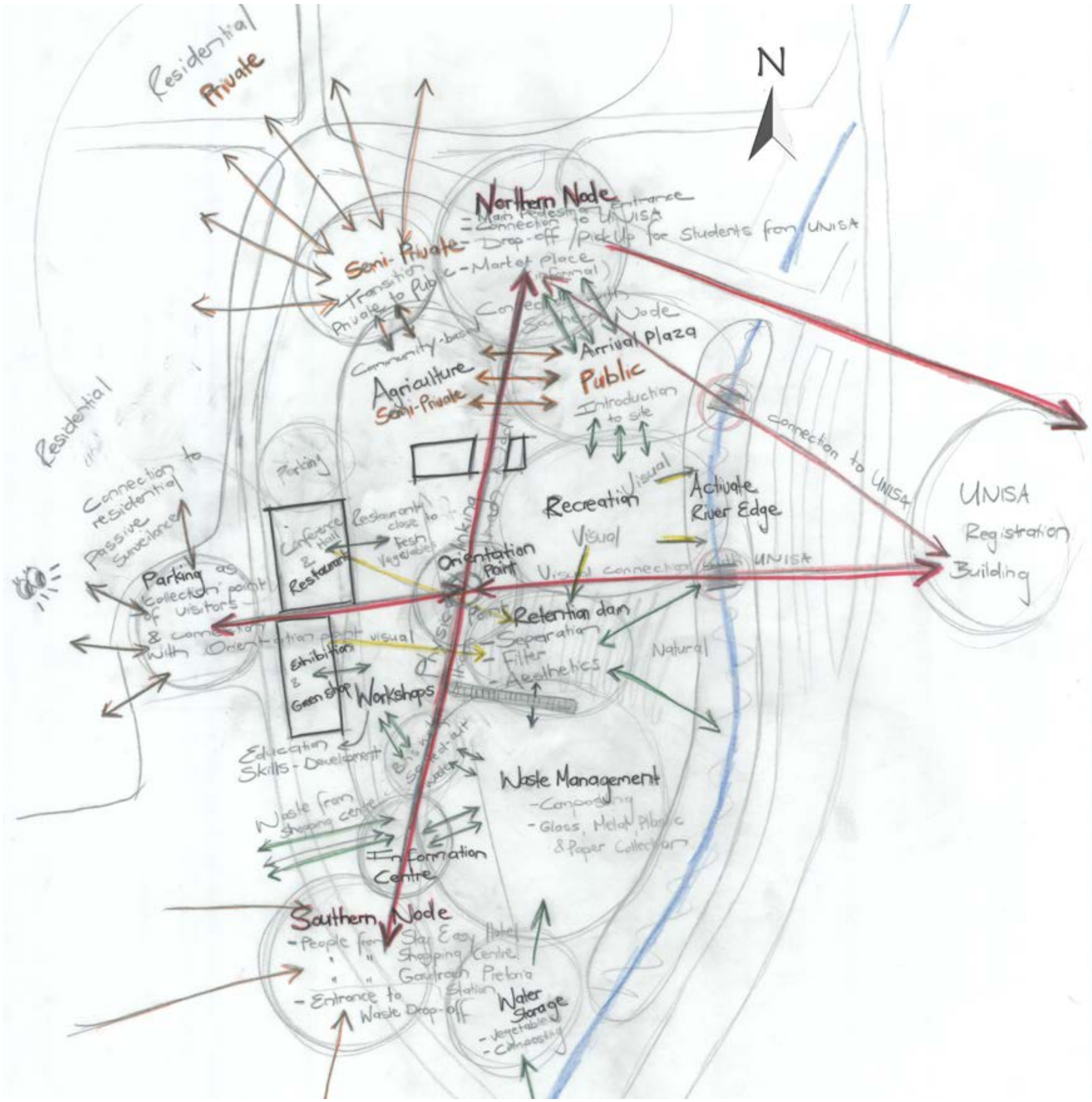


Fig. 119: Spatial exploration 3 (Author, 2012)

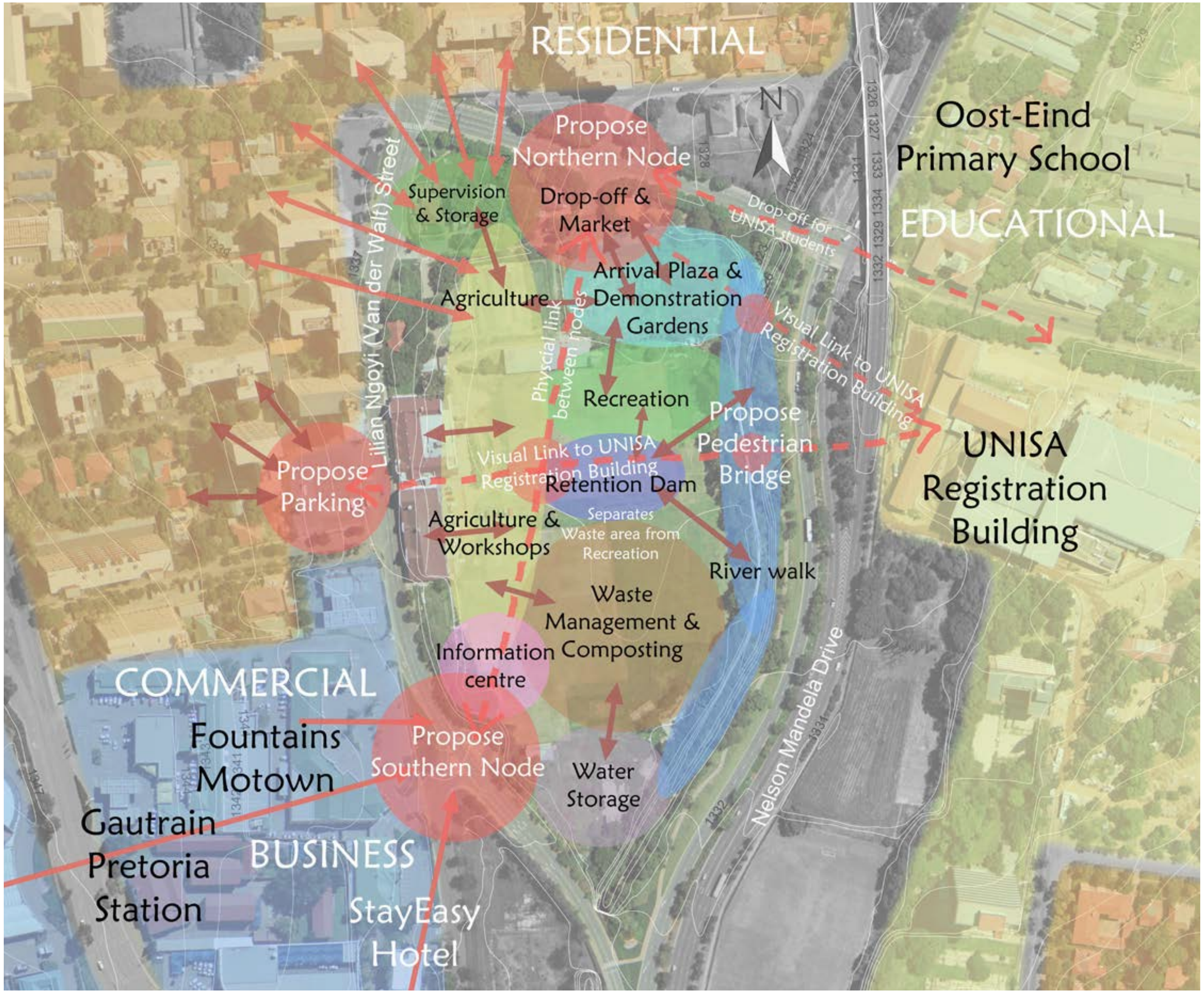


Fig. 120: Master plan proposal (Author, 2012)

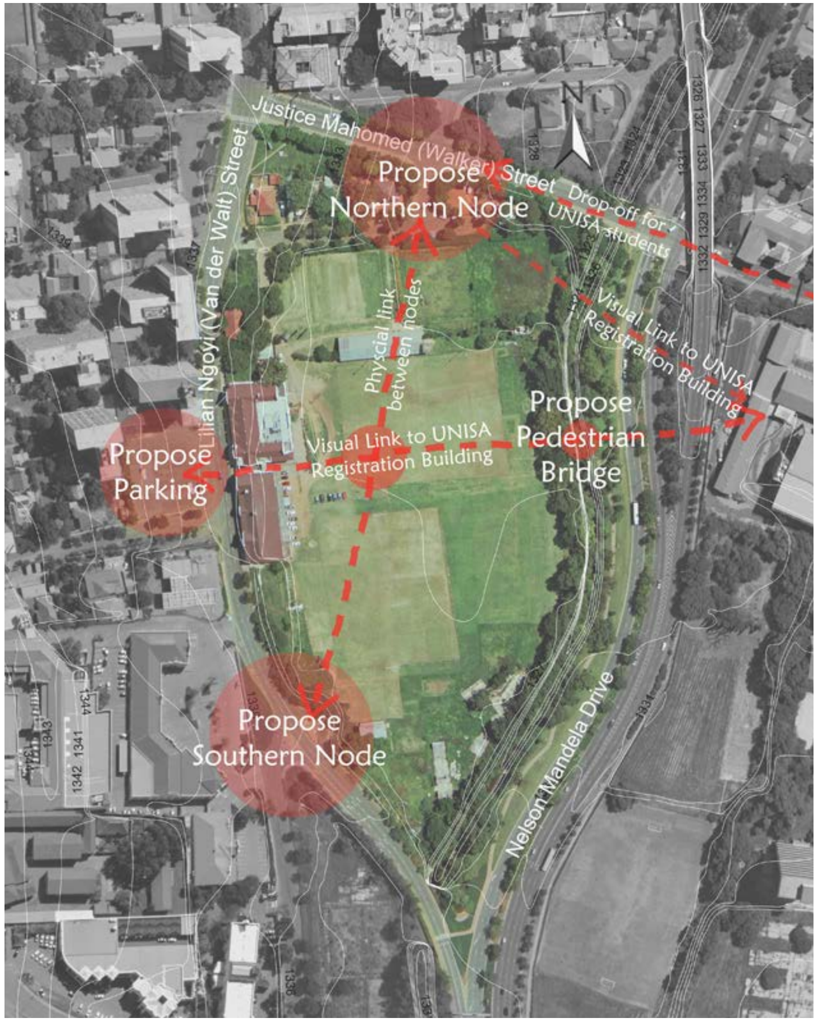


Fig. 121: Proposed Nodes and Visual Connections (Author, 2012)

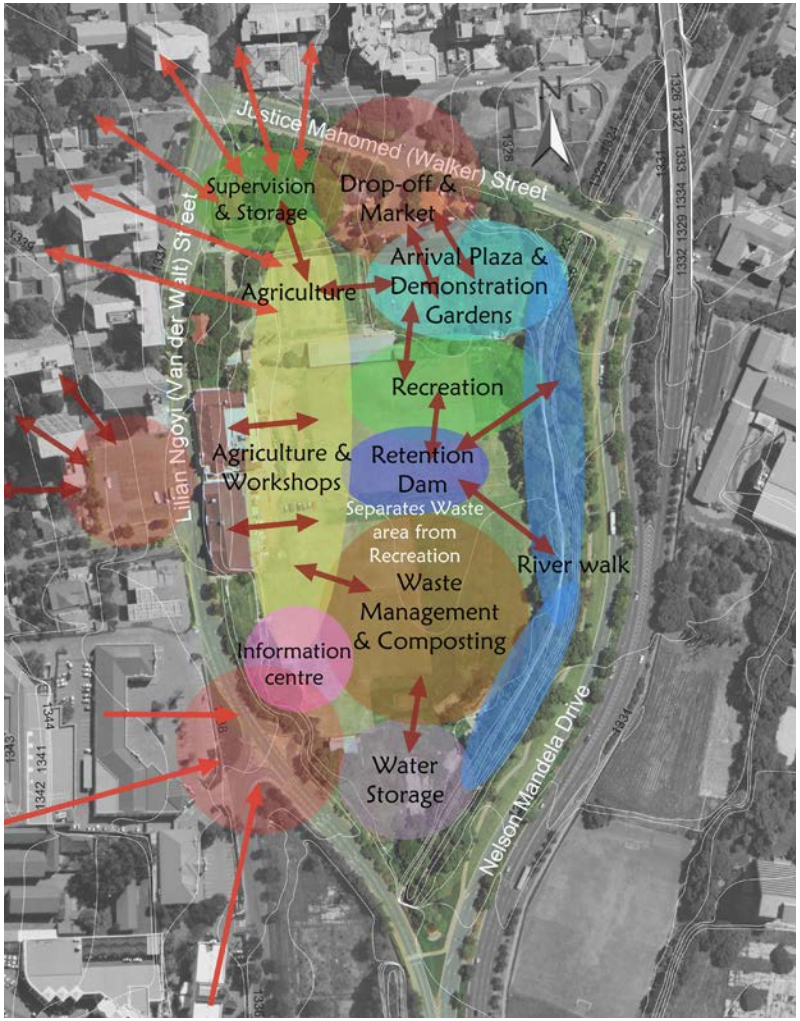


Fig. 122: Activity zones and Relationships (Author, 2012)

The master plan proposal was developed further (Refer to Fig. 123 and 124) and consists of the following: a market area, an arrival plaza with demonstration gardens (east of entrance building), agriculture and workshops in front of the buildings, a retention dam and recreation area. The northern building is proposed to be used as conference facilities and a restaurant. The southern building is proposed as a green shop and exhibition space. The southern entrance was explored in terms of adequate space for vehicles entering, dropping of waste at the waste management area, turning and exiting.

Fig. 123: Master plan development 5 (Author, 2012)

An information centre is proposed, as shown in Fig. 123, at the southern entrance, but it was moved to the northern entrance of the site as a new function to an old, existing building, because most visitors will enter the site from the main (northern) entrance (Refer to Fig. 130).

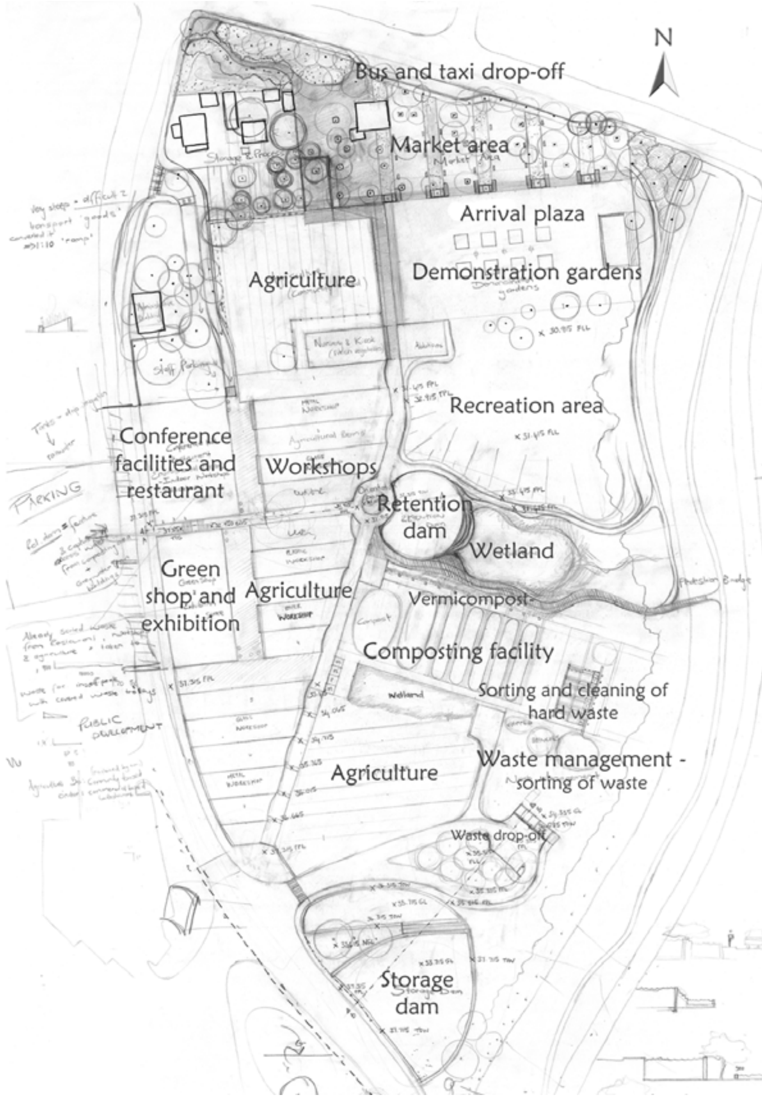


Fig. 124: Master plan development 6 (Author, 2012)

A retention dam flowing into a wetland is proposed (Refer to Fig. 124), but as shown in Fig. 125 it was decided that a wetland alone would be sufficient. The wetland acts as a filter to clean the water and, at the same time, has aesthetic value and separates the waste management area from the recreational area. The size of the storage dam was also investigated and determined in order to provide the entire site with water.

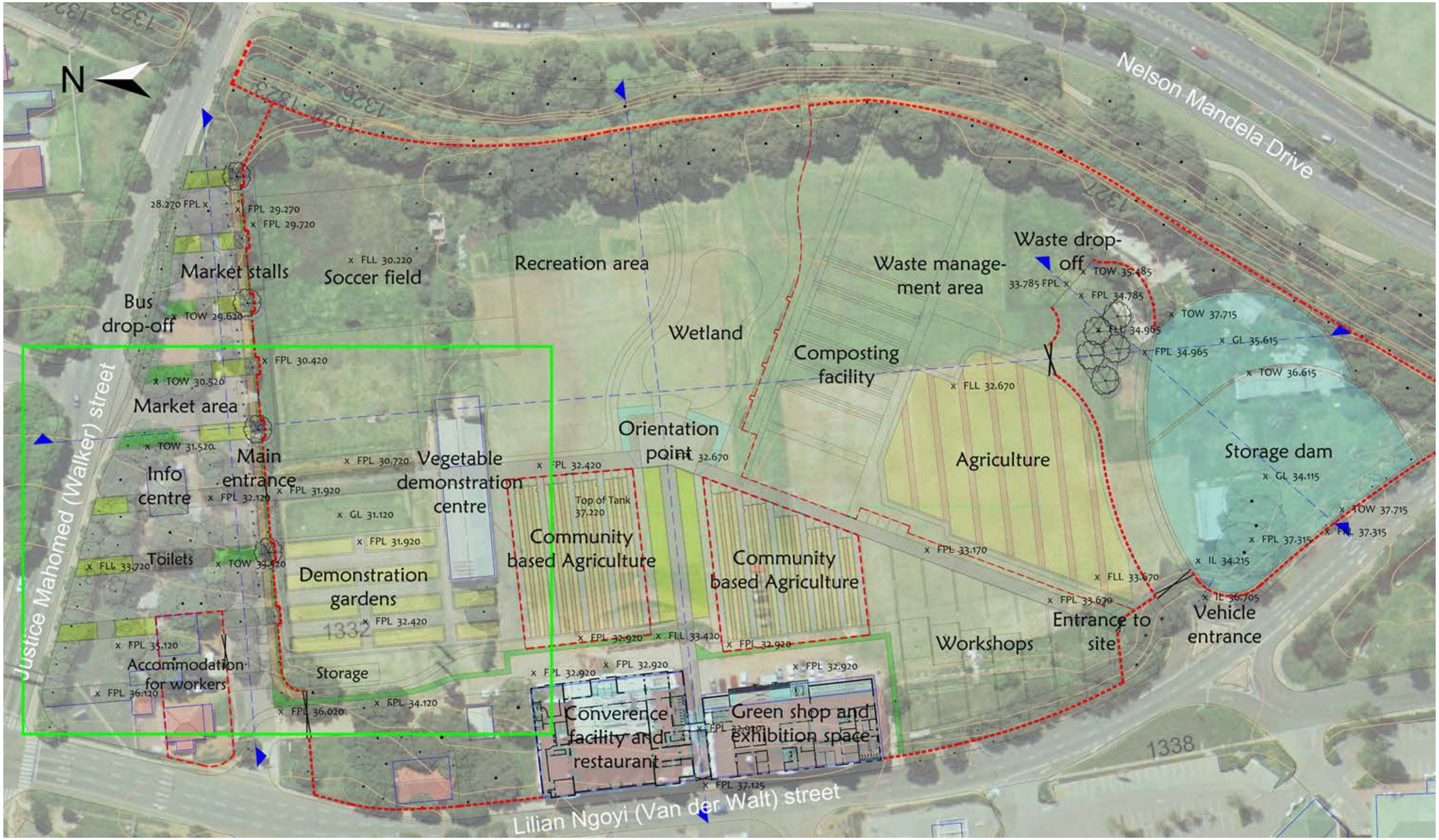


Fig. 125: Master plan development 7 (Author, 2012) - Due to practical reasons the layout of the site on plan will be developed further in landscape format (rotating the layout of the site 90° counter clockwise)

The general circulation on site is illustrated in Fig. 126 and the different views as seen by the visitors at different locations on site are illustrated in Fig. 127.

Fig. 126: General circulation on site (Author, 2013)

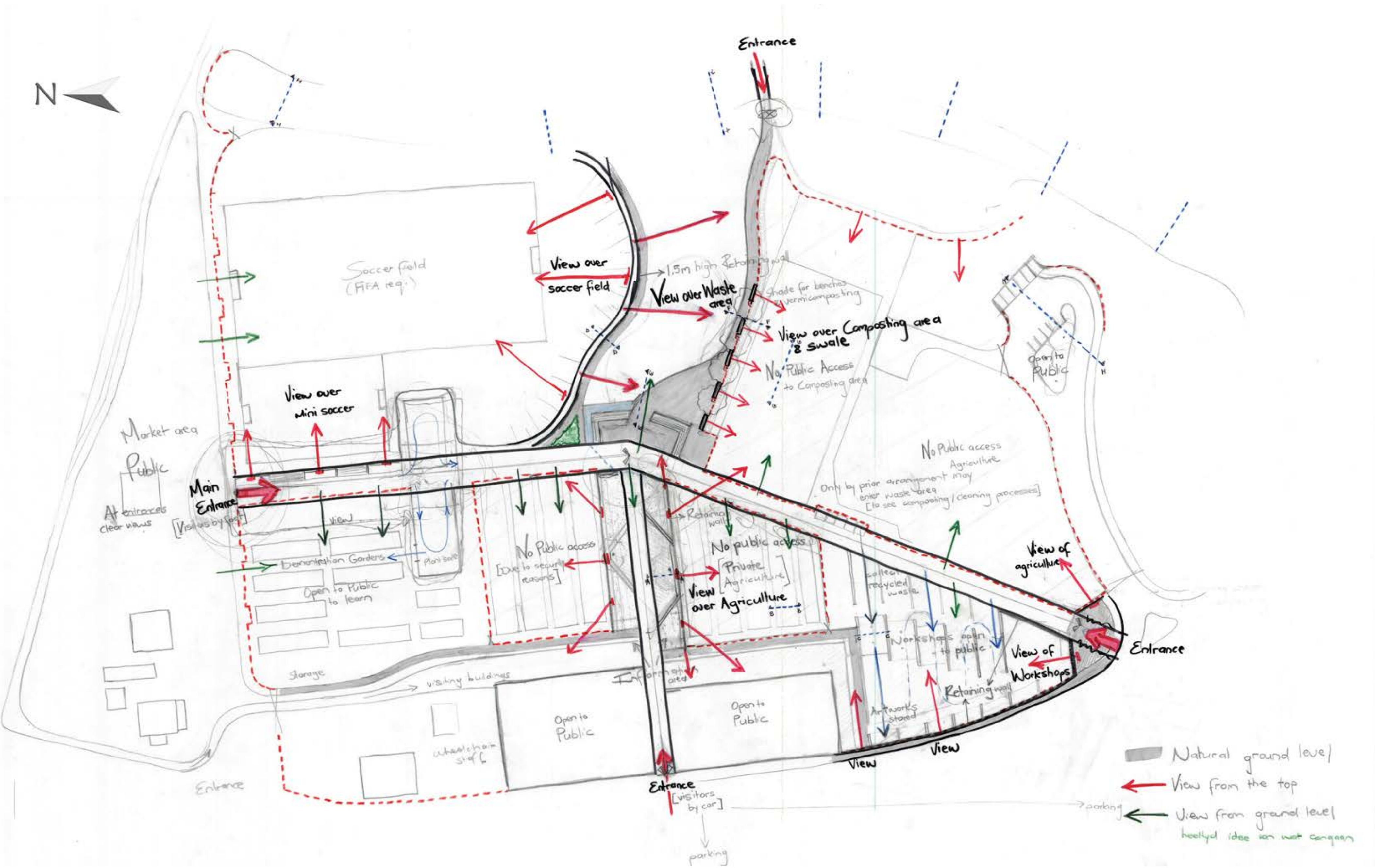


Fig. 127: Views as seen by visitors at different locations on site (Author, 2013)

The arrival plaza changed from the previous diagrams and evolved into a market area (Refer to Figs. 125, 128 and 129). The demonstration gardens moved to the west side of the entrance building to provide space for a soccer field in the recreation area. The entrance building will function as a gardening shop with toilet facilities. The workshops are no longer in front of the buildings, but were moved next to the southern building to be closer to the waste management area to be able to obtain the cleaned, recycled waste.

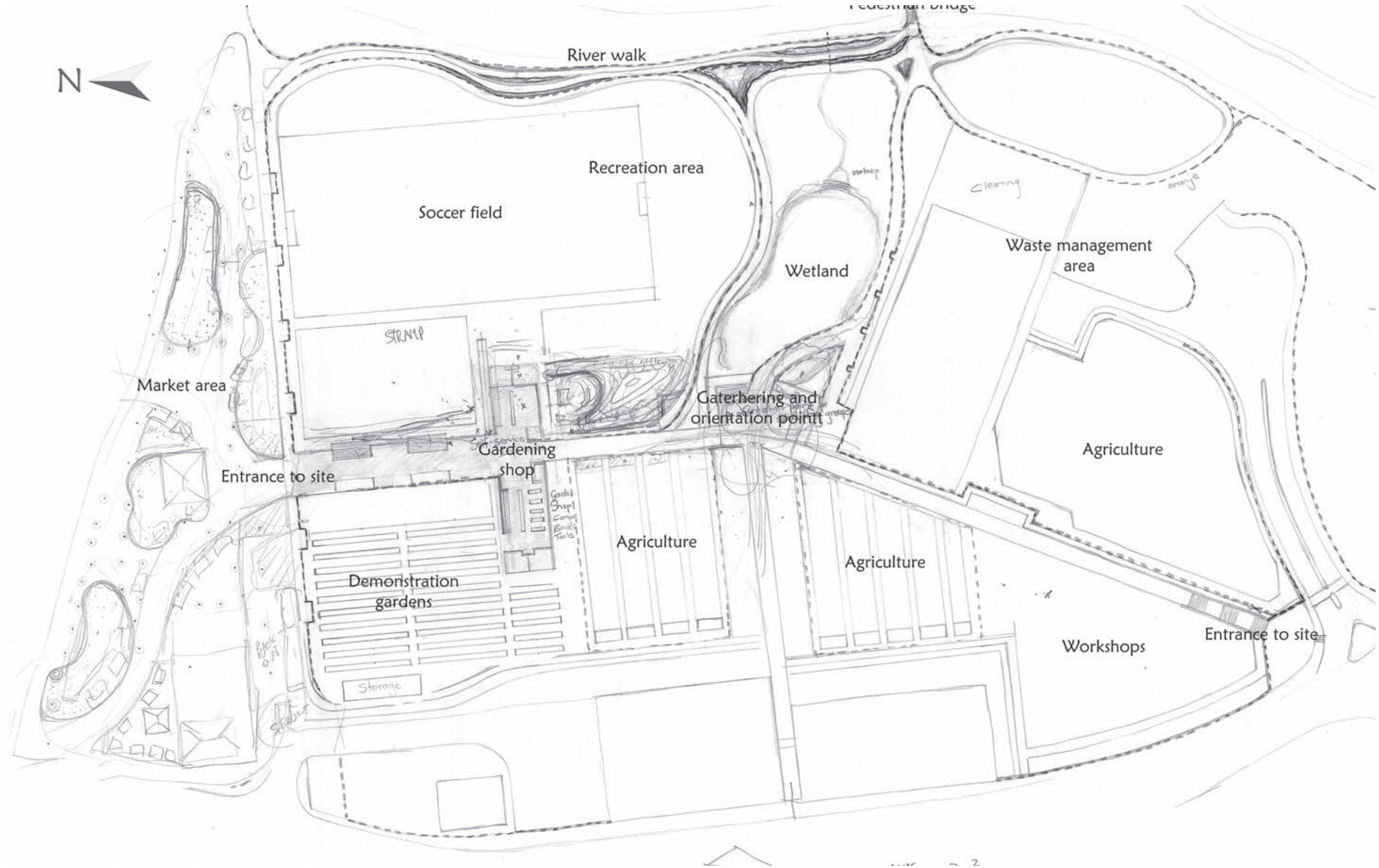


Fig. 128: Master plan development 8 (Author, 2013)

A gathering and orientation point is proposed in the center of the site as well as a river walk along the Apies River with a pedestrian bridge crossing the river. The market area was further developed according to the movement patterns of the locals and visitors moving through the market area to enter the site. Grass patches were provided to be used for seating and as a waiting area. The gardening shop spills out into a gathering space for big school groups.

Following a very long and reiterative process a final landscape master plan was proposed (Refer to Fig. 130).

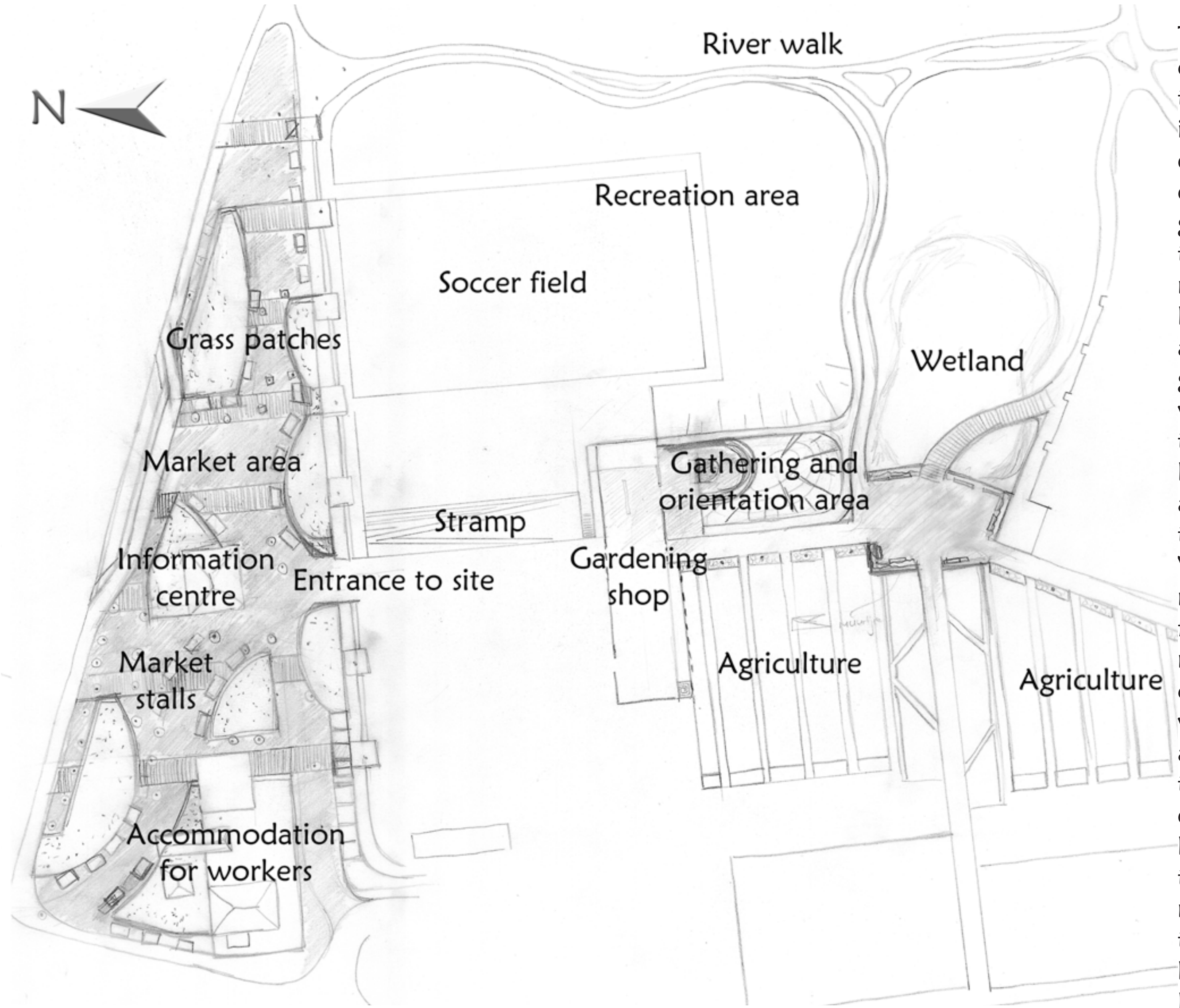


Fig. 129: Master plan development 9 (Author, 2013)

The master plan consists of: a bus and taxi drop-off from where visitors can move through the market area and obtain a map and other information from the information centre. Visitors enter the site through the main (Northern) entrance. School groups come together at the gathering area where a tour guide will orientate them and guide them through the park. The recreational area comprises of a soccer field and lawn area serving as a play area for children or a space to be used for functions. Demonstration gardens are located next to the gardening shop where visitors will be educated on how to grow their own vegetables. Urban agriculture is located in front of the existing buildings proposed as a restaurant, offices, accommodation and toilets for workers, as well as exhibition space. Workshops where visitors and workers will make artwork from recycled waste (obtained from the waste management area) are hosted next to the existing buildings. Recycling and composting of organic waste takes place in the waste management area as well as the recycling and cleaning of hard waste. Vehicles have access to the waste management area from the southern entrance to drop off waste. The storage dam, located at the southern end of the park, provides the entire park, including the agriculture, waste management area, demonstration gardens and the recreation area with recycled water. A well-lit river walk is also provided along the Apies River.

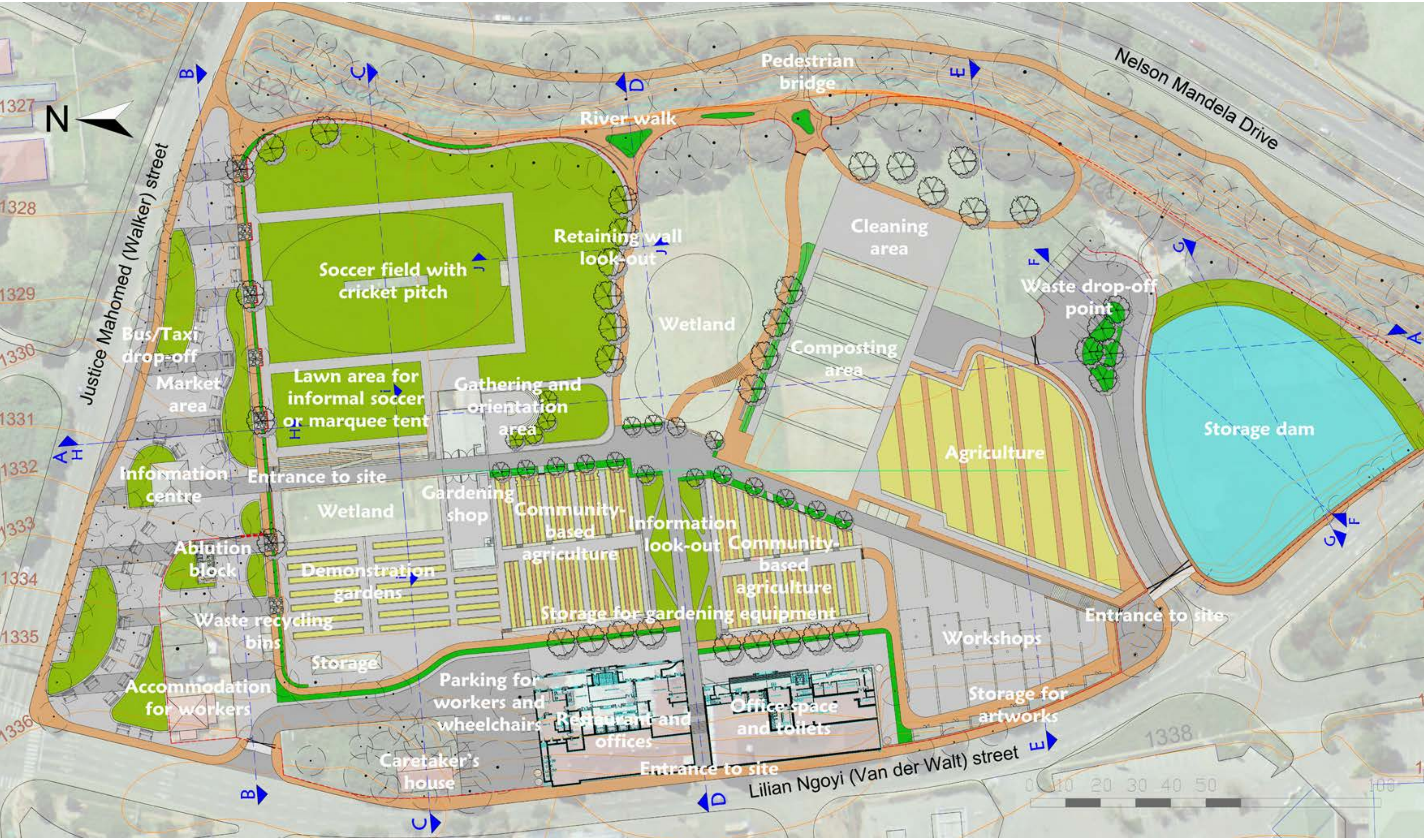


Fig. 130: Landscape master plan (Author, 2013)

Figs. 131 - 134 illustrates some of the spaces proposed on the master plan.

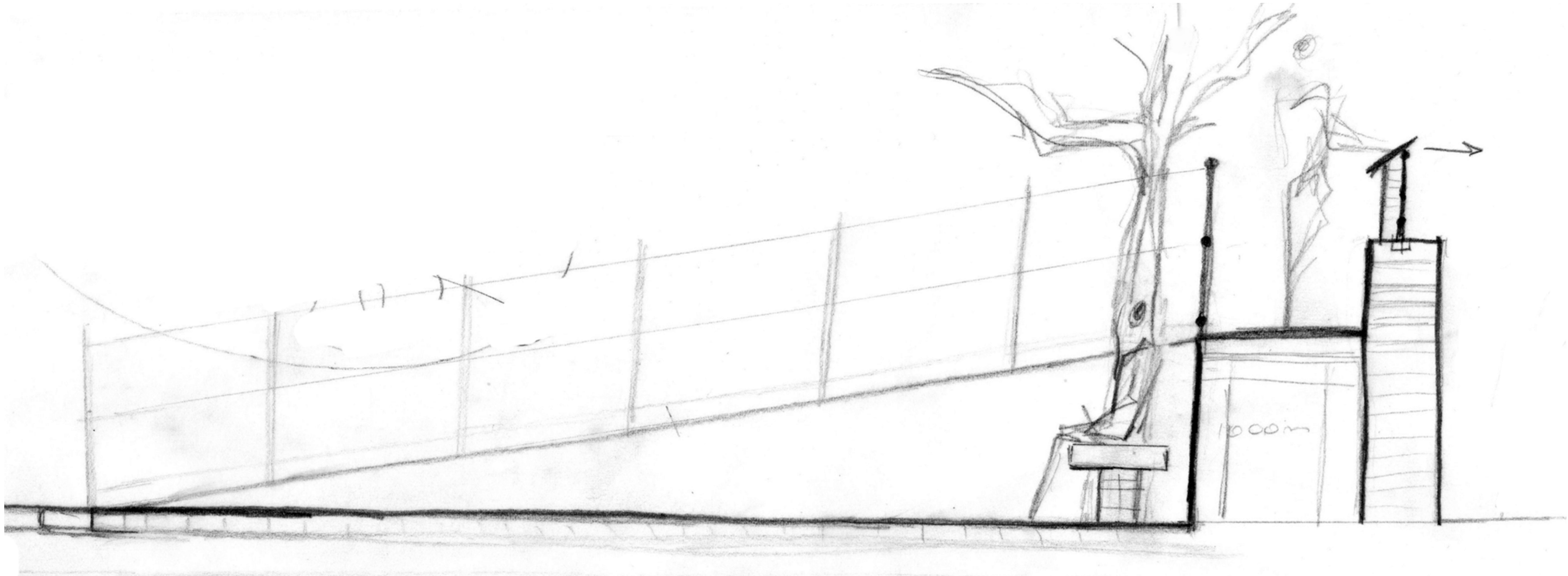


Fig. 131: Section through information look-out (Author, 2013)

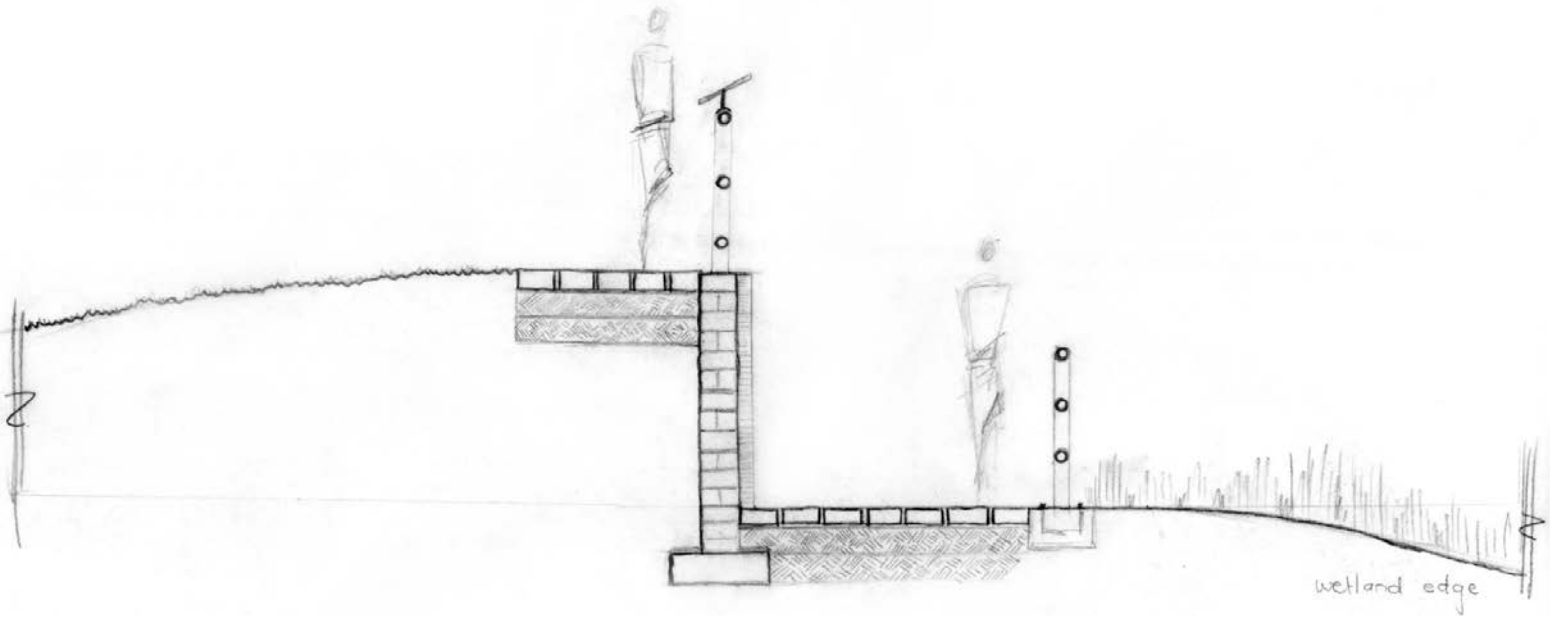


Fig. 132: Section through retaining wall look-out (Author, 2013)

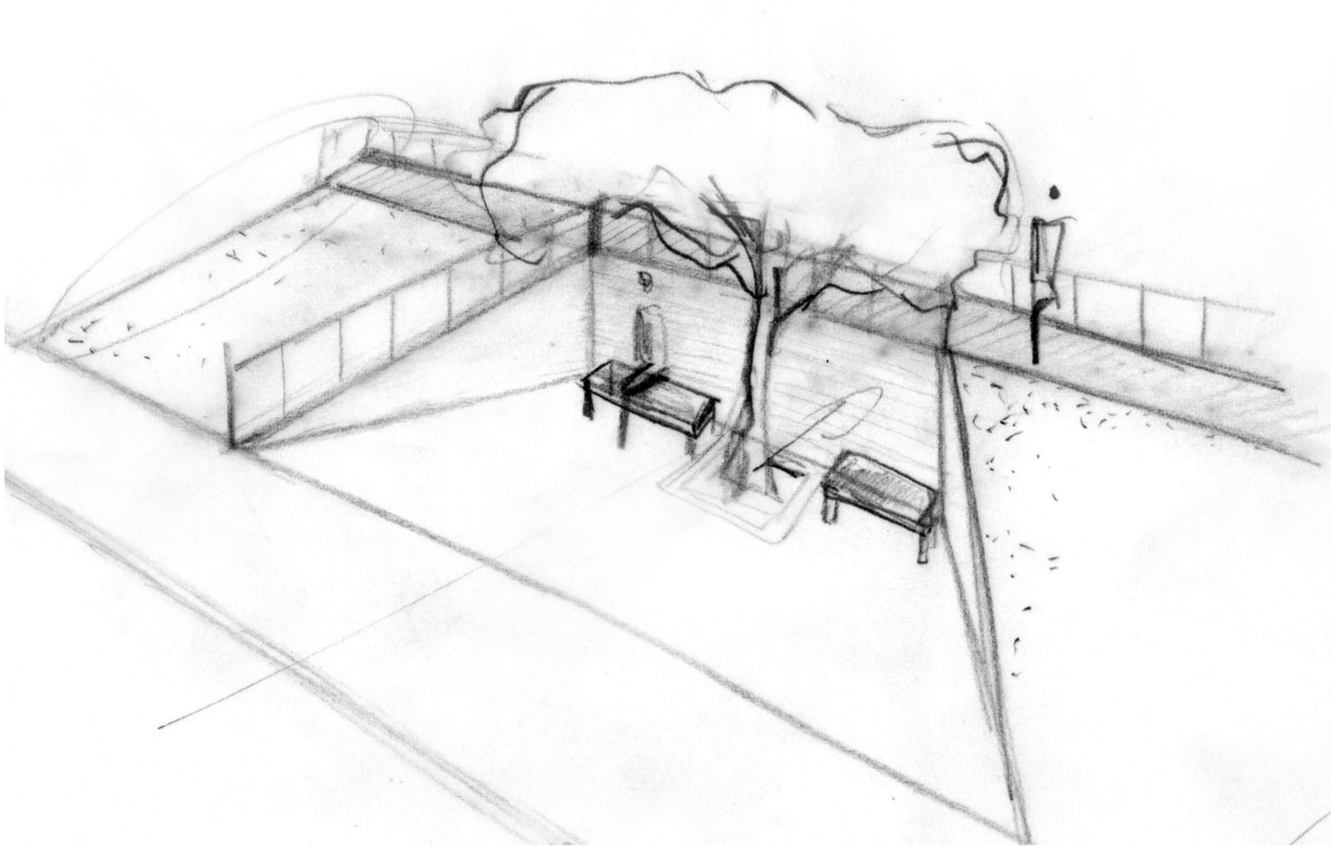


Fig. 133: 3D drawing of information look-out (Author, 2013)

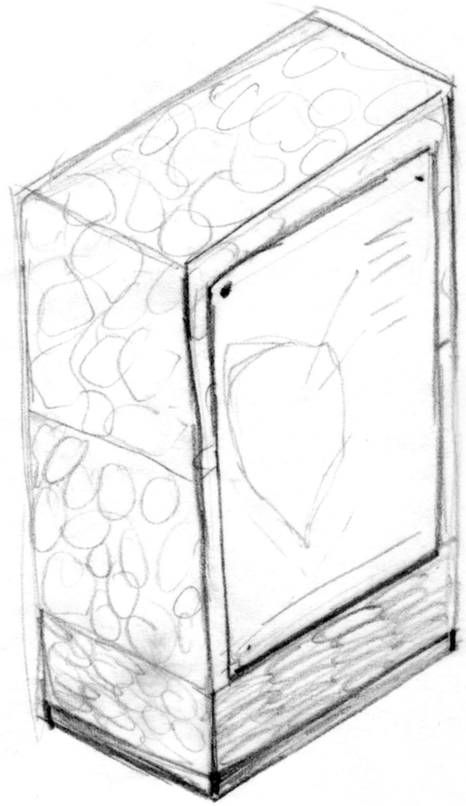


Fig. 134: Informative signage (Author, 2013)

Creative ideas for fence applications throughout the park will be implemented:

- Recycled material fence (Johnson, 2009). See Fig. 135.1
- Road sign fence (Vanderlinden, 2011). See Fig. 135.2
- Recycled PVC pipe fence (Bring, no date). See Fig. 135.3
- Bicycle fence 1 (Diamond, 2012). See Fig. 135.4
- Fence from old boards, scrap metal and bicycle wheels (Neiman, 2012). See Fig. 135.5
- Creative fence (Chow, 2012). See Fig. 135.6
- Bicycle fence 2 (Loper, 2010). See Fig. 135.7
- Recycled plastic bottles (Lushome, 2012). See Fig. 135.8
- Recycled steel fence (Johnson, 2009). See Fig. 135.9


135.1


135.2


135.3


135.4


135.5

135.6


135.7


135.8


135.9

Different circulation routes on site are illustrated in Figs. 136 - 138.

Fig. 136: Service routes (Author, 2013)

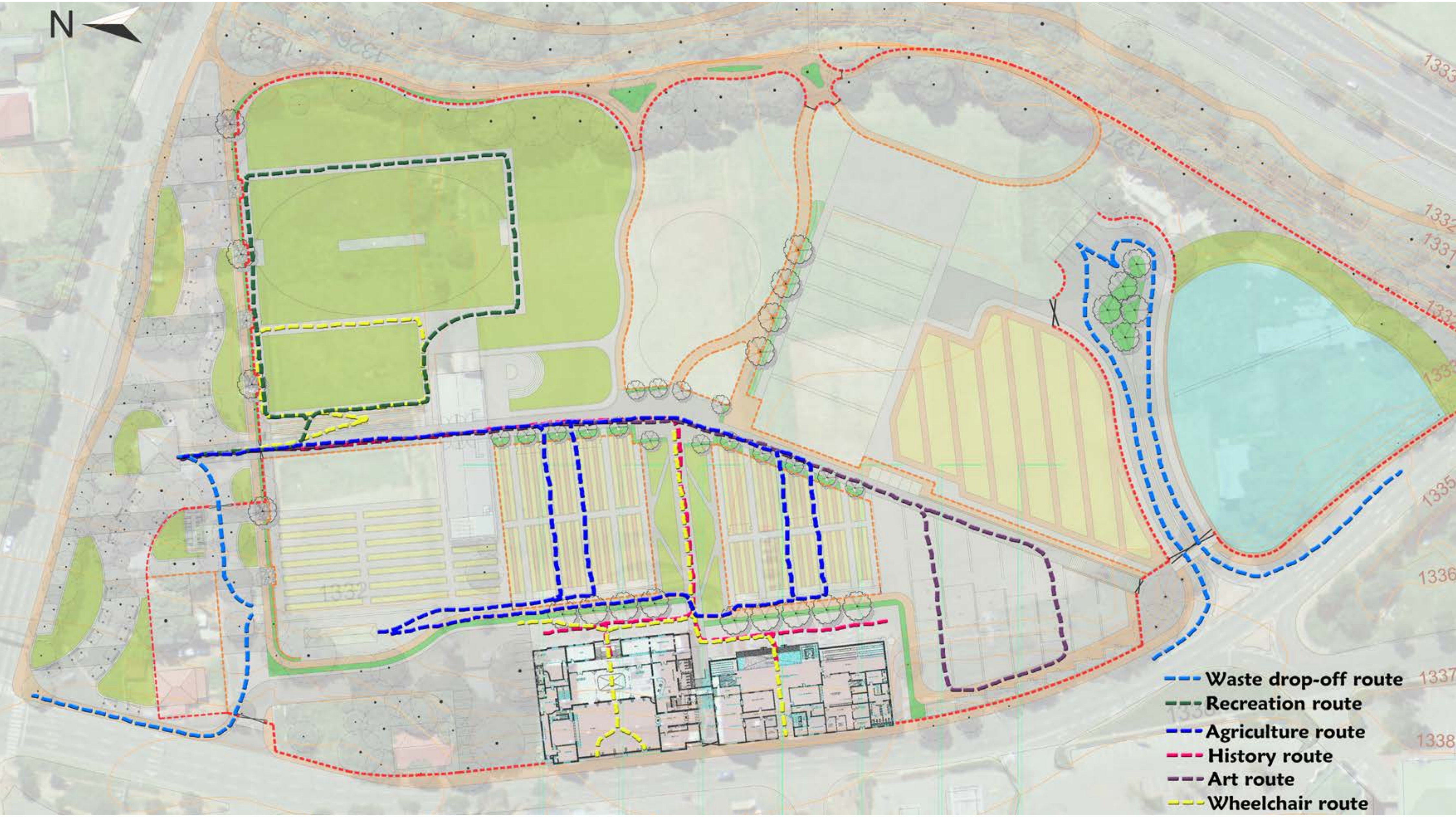


Fig. 137: Circulation routes of different visitors (Author, 2013)

Fig. 138: Educational routes (Author, 2013)

6.10 Cross-sections

For cross-sections indicating the different activities across the site refer to Figs. 139 - 143.

6.11 Conclusion

Between the ‘first stab’ at a design and the final master plan the design development process involves many decisions and many factors need to be taken into consideration. It is a continuous exploration of different designs and scenarios until you find the most suitable and appropriate solution.

The landscape master plan evolved from a loose, disintegrated program on a site into an organised, well-functioning design with different activities integrated and working together successfully to form the best and most suitable solution for the Berea Waste Park.

In the next chapter the three main design strategies, namely water recycling, waste recycling and urban agriculture of the Berea Waste Park will be explained by means of diagrams and calculations.

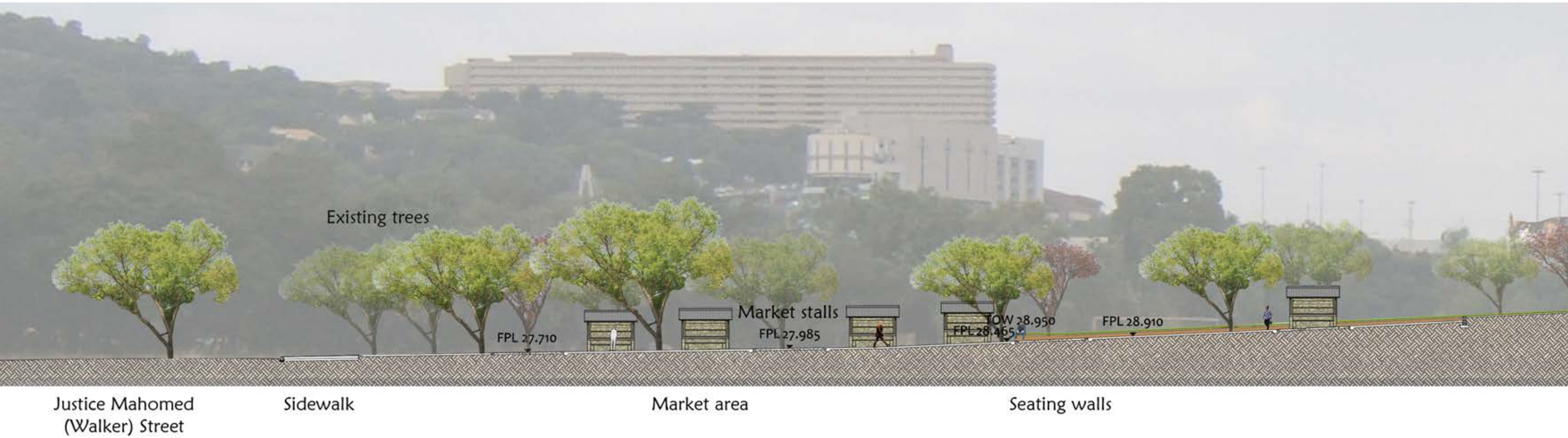


Fig. 139: Cross section A-A (Author, 2013)


Gardening shop
FPL 31.150
FPL 33.450
FPL 34.545
Entrance to site
New tree
Seating walls
Concrete strips
Concrete with recylcled glass
Concrete strips
Caretaker's house

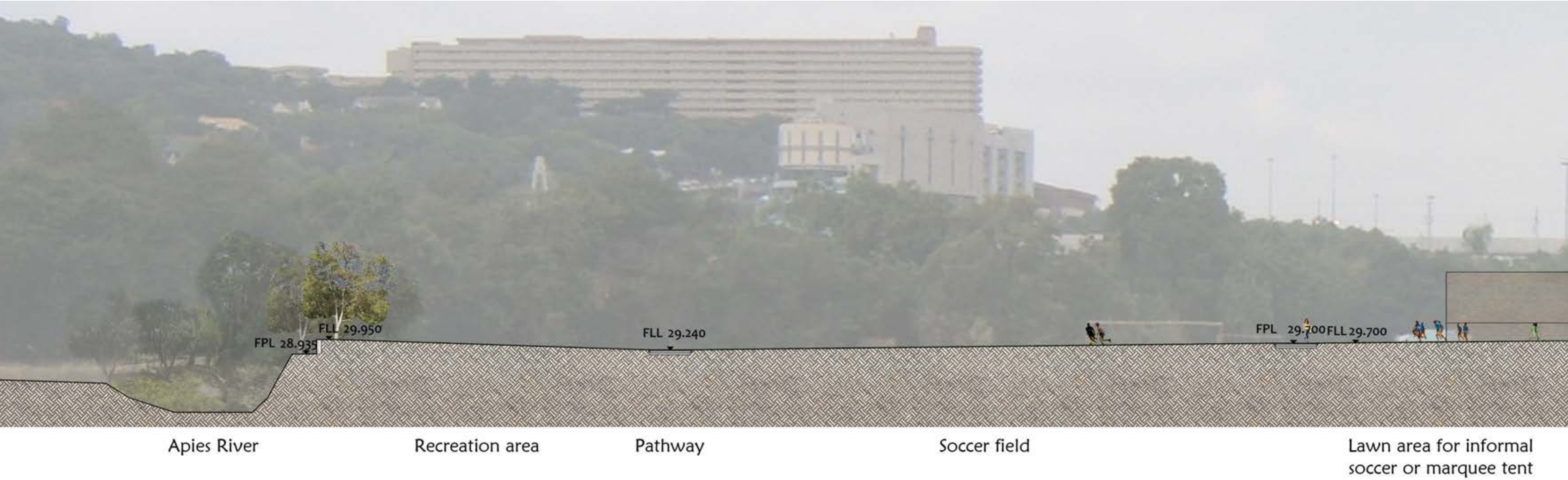


Fig. 140: Cross section B-B (Author, 2013)

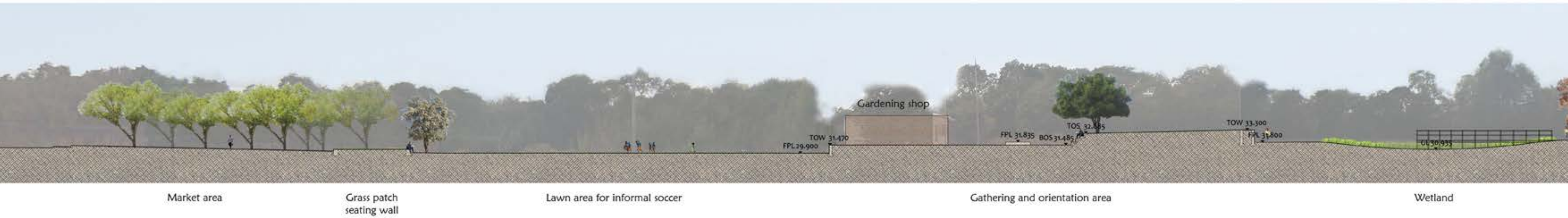
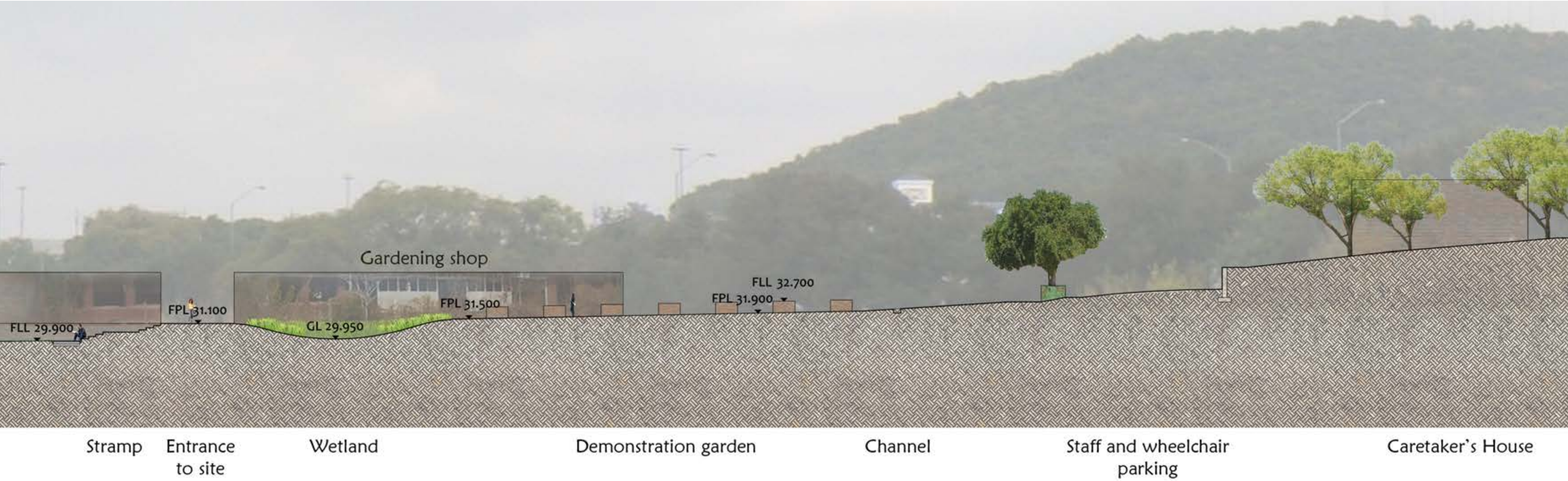


Fig. 141: Cross section C-C (Author, 2013)


Gardening shop
FLL 29.900
FPL 31.100
GL 29.950
FPL 31.500
FLL 32.700
FPL 31.900
Stramp
Entrance to site
Wetland
Demonstration garden
Channel
Staff and wheelchair parking
Caretaker's House

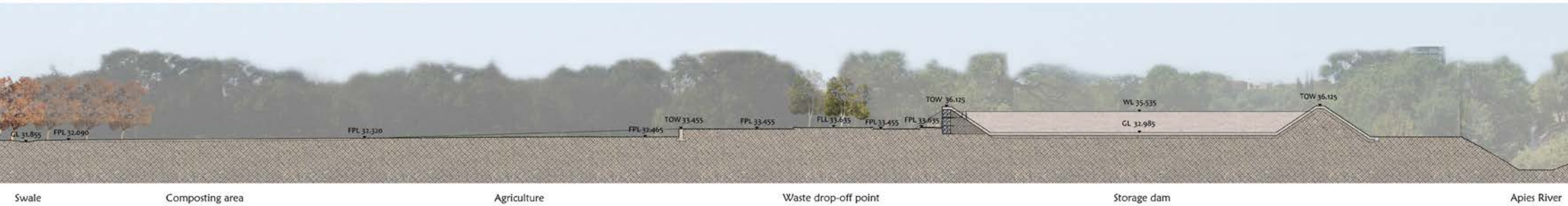
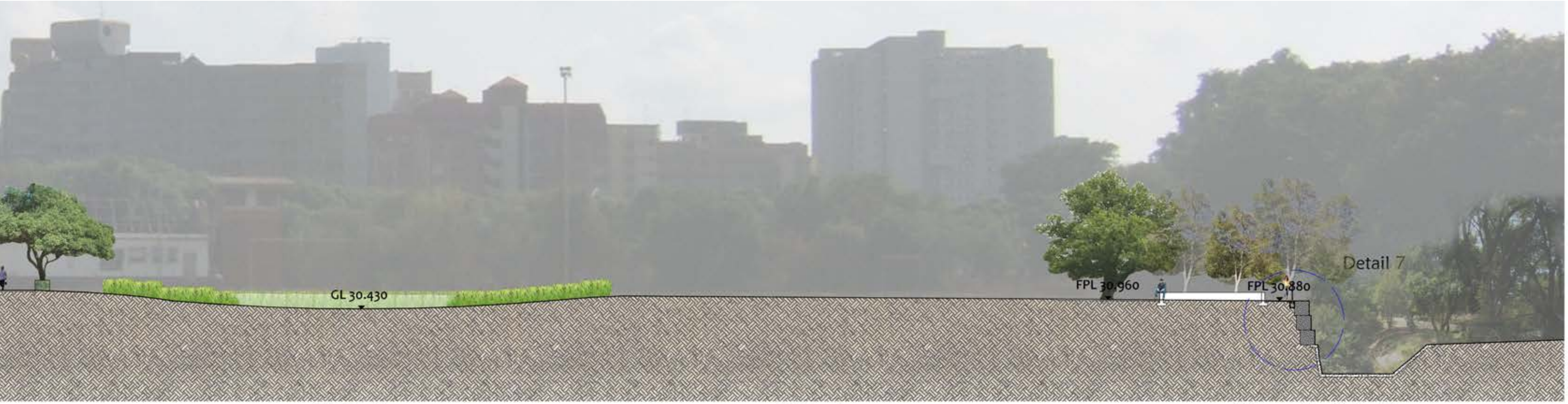
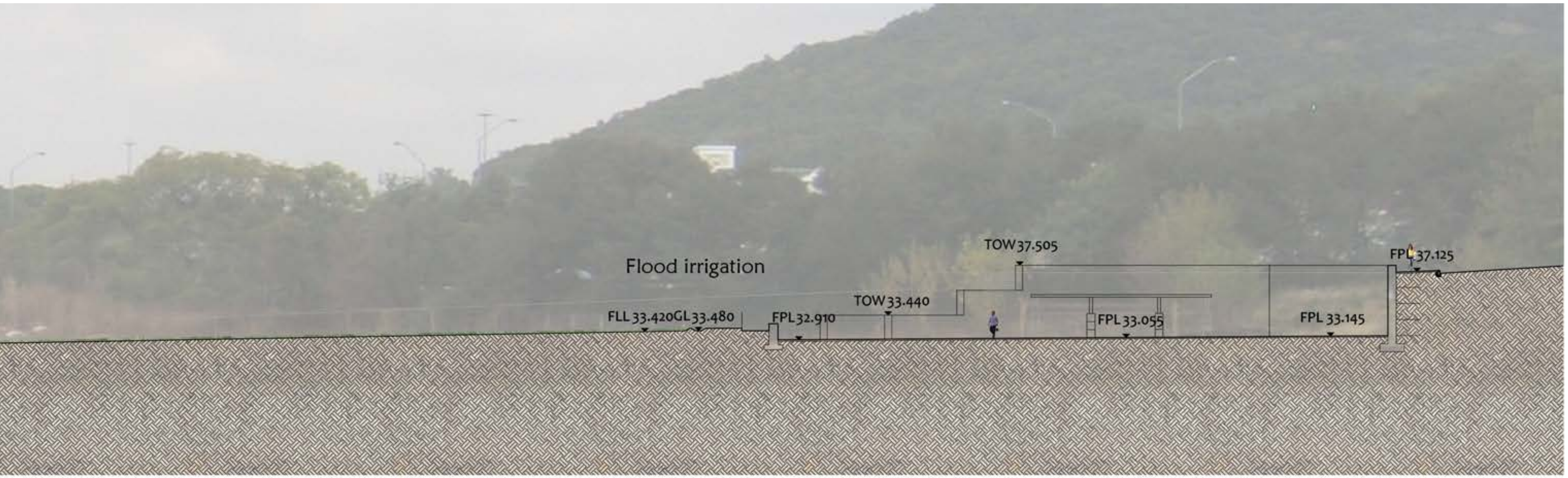

GL 31.855
FPL 32.090
FPL 32.320
FPL 32.465
TOW 33.455
FPL 33.455
FLL 33.635
FPL 33.455
FPL 33.635
TOW 36.125
WL 35.535
GL 32.985
TOW 36.125
Swale
Composting area
Agriculture
Waste drop-off point
Storage dam
Apies River

Fig. 142: Cross section D-D (Author, 2013)

Fig. 143: Cross section E-E (Author, 2013)



Wetland | Natural area | River walk | Apies River



Agriculture | Southern entrance to site | Workshops | Retaining wall

CHAPTER 7

Strategies

CHAPTER 7: Strategies

7.1 Introduction

It is important to understand the whole story and not only a chapter of the story. The different design strategies were investigated and technically resolved for the entire site - not only the sketch plan area.

The storyline would've been unclear and not thoroughly understandable if only the sketch plan area was investigated in terms of the three main strategies, namely water, waste and agriculture.

7.2 Waste Strategy

The processes and activities that make up the waste strategy can be seen as the recycling of organic waste, which includes the recycling of green waste and vermicomposting, recycling of hard waste and the workshops where recycled waste is used.

7.2.1 Diagrams

Different diagrams are used to explain the processes required for the waste strategy. Figures 144 and 145 indicate all of these processes. Fig. 146 illustrates the circulation of vehicles and pedestrians dropping of waste at the waste management area. The recycling process of hard waste is explained in Fig. 147; where the waste comes from (input) and where the waste is sent to (output). Fig. 148 explains the organic waste recycling process; the waste comes from the agriculture area (vegetable off-cuts) and is sent to the vermicomposting facility.

Lastly, the garden waste process is explained in Fig. 149 where the garden waste delivered to the site is sorted, large branches are chipped (input) and thrown onto heaps. These heaps are then subjected to the Windrow system (described in Chapter 2, section 2.2.3.1.1). The compost produced during this process is then used for the agriculture activities and sold on site (output).

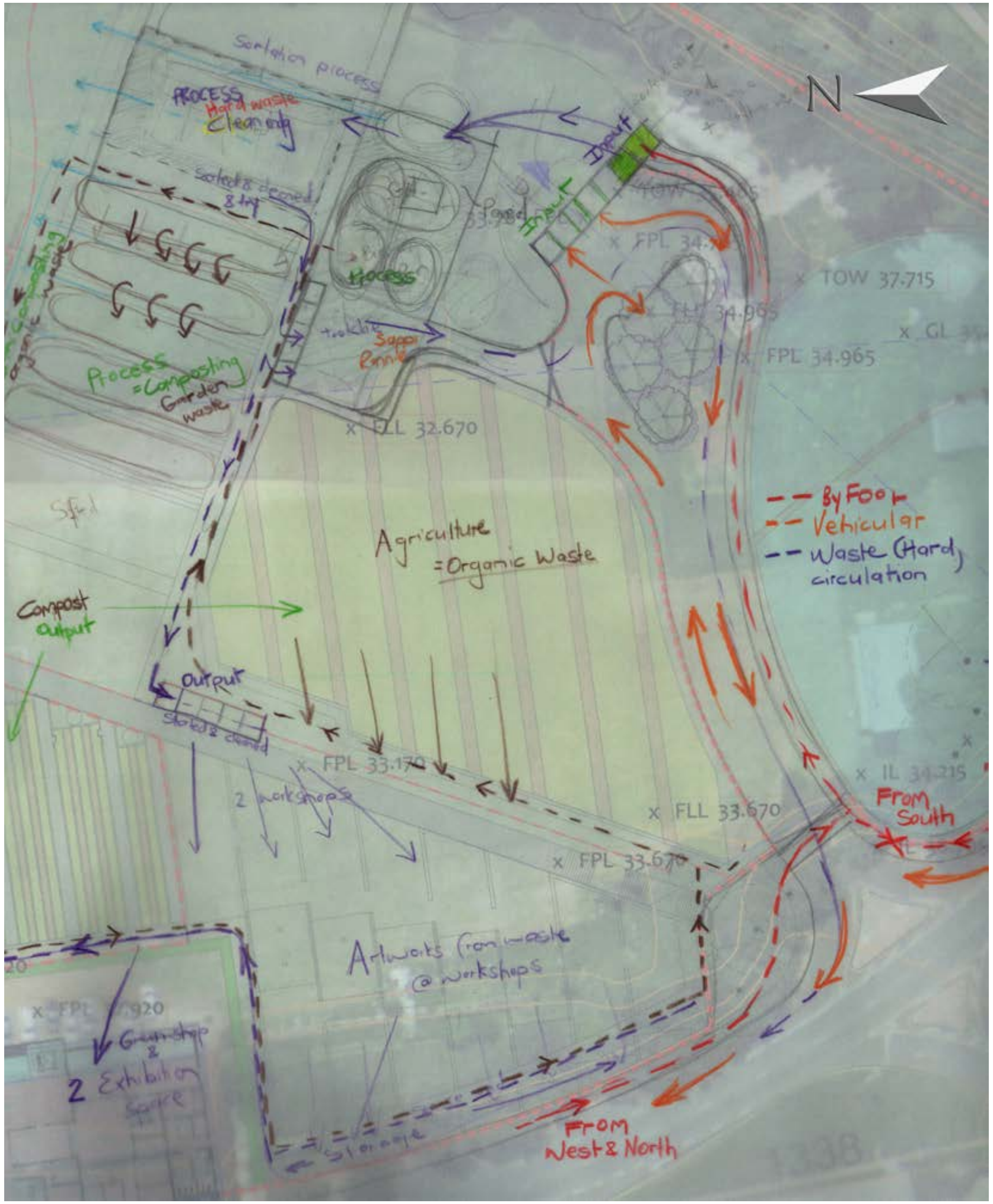


Fig. 144: Diagram of Waste Strategy (Author, 2012)

Fig. 145: Diagram of all the processes contributing to the Waste Strategy (Author, 2012)

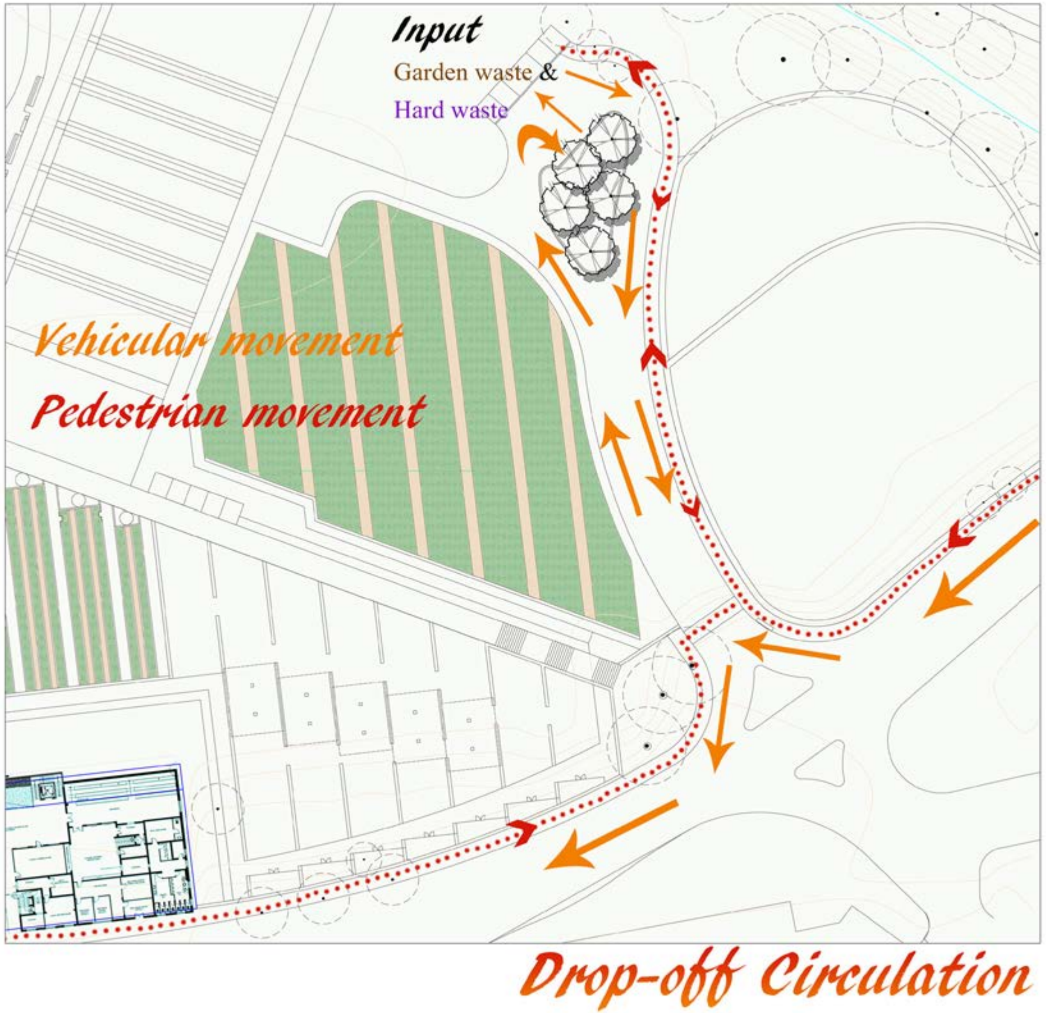


Fig. 146: Diagram of drop-off circulation (Author, 2012)

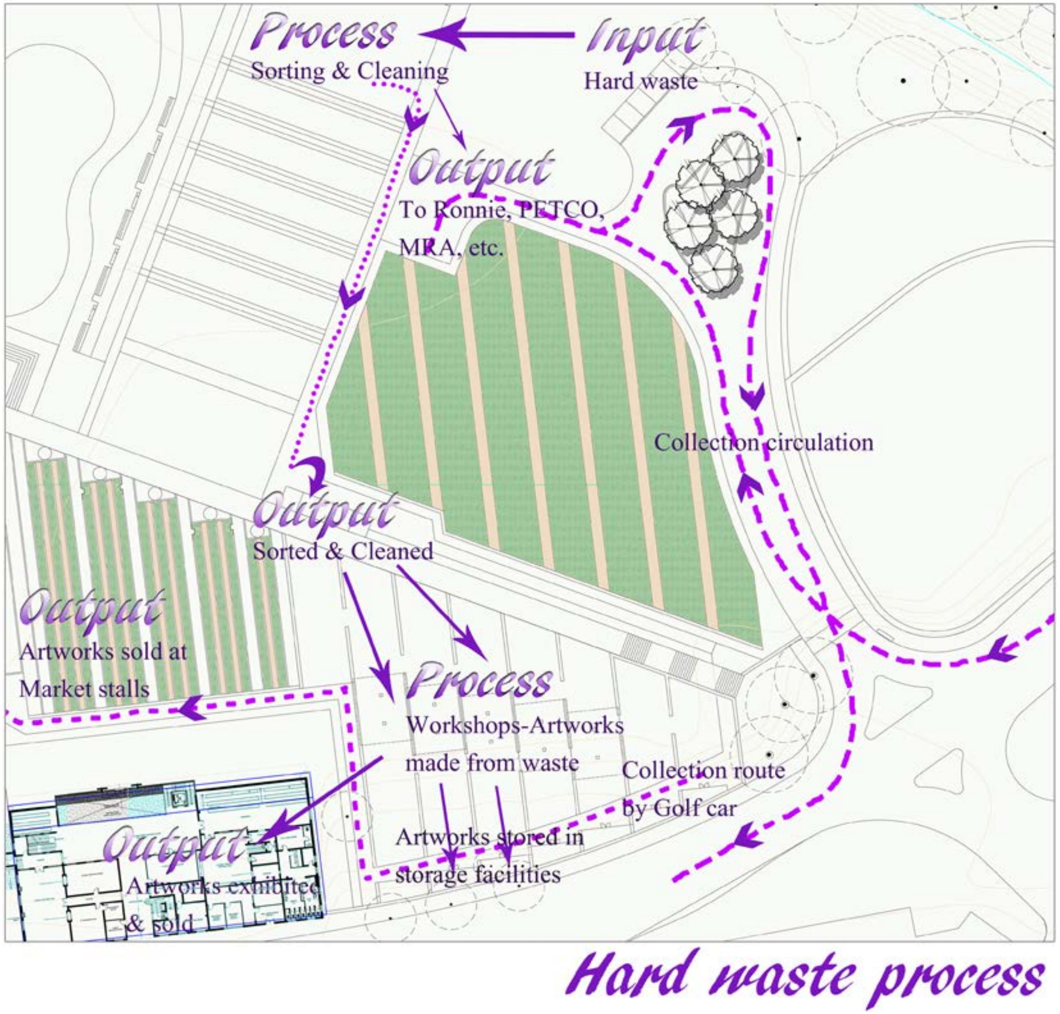


Fig. 147: Diagram of the Hard waste process (Author, 2012)

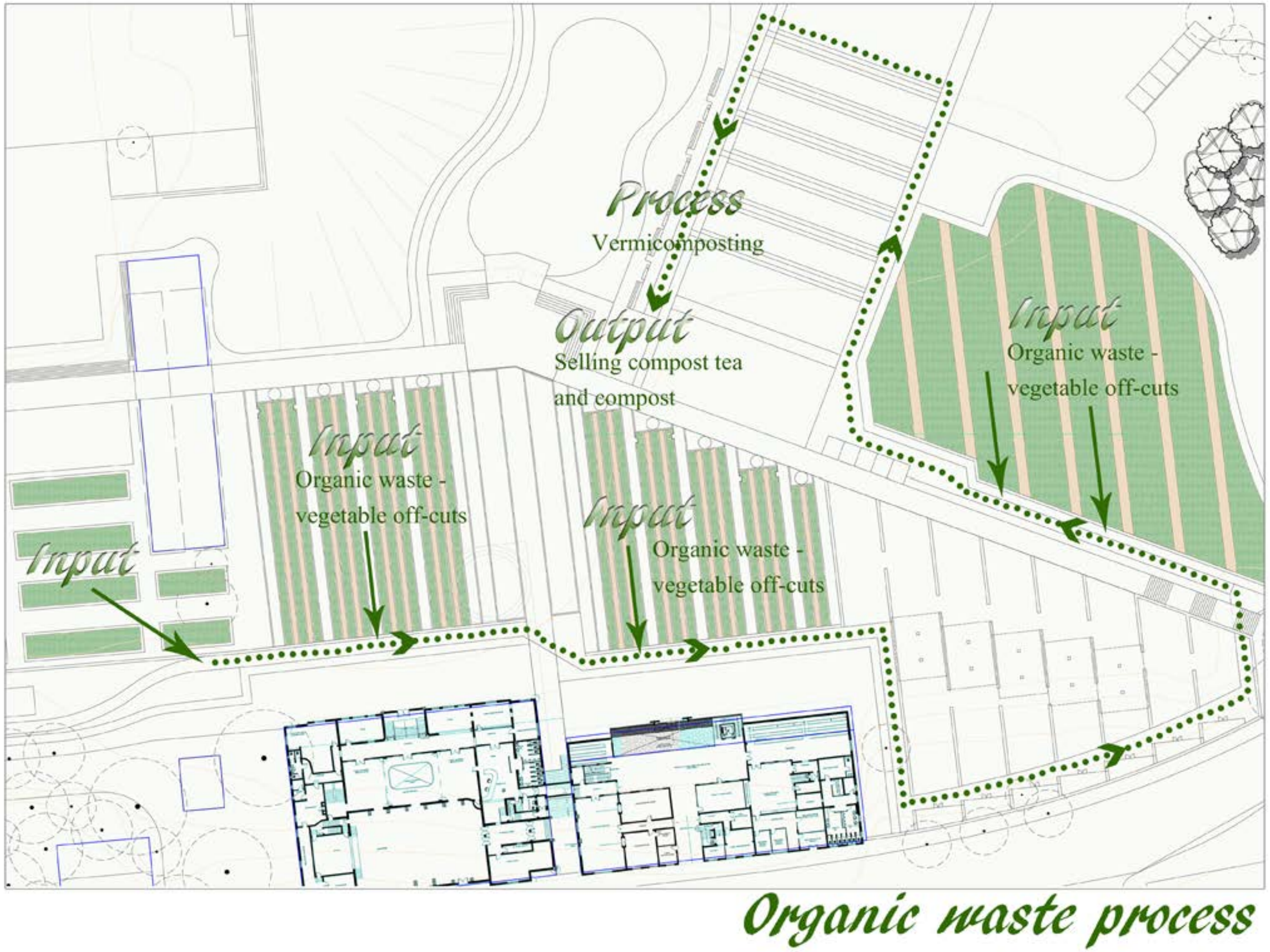


Fig. 148: Diagram of the Organic waste process (Author, 2012)

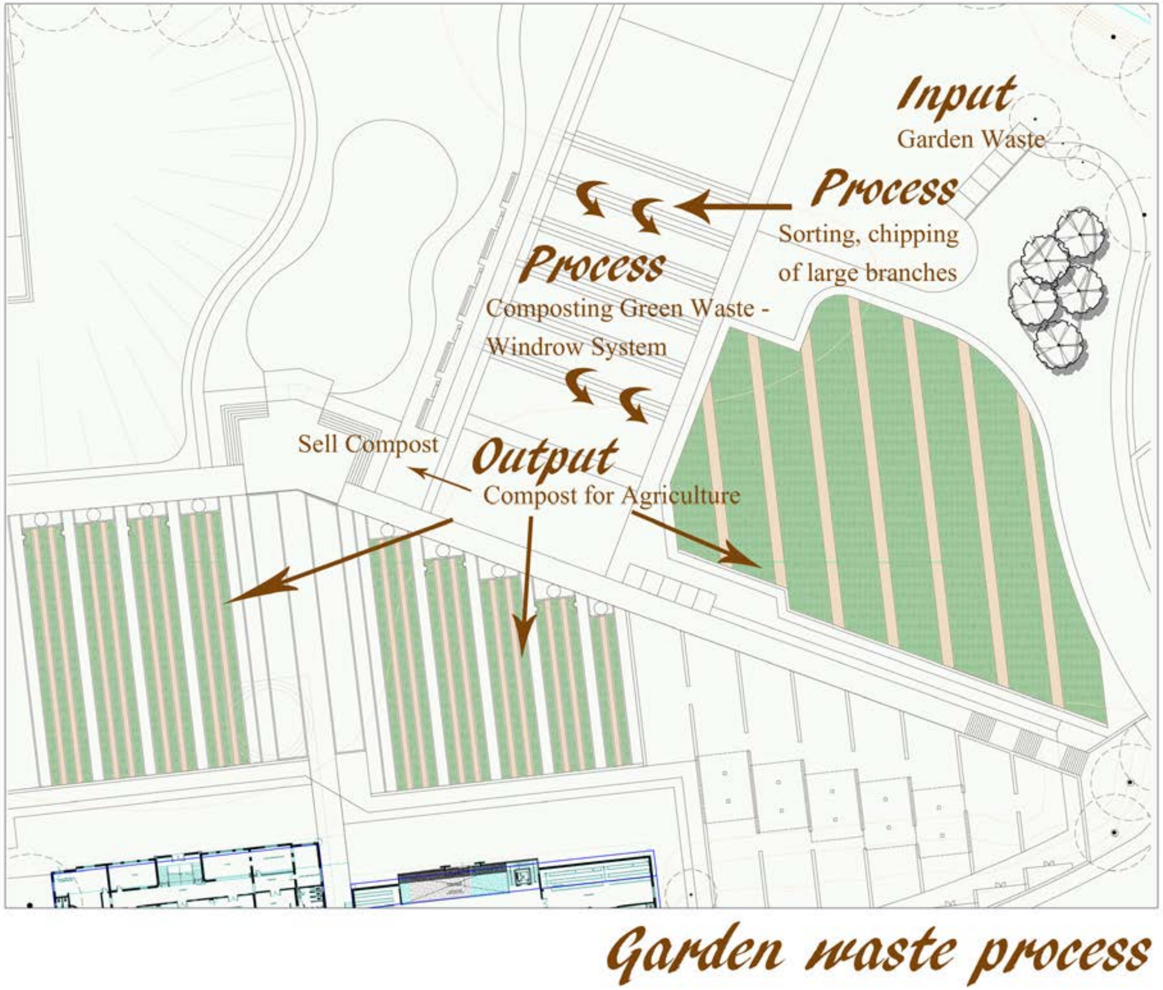


Fig. 149: Diagram of the Garden waste process (Author, 2012)

7.3 Agriculture Strategy

The agriculture strategy is all about the production of vegetables, vermicomposting the wasted vegetables and teaching visitors about vegetables and how to grow their own at home. Locals will also have the opportunity to hire a piece of land to grow their own vegetables (Refer to Figs. 150 and 151).

Fig. 150: Locals working in their own patch of land (Author, 2012)

Fig. 151: Locals working in their own patch of land (Author, 2012)

Golf carts will be used for collections and deliveries (Refer to Figs. 152 - 154).

Fig. 152 - 154: Golf cart for collections and deliveries (GCA, 2012)

Fig. 155: Diagram of all the processes contributing to the Agriculture Strategy (Author, 2012)

7.3.1 Diagrams

Fig. 155 explains the complete process of the agriculture strategy. Similar to the waste strategy, different diagrams are used to explain each process associated with the agriculture strategy separately. Fig. 156 illustrates the requirements for producing vegetables and the collection of vegetables.

The final destination of the vegetables produced on site is indicated on the delivery of vegetables diagram (Refer to Fig. 157). The vegetables are transported to the restaurant and sold at the market area. Fig. 158 illustrates that the leftover vegetables and the off-cuts are collected and transported to the vermicomposting facility to form compost and compost tea.

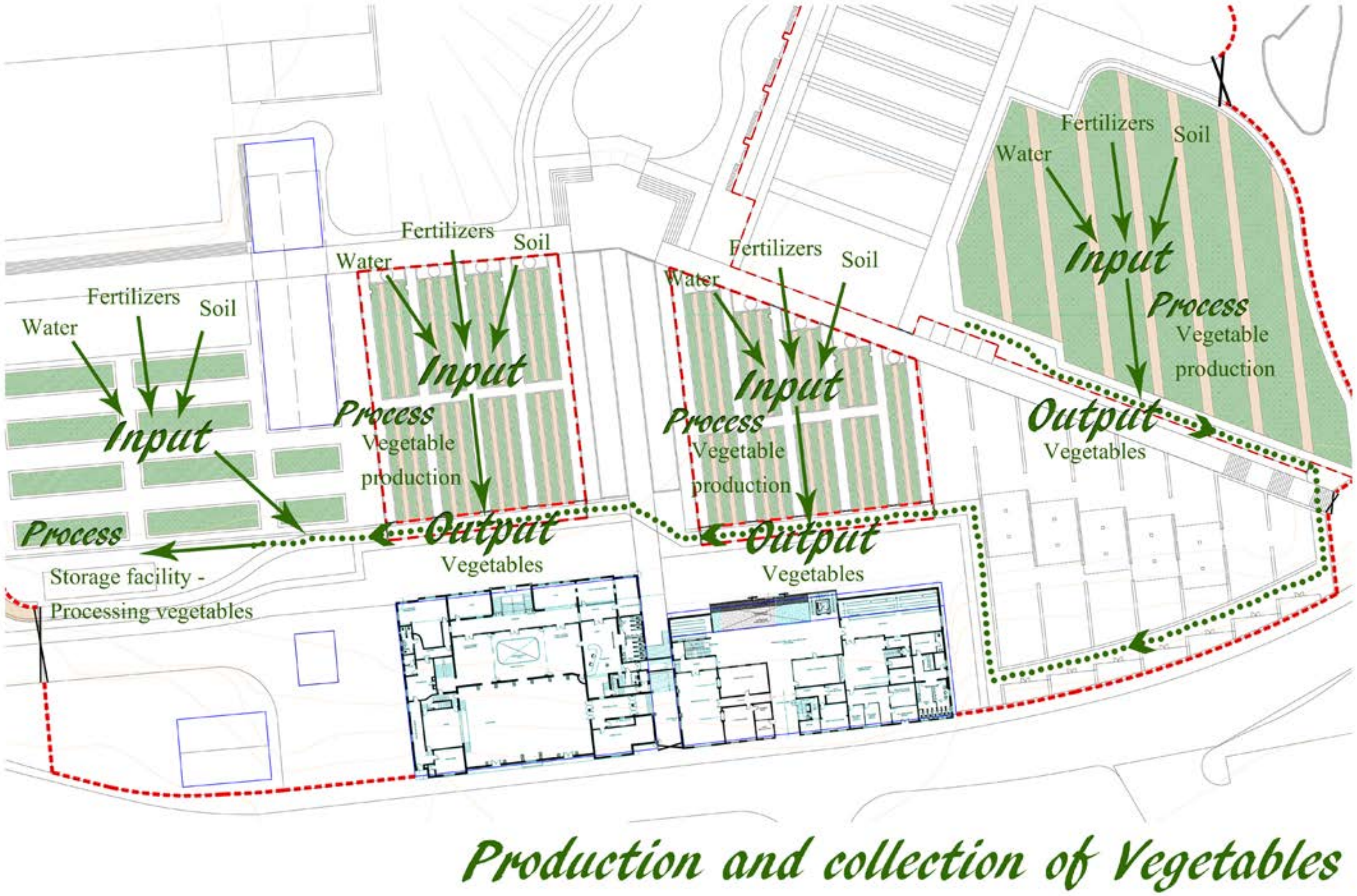


Fig. 156: Diagram of the production and collection of vegetables (Author, 2012)

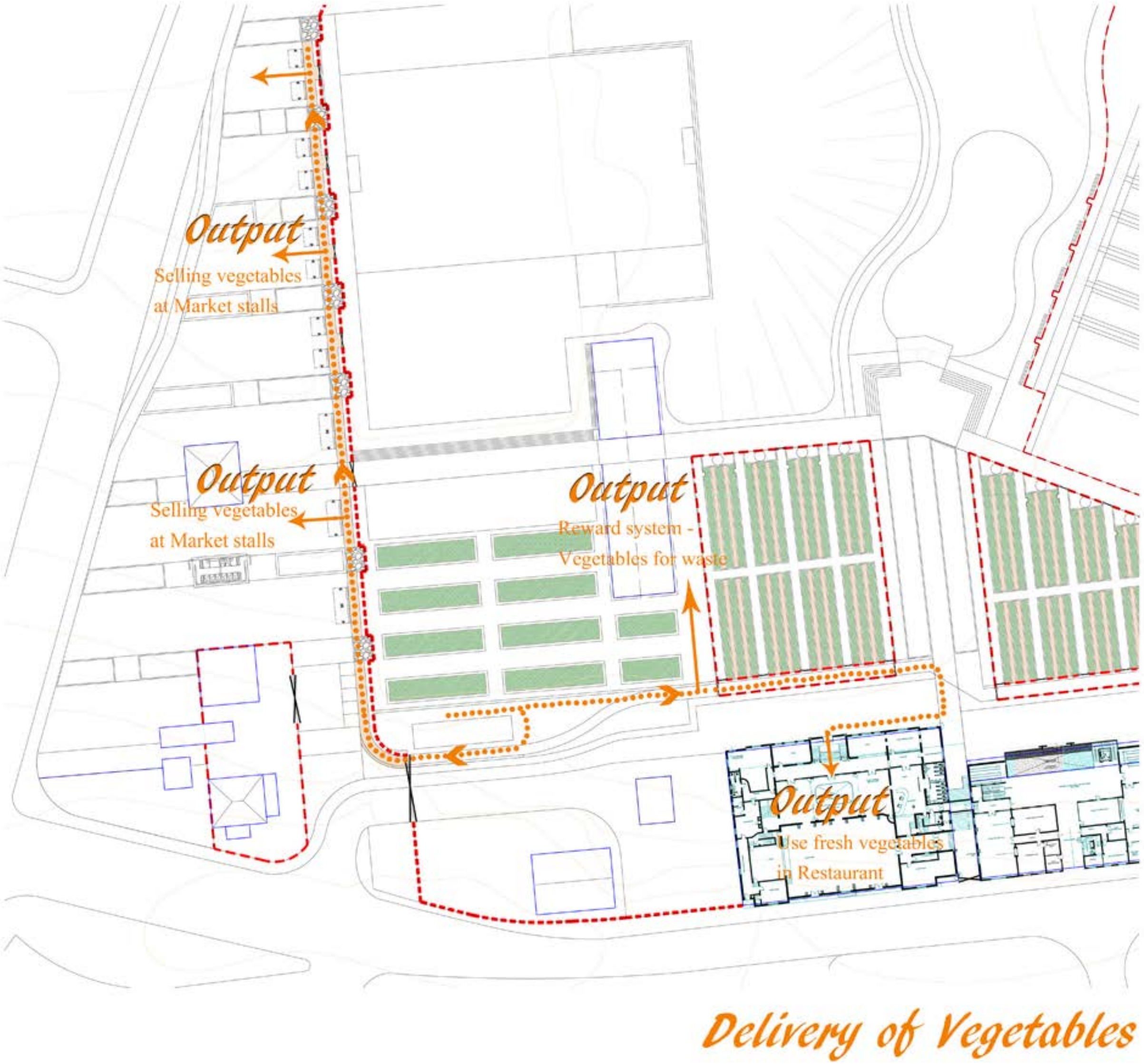


Fig. 157: Diagram of the delivery of vegetables (Author, 2012)

Fig. 158: Diagram of the collection of wasted vegetables (Author, 2012)

7.3.2 Vegetable information

The following guidelines are provided by the Department of Agriculture, Forestry and Fisheries (NDA, 2010) for the production of different vegetables (Refer to Fig. 159):

1. Pigeon peas grow well in temperatures between 18 and 29 °C. The plants are sensitive to waterlogging and frost.
2. Cabbage grows and develops in temperatures from 18 to 20 °C. Cabbage should be irrigated immediately after sowing or transplanting. Thereafter, irrigation should be applied at intervals of 10 to 12 days in heavy soils or 8 days in light soils and this schedule should be followed until the heads are fully developed and firm.
3. Squash are warm climate crops requiring a temperature range of 18 to 27 °C. It favours an average rainfall, but the roots are sensitive to high soil-water levels.
4. Sweet corn requires a warm to hot, frost-free growing season. The required soil temperature is between 20 and 35 °C. Well-drained, loamy soil is most suitable for sweet corn.
5. Green beans need to be irrigated regularly when growing in light, sandy soils and even on heavier soils. Adequate irrigation during flowering and pod development is needed for optimal yields.
6. Spinach requires a constant and uniform supply of water to obtain a good crop of high quality. Spinach fields are sprinkler irrigated to ensure the germination of seed.
7. Carrots are cool weather crops and also do well in warm climates. The optimum temperature for growth is between 15 and 20 °C. Carrots require approximately 25 – 50 mm of water per week.
8. Tomatoes need to be irrigated regularly during production. Excess irrigation after a long dry spell without prior light irrigation results in fruit cracking.
9. Pumpkins are warm weather crops and can be damaged easily by light frosts. A temperature range of 18 to 27°C is required for growth. Pumpkins prefer a generous water supply.

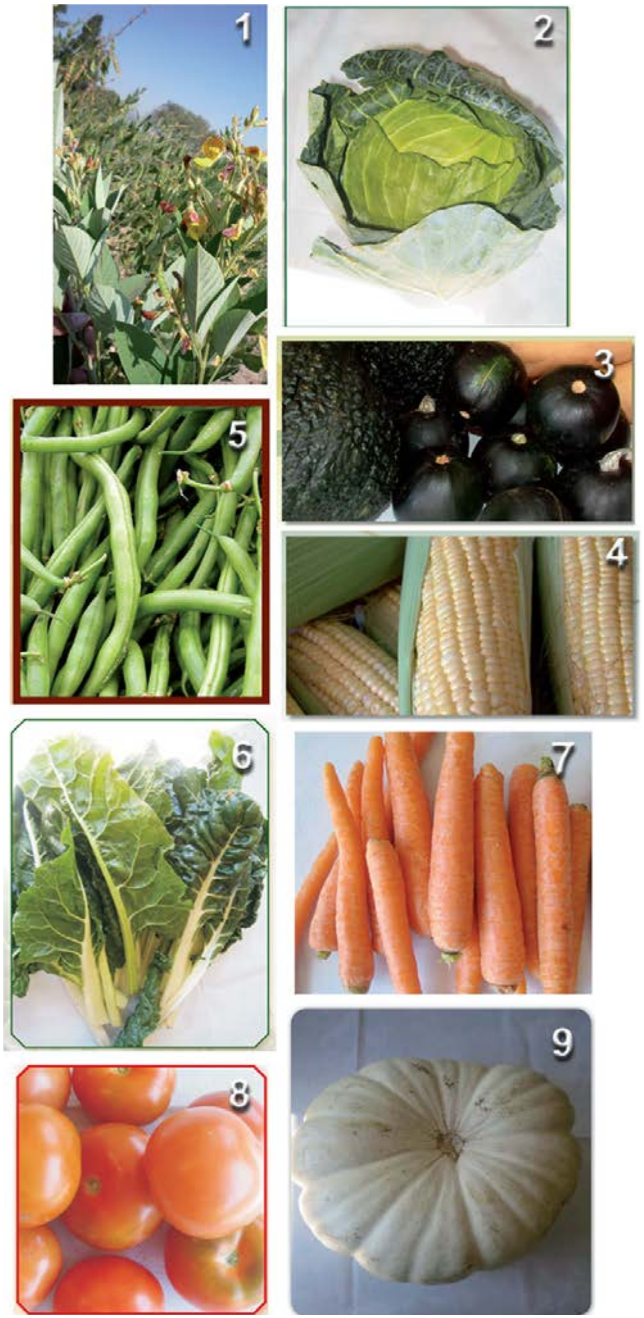


Fig. 159: Vegetables (NDA, 2010)

7.3.3 Calculations

The recommended vegetable consumption per person per day was calculated (Refer to Table 7). The amount of vegetables that could be produced per square metre was also calculated (Refer to Table 8).

The recommended vegetable consumption per person is at least 400 g per day
[According to the World Health Organisation (WHO)]

	Vegetables (kg)	Period
One Person	0.4	per day
Recommended	146	per year
Recommended + Income	292	per year
Family of 6	1752	per year

	Vegetables (kg)	Area (m^2)
Average harvest per m^2	2.69	1
Average area needed per kg	1	0.372
For Family of 6	1752	651.60

Table 7: The recommended vegetable consumption per person (Maunder and Meaker 2009, modifications by the Author, 2012)

Information of Vegetables Grown

VEGETABLE NAME	HARVEST: kg/m^2
1- Pigeon Peas	0.4
2- Cabbage	8.6
3- Squash	1.1
4- Sweet Corn	0.86
5- Green Beans	0.6
6- Spinach	0.75
7- Tomatoes	6.2
8- Carrots	3
TOTAL:	21.51
AVERAGE:	2.69

Table 8: Amount of vegetables produced per square metre (DAR 2006, modifications by the Author, 2012)

7.4 Water Strategy

The water strategy revolves around the collection (capturing), distribution and recycling of water throughout the site (Refer to Fig. 160).

Phase 1 is the construction of the storage dam and the restoration of the buildings on site. When the dam is completed rainwater is to be captured from catchment 1 (off-site water sources) while phase 2 (the rest of the Waste Park) is being constructed. When Phase 2 is completed and the park starts to function, there will already be water in the storage dam to kick-start the water harvesting process.

7.4.1 Diagrams

The distribution of water is illustrated in Fig. 161. One big storage dam will provide water to the entire site. There are five catchment areas, catchment 1 being the primary supply of the storage dam's water. Water is distributed from the storage dam to the agriculture, demonstration gardens, composting facility, waste cleaning facility and the recreational area. The collection of water is illustrated in Fig. 162 where catchments 2 to 5 will capture the runoff (remaining water after rain and usage), collect it in a wetland and pump the water back to the storage dam.

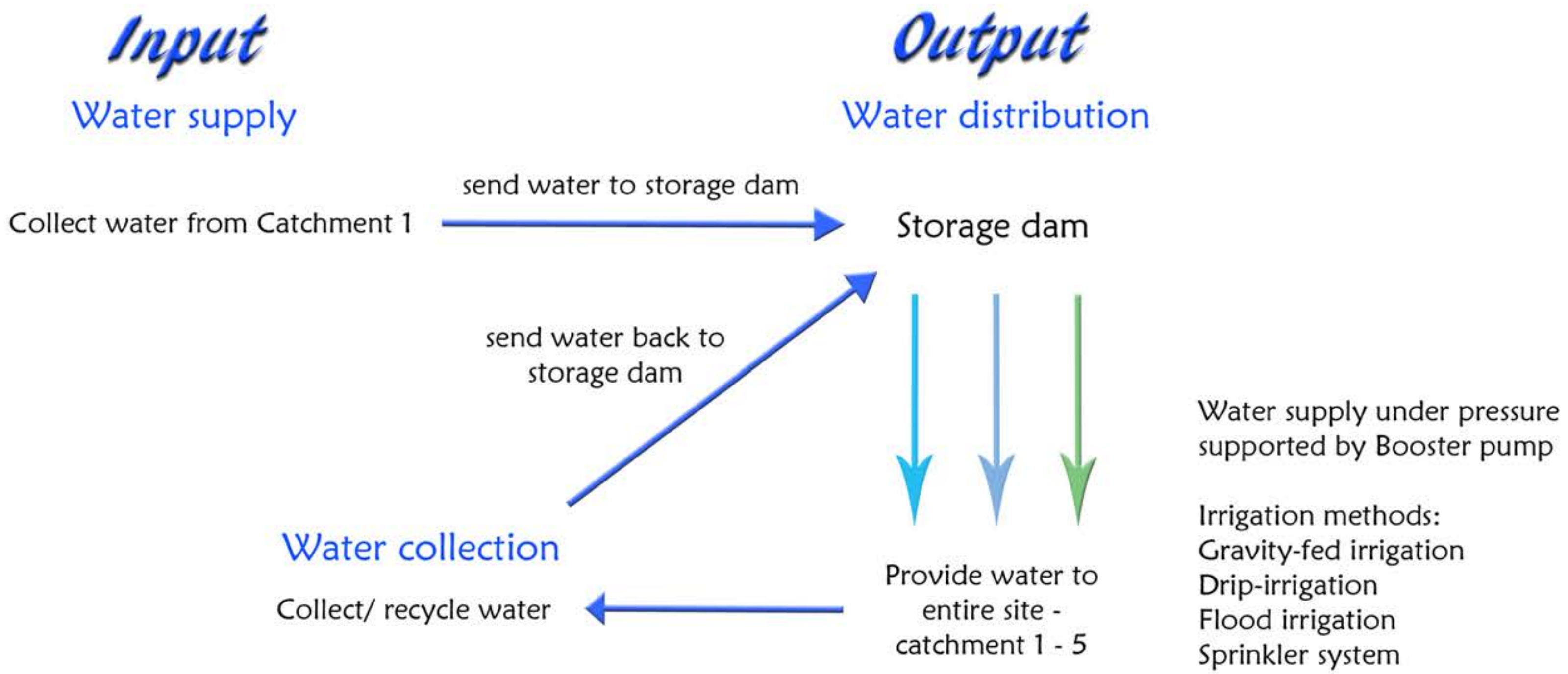


Fig. 160: Water Strategy summary (Author, 2013)

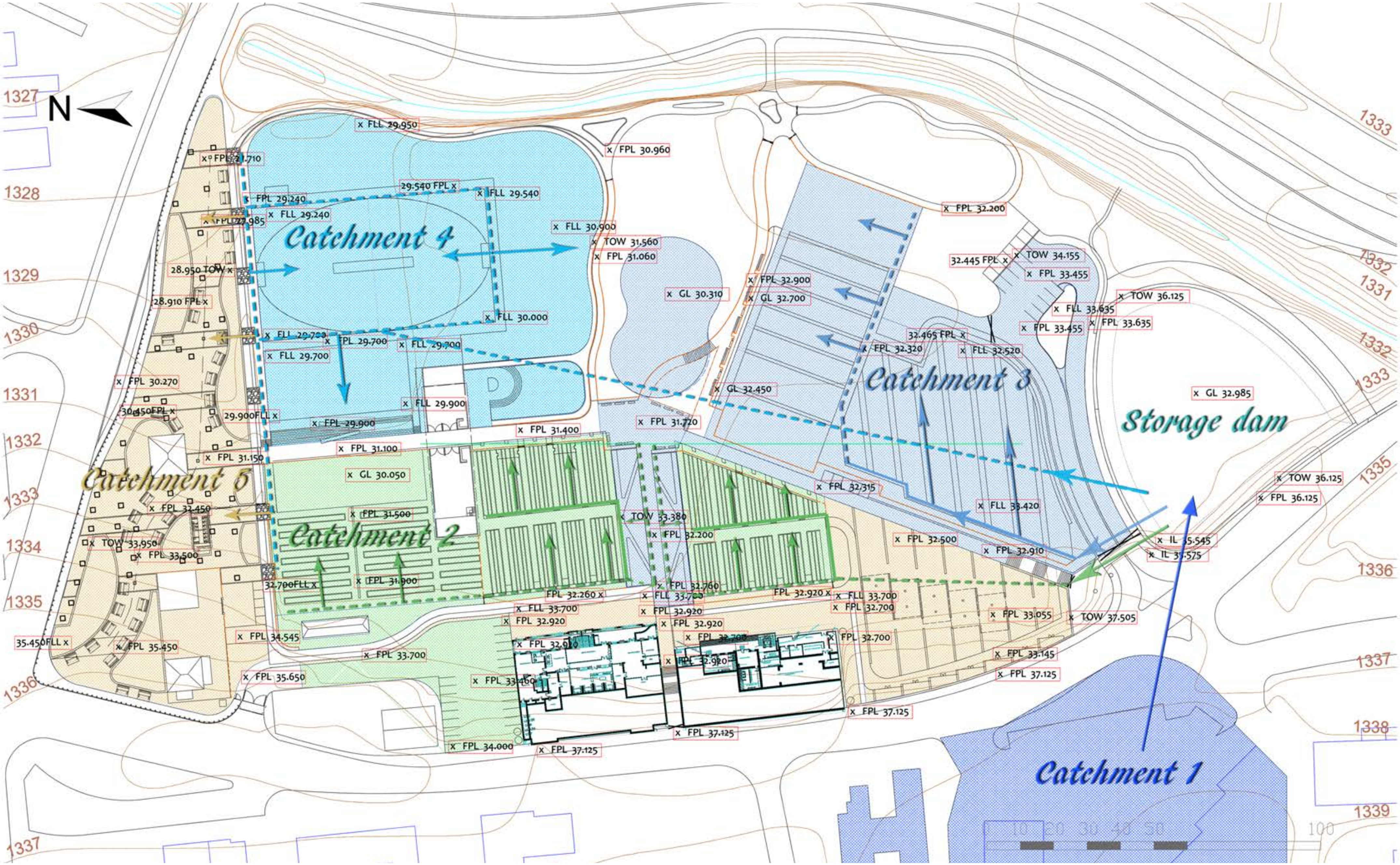


Fig. 161: Diagram of the water distribution of the Water Strategy (Author, 2013)

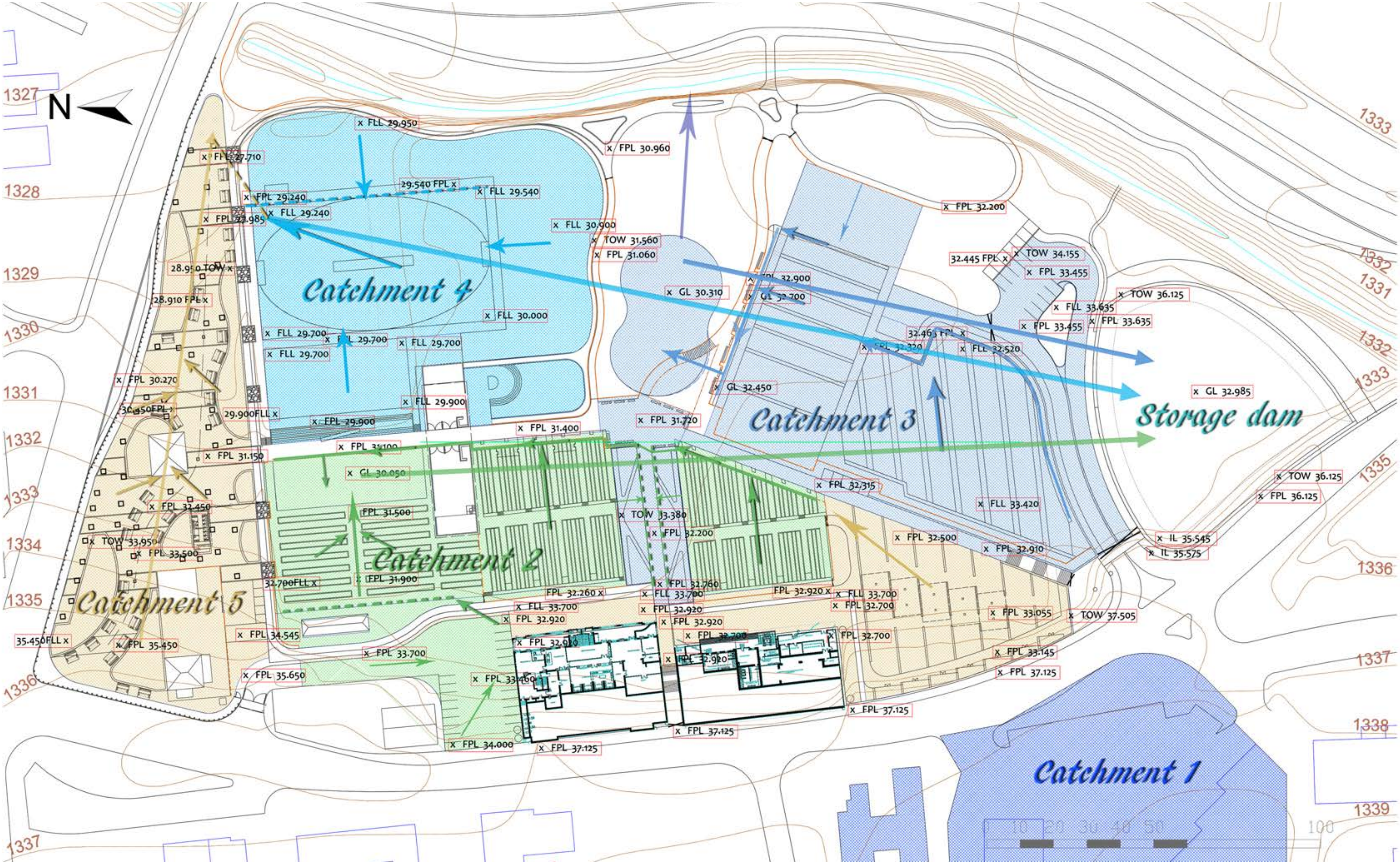


Fig. 162: Diagram of the water collection of the Water Strategy (Author, 2013)

7.4.2 Calculations

Water distribution calculations

A water budget was set up for the whole site (Refer to Table 9 and Fig. 163) and the size of the dam and wetlands were calculated accordingly (Refer to Table 10).

Water Budget Calculations					
WHOLE SITE (catchment 1,2,3, 4 & 5)					
	YEAR 1	YEAR 2			
	Harvestable water / month (m³) (from catchment 1)	**Harvestable water / month (m³) (from catchment 1, 2, 3, 4 & 5)**	**Total Irrigation Max. requirements / month (m³)**	**Balance**	**Total water in storage dam/ month (m³)**
	After Phase 1 (storage dam) was constructed; started with Phase 2	After Phase 2 was constructed & park started to function			
January	1 494.73	4 696.25	1 545.43	3 150.82	8 744.96
February	591.97	1 979.91	1 545.43	434.48	9 179.44
March	695.57	2 291.62	1 545.43	746.19	9 925.64
April	236.79	911.19	1 545.43	-634.24	9 291.39
May	-	198.71	1 545.43	-1 346.72	7 944.67
June	-	198.71	1 545.43	-1 346.72	6 597.95
July	-	198.71	1 545.43	-1 346.72	5 251.22
August	-	198.71	1 545.43	-1 346.72	3 904.50
September	-	198.71	1 545.43	-1 346.72	2 557.77
October	532.78	1 801.79	1 545.43	256.36	2 814.13
November	932.36	3 004.10	1 545.43	1 458.67	4 272.81
December	1 109.95	3 538.46	1 545.43	1 993.04	6 265.84
Water harvested during construction of Phase 2	**5 594.14**	**19 216.85**	**18 545.16**	**8 039.6**	

Table 9: Water budget calculations (Author, 2013)

Water budget

Year 1	January	February	March	April	May	June	July	August	September	October	November	December	Year 2 January	February	March	April	May	June	July	August	September	October	November	December
Harvestable water	1 494.73	591.97	695.57	236.79	-	-	-	-	-	532.78	932.36	1 109.95	4 696.25	1 979.91	2 291.62	911.19	198.71	198.71	198.71	198.71	198.71	1 801.79	3 004.10	3 538.46
Max. Irrigation Requirements (10% added)	-	-	-	-	-	-	-	-	-	-	-	-	1 545.43	1 545.43	1 545.43	1 545.43	1 545.43	1 545.43	1 545.43	1 545.43	1 545.43	1 545.43	1 545.43	1 545.43
Water sufficiency	1 494.73	591.97	695.57	236.79	-	-	-	-	-	532.78	932.36	1 109.95	3 150.82	434.48	746.19	-634.24	-1 346.72	-1 346.72	-1 346.72	-1 346.72	-1 346.72	256.36	1 458.67	1 993.03

Volume of water that needs to be stored for dry months	13 633.70	Volume of water needed during dry months	7 367.84

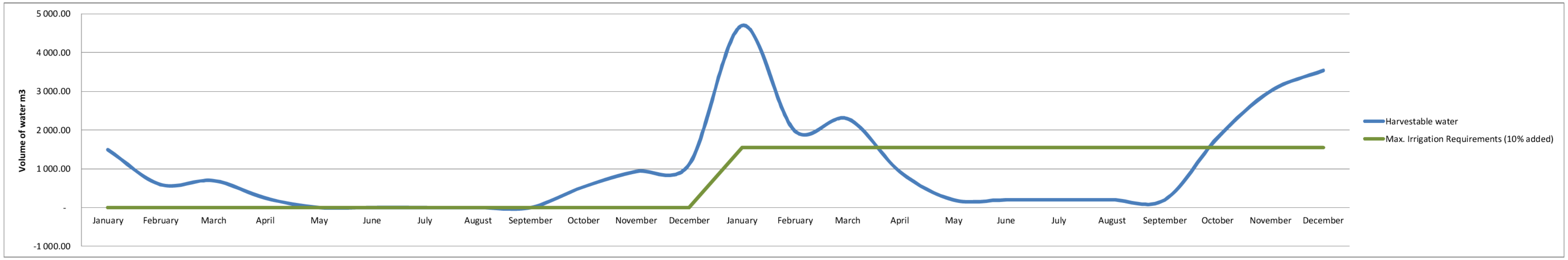


Fig. 163: Water Budget graph (Author, 2013)

Information of Storage dam and wetlands				
Name of dam	Height of Dam/ Depth of Wetland (m)	Area of dam (m²)	Capacity (m³)	Total Volume (m³)
Storage dam - Deel 1	2.55	3 010.00	7 675.50	
Deel 2	2.1	1 200.00	2 520.00	10 195.50
	0	-	-	
Wetland 1 - Compost Area	1	1 230.00	1 230.00	(Back to Storage dam)
Wetland 2 - Agriculture area	1.2	680.00	816.00	(Back to Storage dam)
Soccer field	0	2 800.00	-	(Back to Storage dam)
Bioswale	0.2	803.28	160.66	

Table 10: Size of the dam and wetlands (Author, 2013)

Storm water calculations and a water budget for catchment 1 was completed (Refer to Chapter 11, Table 11 and 12) as well as the irrigation requirements for the agriculture, demonstration gardens, composting facility, waste cleaning facility and the recreational area (Refer to Chapter 11, Tables 13 and 14).

Water collection calculations

Storm water calculations and water budgets were completed for catchments 2 to 5 (Refer to Chapter 11, Tables 15 – 21). Grey water calculations were also done (Refer to Chapter 11, Table 22).

7.5 Sustainability Rating

7.5.1 SSI

The Sustainable Sites Initiative rating system was applied to rate the Berea Park intervention (Refer to Chapter 11, Table 23).

CHAPTER 8

Technical Development

CHAPTER 8: Technical Development

8.1 Introduction - Area for further investigation

After the final master plan was developed, the area most suitable for technical development was chosen as the sketch plan area (as illustrated in Fig. 164 with the blue outline).

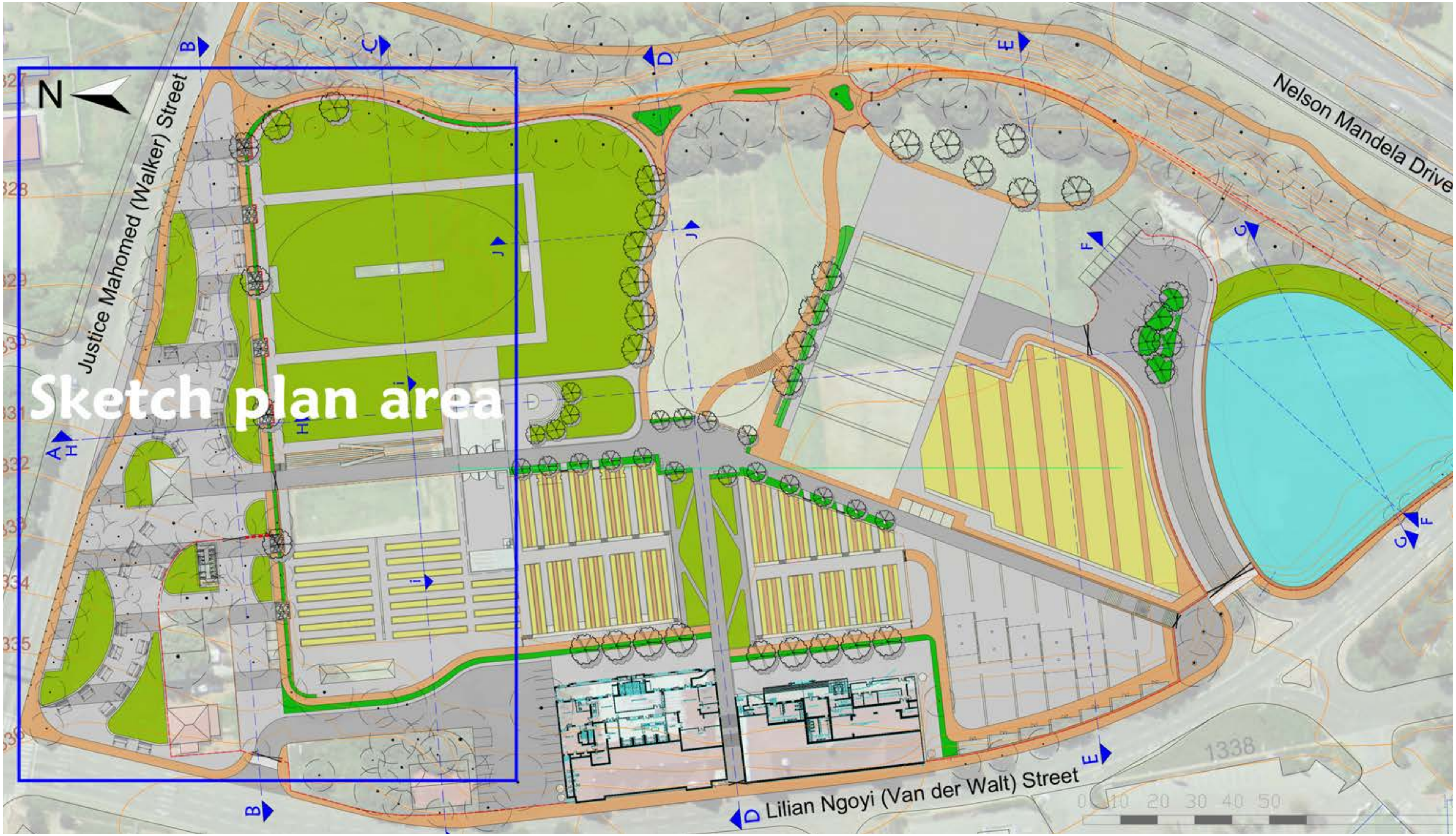


Fig. 164: Landscape master plan indicating Sketch plan area (Author, 2013)

8.2 Sketch plan development

Steps were proposed next to the information centre as well as public toilets (Refer to Fig. 165). All the trees were preserved and the existing buildings were restored and given new functions. Waste recycling bins are provided for pedestrians to drop off waste and market stalls were proposed along the lawn strips. The entrance building will function as a gardening shop with demonstration gardens and community-based agriculture next to the building. Storage will also be provided for vegetables and gardening tools.

Fig. 165: Sketch Plan development 1 (Author, 2012)

The steps were removed in Figs. 166 and 167 to improve wheelchair accessibility; planters were added to the lawn strips to provide seating and the market stalls were placed according to the location of the existing trees. Wheelchair parking was proposed, but because provision for wheelchair parking will be made in the staff parking area it was deemed as unnecessary.

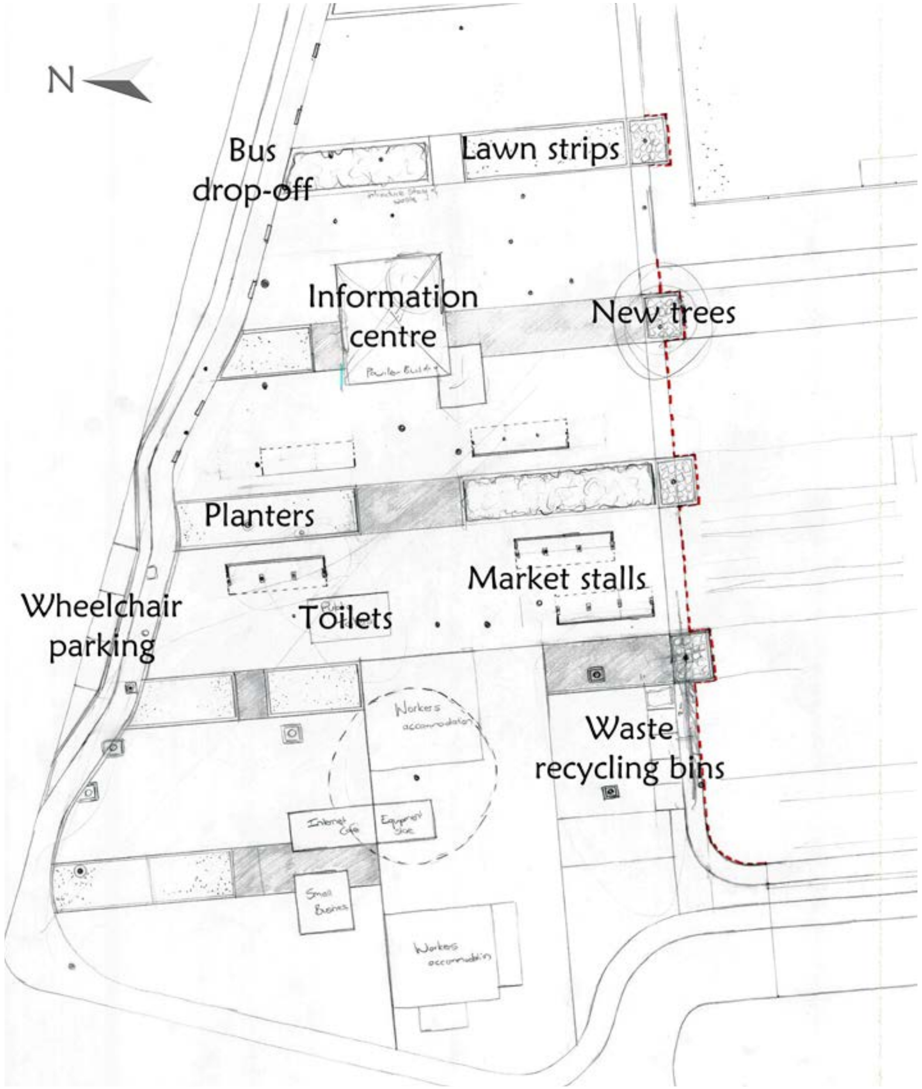


Fig. 166: Sketch Plan development 2 (Author, 2012)

Fig. 167: Sketch Plan development 3 (Author, 2012)

The wheelchair parking was removed and proposed in the staff parking area. The market stalls were moved to a more sensible location (next to the service road), opening up towards the market area and hiding the service road at the same time. The proposed fence is hidden by planting and new trees (Refer to Fig. 168).

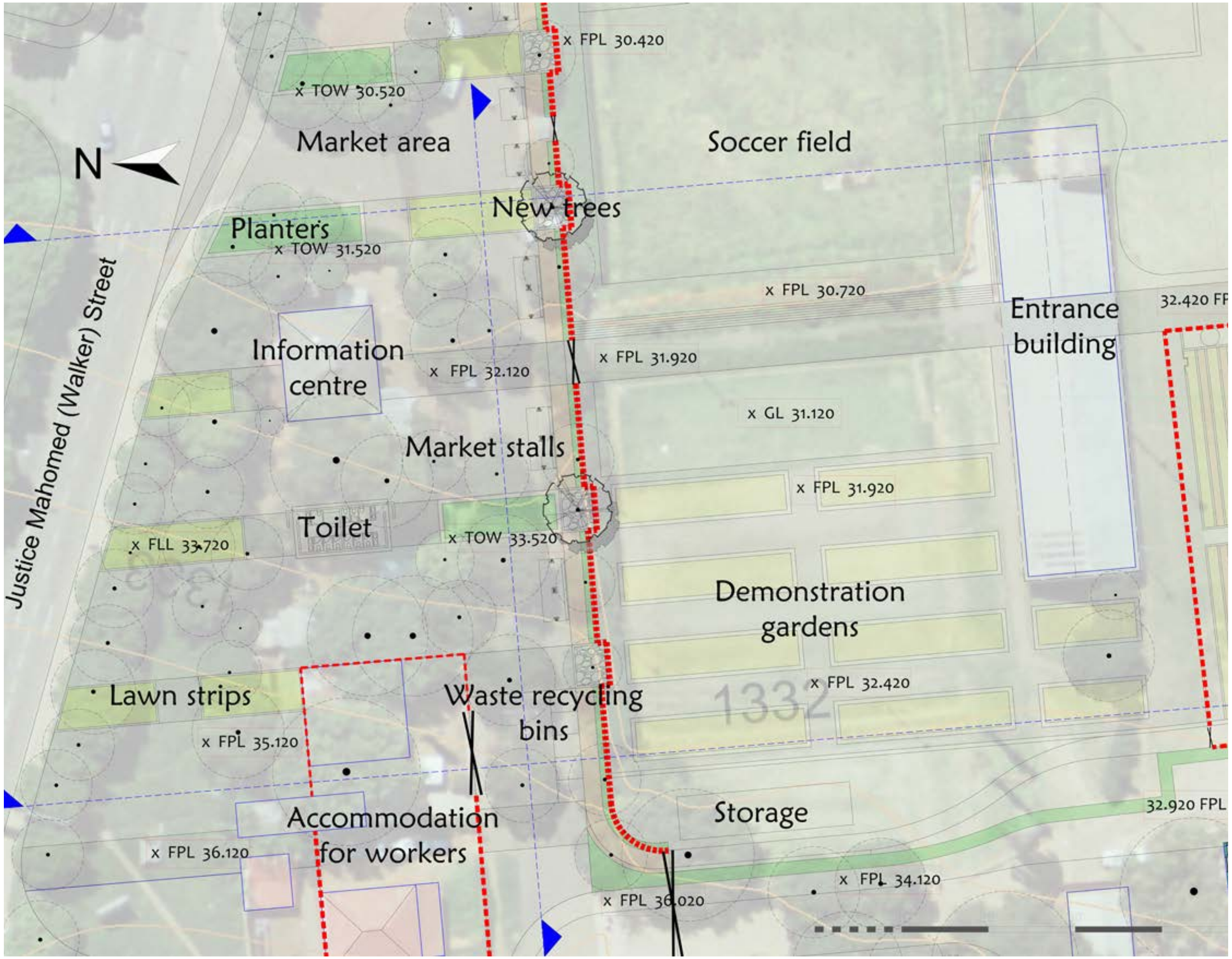


Fig. 168: Sketch Plan development 4 (Author, 2012)

The rectangular grass patches were given a more organic form, imitating the movement patterns (Refer to Fig. 169).

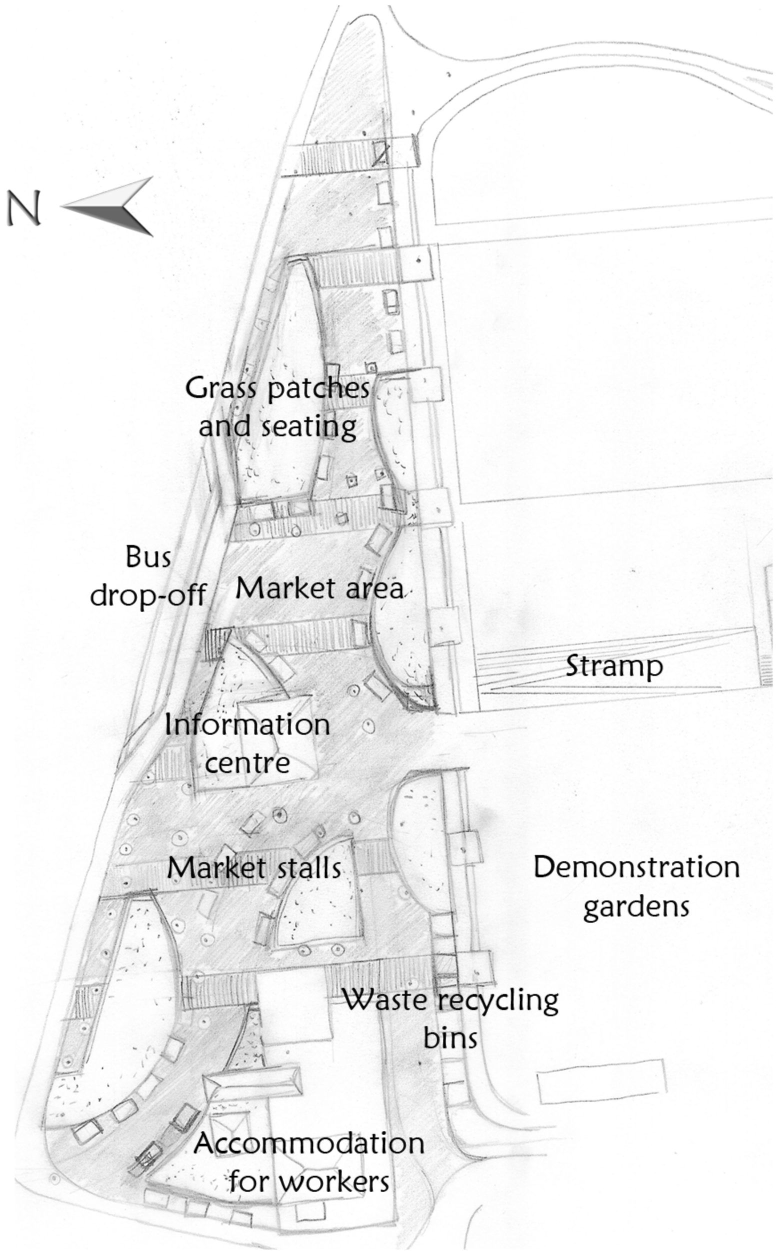


Fig. 169: Sketch Plan development 5 (Author, 2013)

8.3 Final sketch plan

The final sketch plan (Refer to Fig. 170) proposes smaller market stalls strategically placed in the market area according to the movement patterns of the locals and visitors moving through the market area and entering the site. Grass patches were provided for seating, some of the grass areas are on ground level and others are raised to seating height. The proposed toilets are fenced-off together with the accommodation for workers. The entrance building will function as a gardening shop that sells tools, compost and books about gardening with demonstration gardens next to the building where visitors will be educated on how to grow their own vegetables through demonstrations. The wetland will collect the runoff from the demonstration gardens and pump it to a storage dam. A lawn area for informal soccer, a marquee tent for functions or performances and a stramp to get to this area (recreation area) are proposed. The steps provide seating for parents to watch over their kids playing or for a performance.

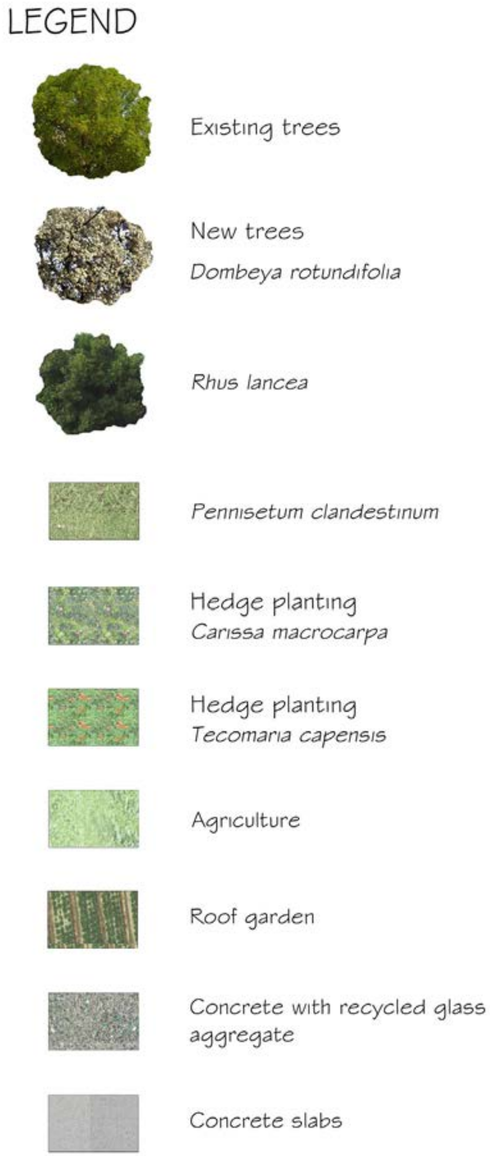


Fig. 170: Sketch plan (Author, 2013)

8.4 Lighting and material strategy

Regent lighting solutions were chosen because “Regent uses only recycled aluminium. Runners and flaring cut off during the manufacturing process are all remelted, nothing is wasted. As most of the products that Regent manufactures are lights for outdoor installation, aluminium is the ideal metal to use” (Regent, 2013).

Lighting were strategically placed to ensure optimal security at night (Refer to Figs. 171 and 172).

Refer to Fig. 173 for planting and paving material selection.

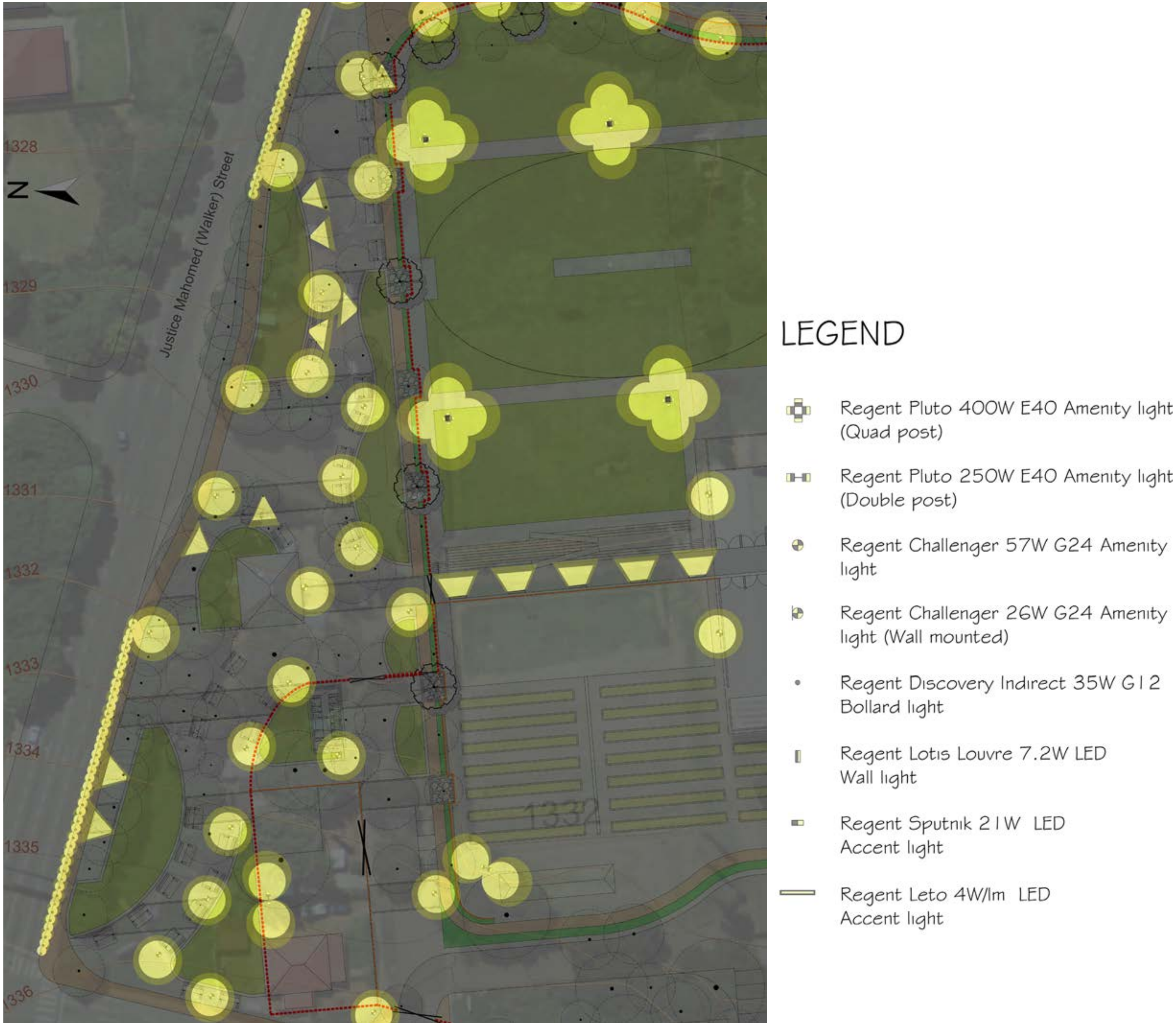


Fig. 171: Lighting Strategy (Author, 2013)

Regent Pluto Double post
250W E40 Amenity Lighting

Regent Pluto Quad post
400W E40 Amenity Lighting

Regent Challenger
57W G24 Amenity Lighting

Regent Challenger
Wall mounted
26W G24 Amenity Lighting

Regent Discovery Indirect
35W G12 Bollard Light

Regent Lotis Louvre
7.2W LED Wall light

Regent Sputnik
21W LED Accent light

Regent Leto
4W/lm LED Accent light

Fig. 172: Lighting materials (Regent Lighting solutions, 2013)

Planting materials

Trees

Dombeya rotundifolia

Market area
Accent/ focal tree
Non-aggressive root system

Rhus lancea

Recreation area
Excellent shade tree
No thorns

Dovyalis caffra

Front of Buildings
Non-aggressive root system
Deciduous, evergreen under favourable conditions

Euclea crispa

Along pathways
Small, structural tree
Non-aggressive root system

Celtis africana

Remaining areas
Already existing tree
Shade tree

Combretum erythrophyllum

Wet areas
Water-loving tree
Shade tree

Shrubs

Carissa macrocarpa

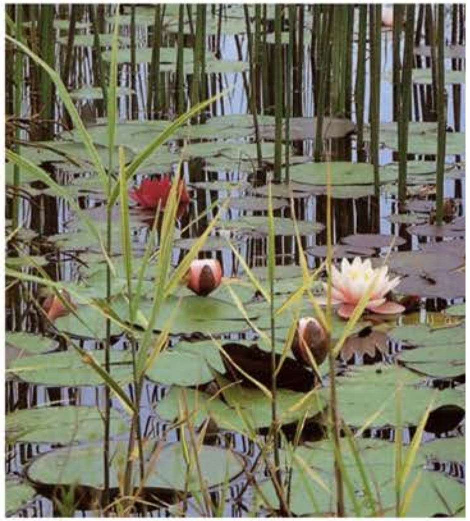
Hedge planting to hide fence
Attractive ornamental
Strong, stiff spines

Tecomaria capensis

Hedge planting front of buildings
Already existing
Attract birds and insects

Wetland plants

Zantedeschia aethiopica



Nymphaea nouchali

Fig. 173: Material Palette (Author, 2013)

Paving materials

Cyperus papyrus

Rocks and rubble from site

Recycled glass as aggregates

Typha capensis

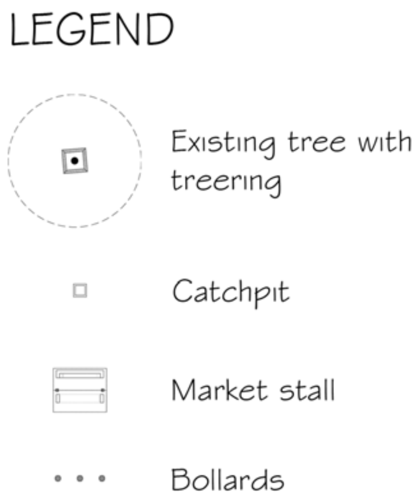
Reuse concrete slabs removed on site

Reuse granite kerbs removed on site

8.5 Storm water strategy and details

The paving in the market area is slightly sloped towards a central line, forming a shallow 'channel' to transport the water through a series of catchpits. All the catchpits are connected with a 450 diameter concrete pipe (Refer to Fig. 174).

The concrete pipe then sends the water to the sub-surface detention basin and back to the storage dam (Refer to Figs. 175 - 178 for details).



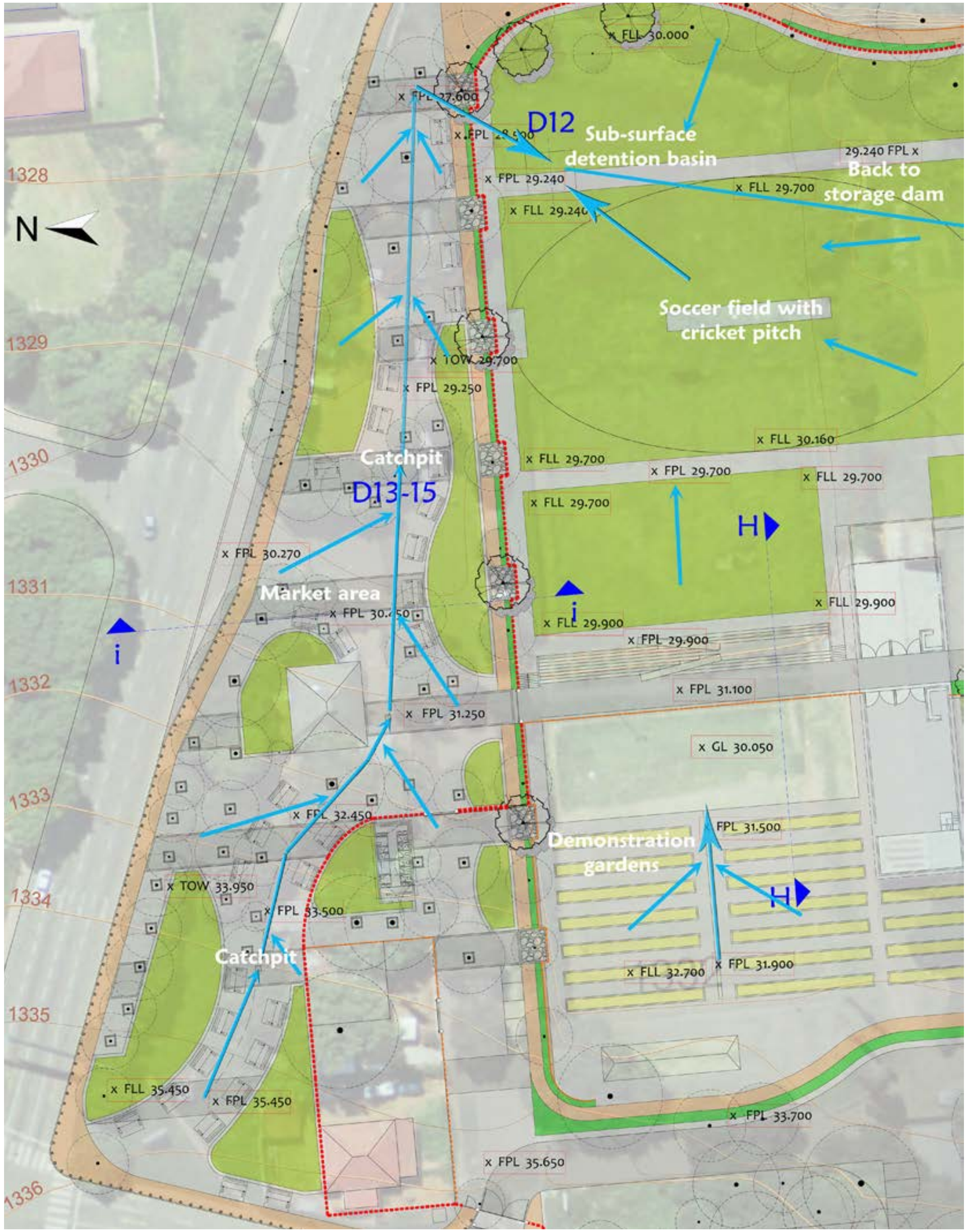


Fig. 174: Storm water Strategy (Author, 2013)

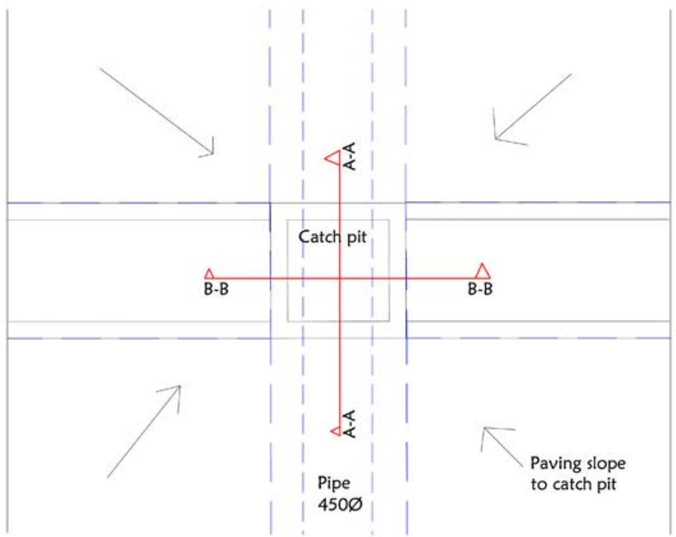


Fig. 175: Catchpit plan (Author, 2013)

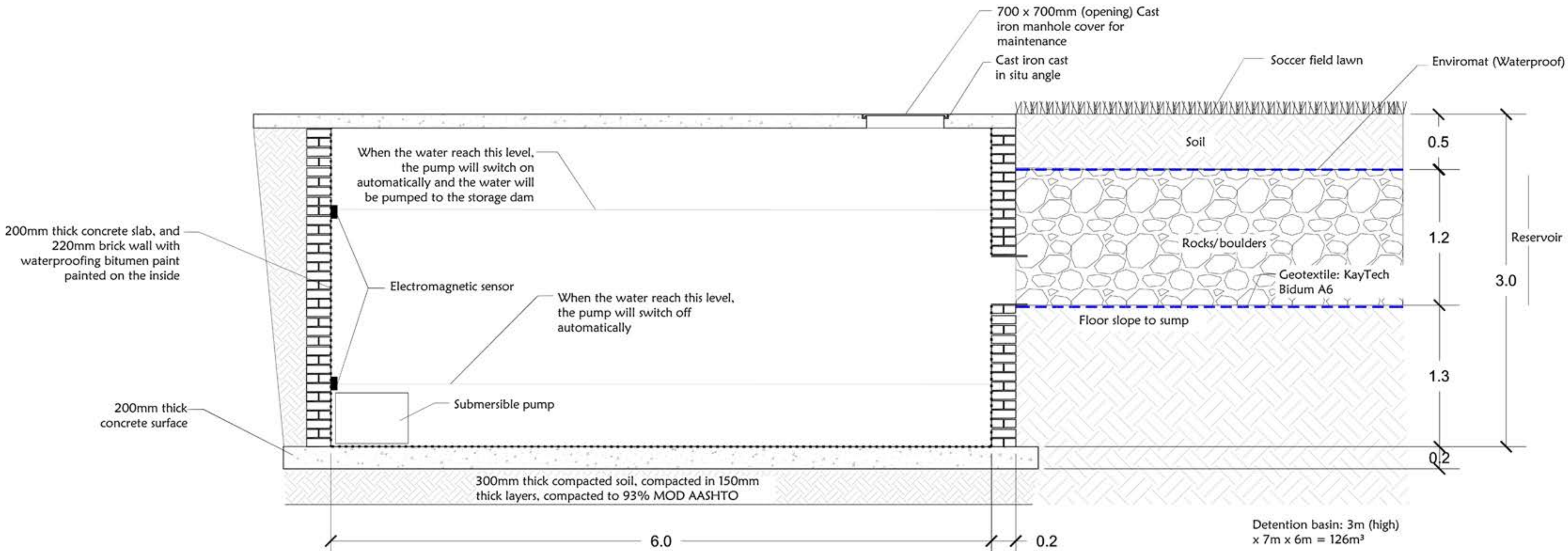


Fig. 176: Sub-surface detention basin (Author, 2013)

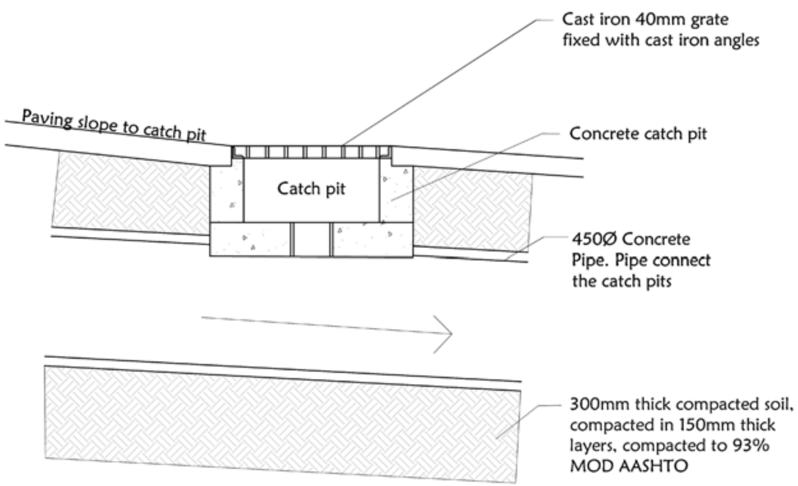


Fig. 177: Catchpit Section A-A (Author, 2013)

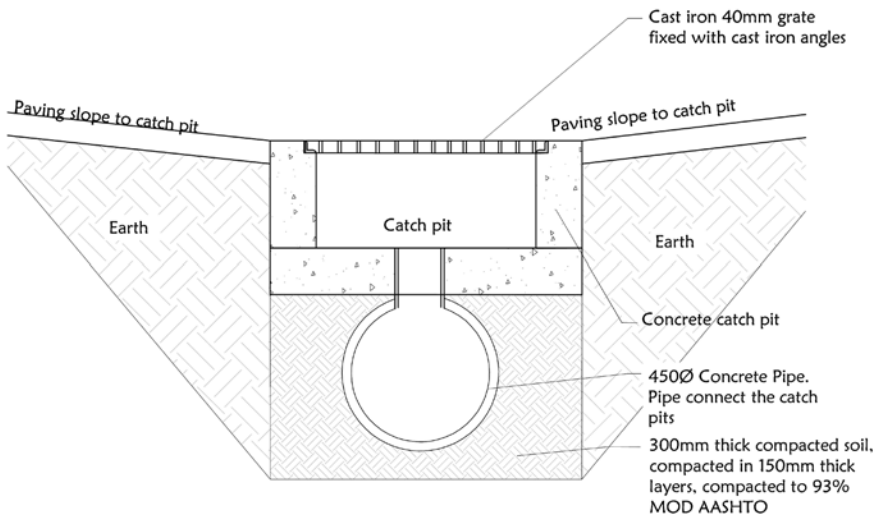


Fig. 178: Catchpit Section B-B (Author, 2013)

8.6 Sections

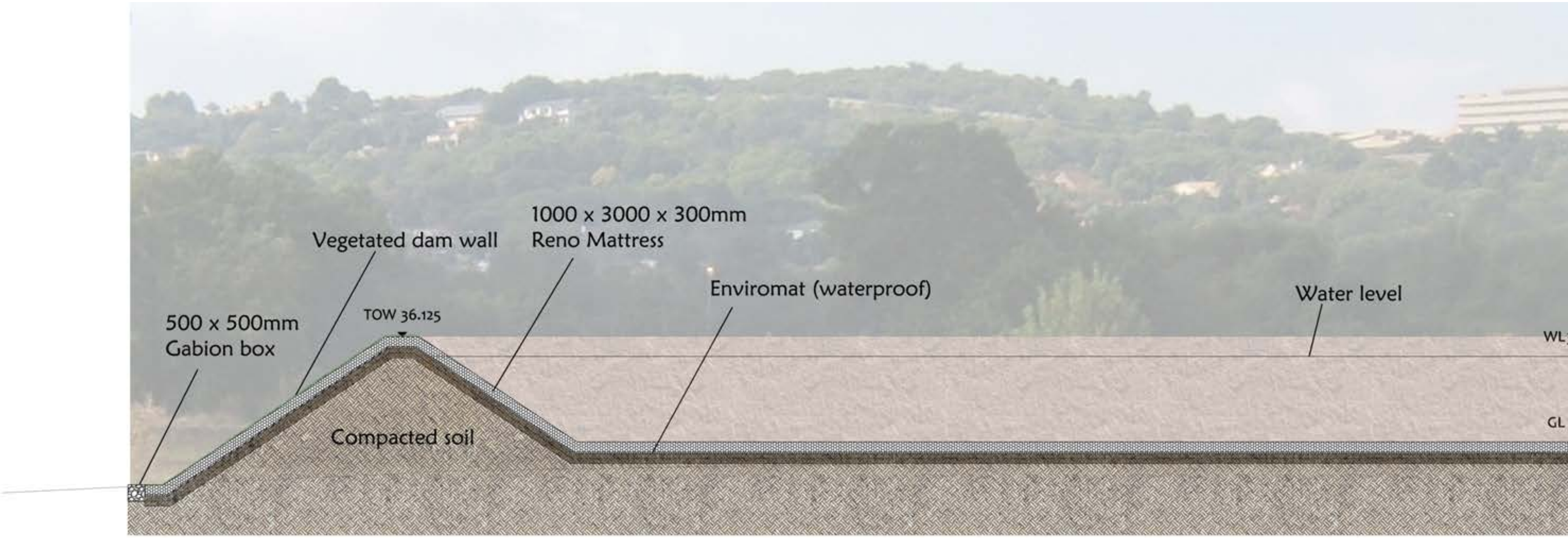


Fig. 179: Section F-F: Storage dam (Author, 2013)

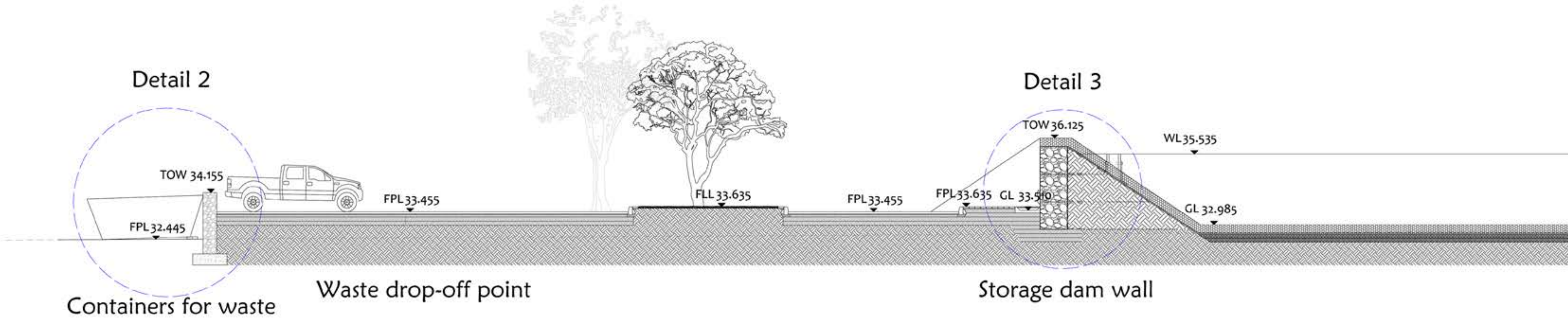
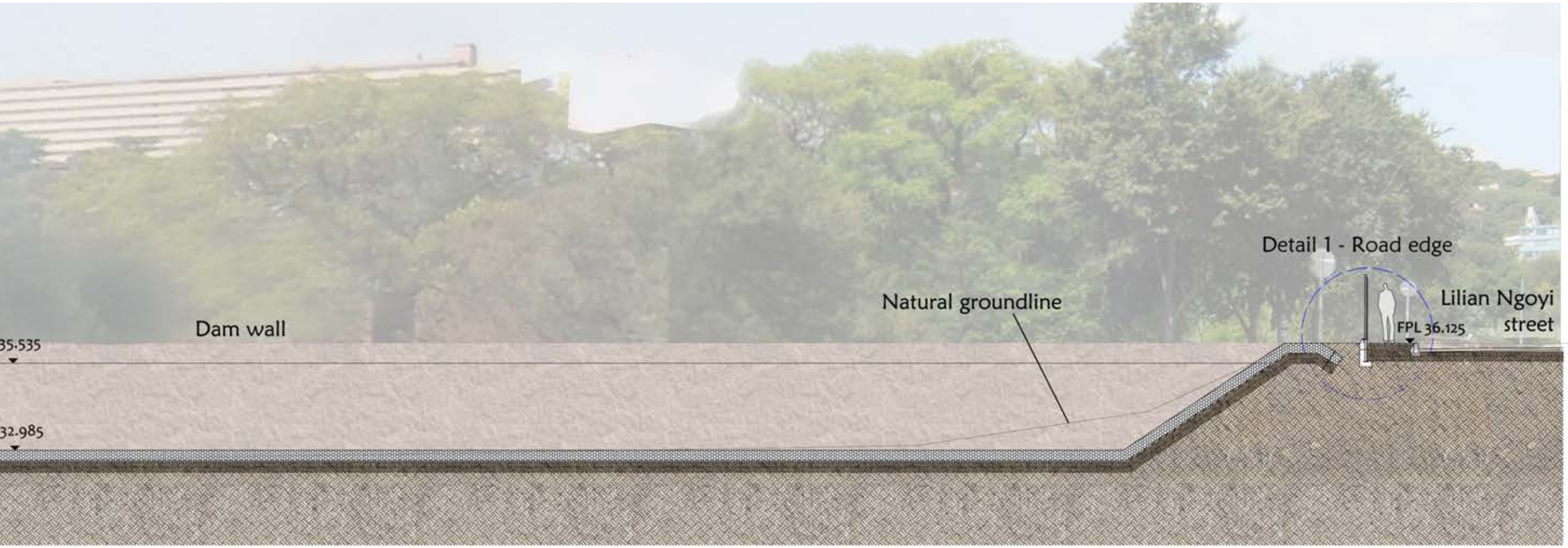
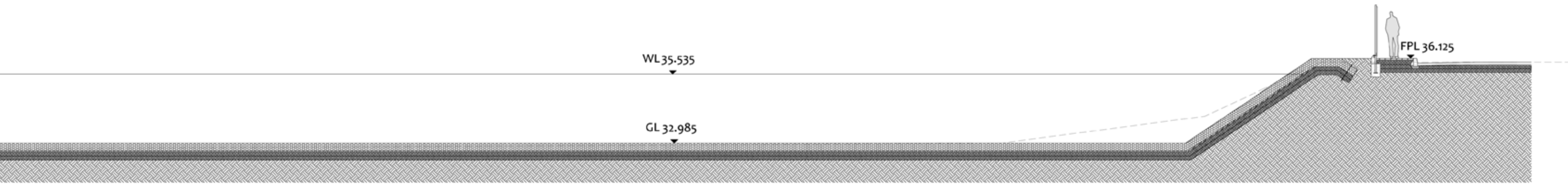


Fig. 180: Section G-G: Waste drop-off and storage dam (Author, 2013)





Storage dam

Road edge

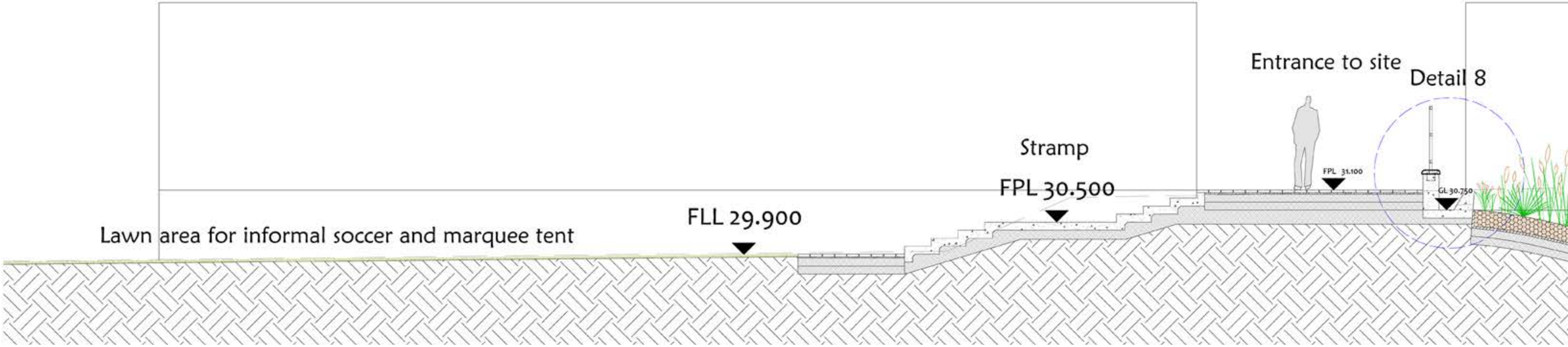


Fig. 181: Section H-H (Author, 2013)

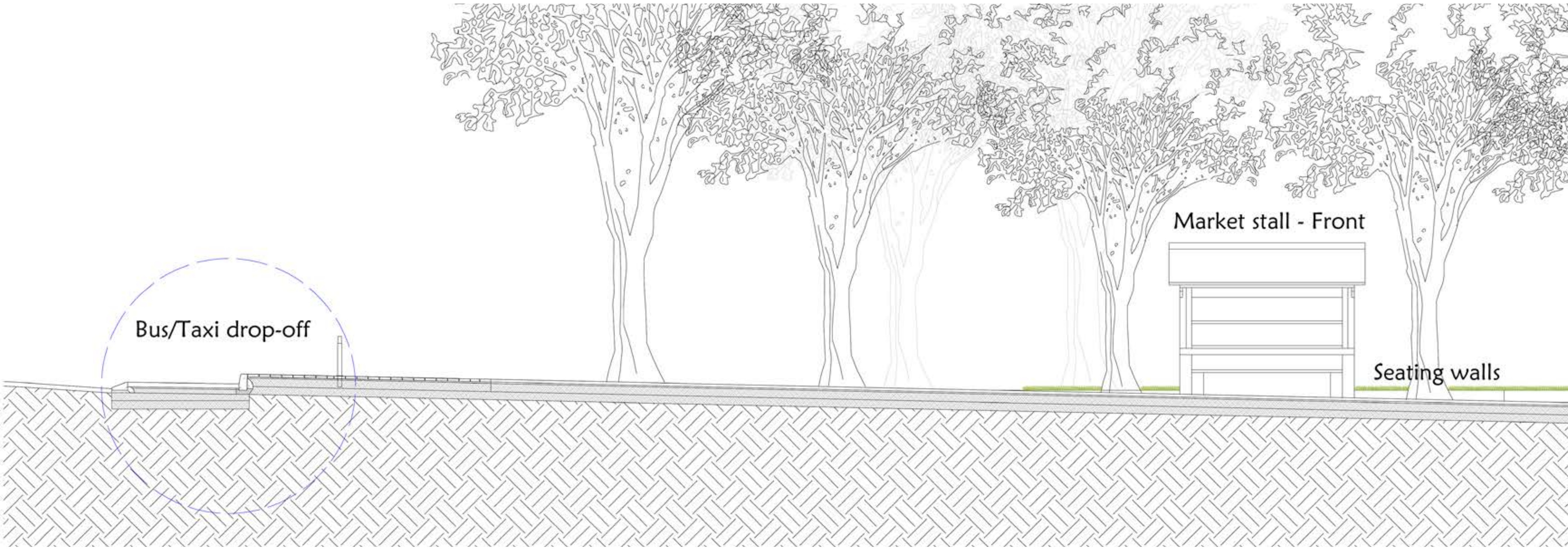
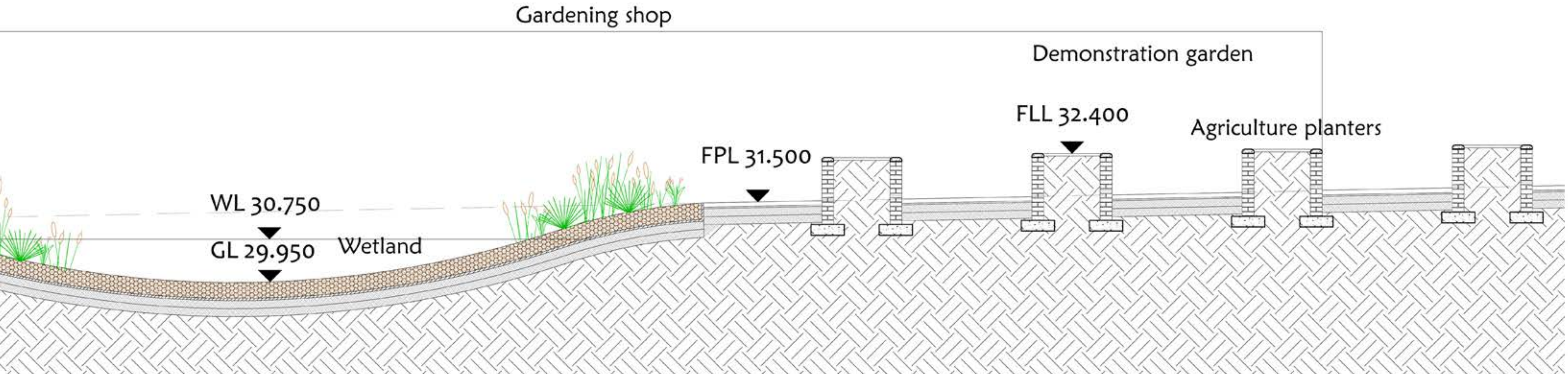
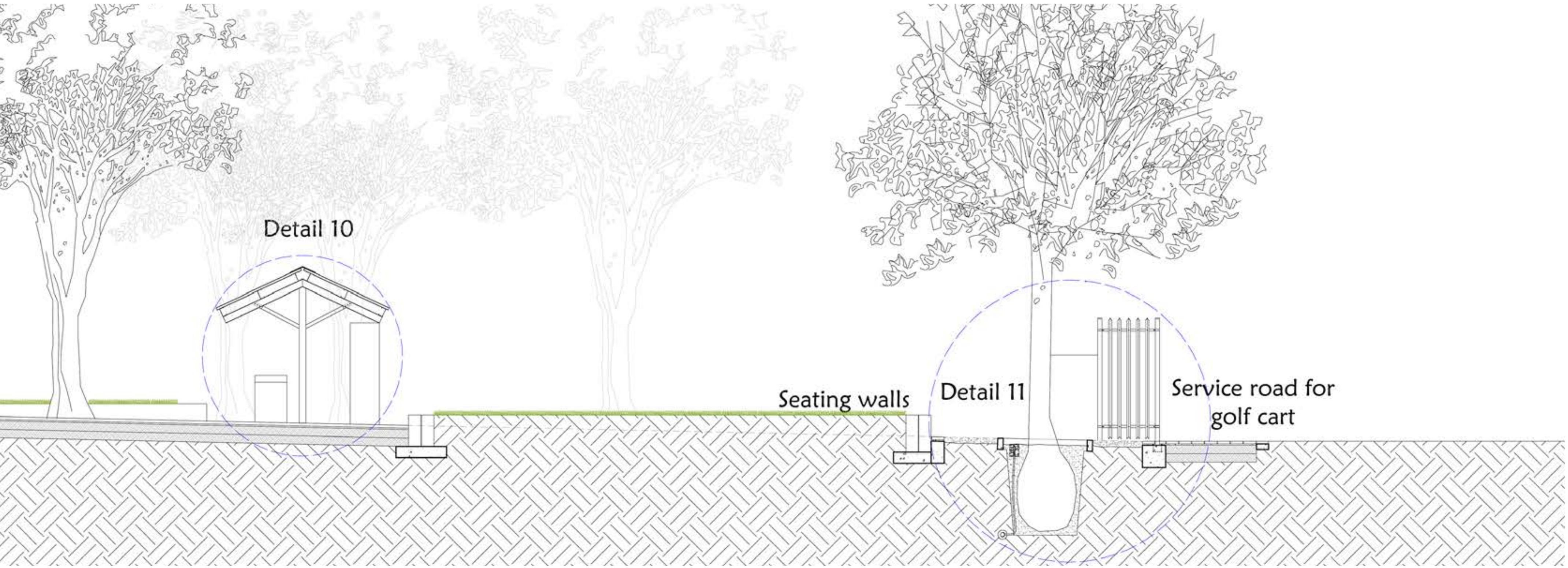


Fig. 182: Section i-i: Market area (Author, 2013)


Gardening shop
Demonstration garden
FLL 32.400
Agriculture planters
FPL 31.500
WL 30.750
GL 29.950
Wetland


Detail 10
Seating walls
Detail 11
Service road for golf cart

8.7 Details

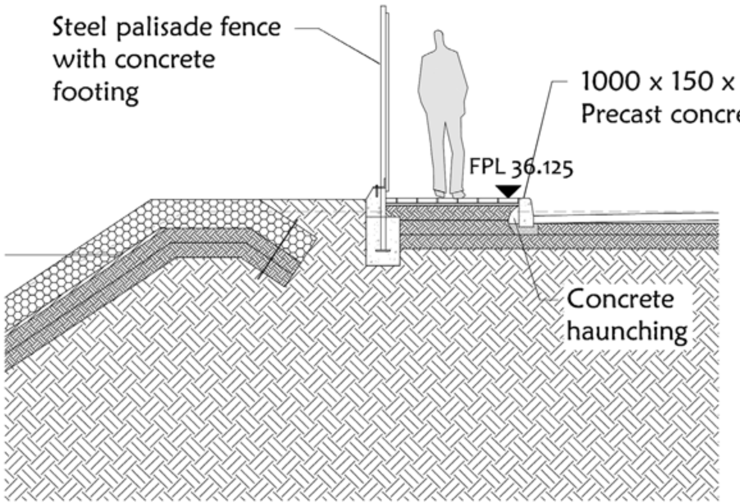


Fig. 183: Detail 1 - Road edge (Author, 2013)

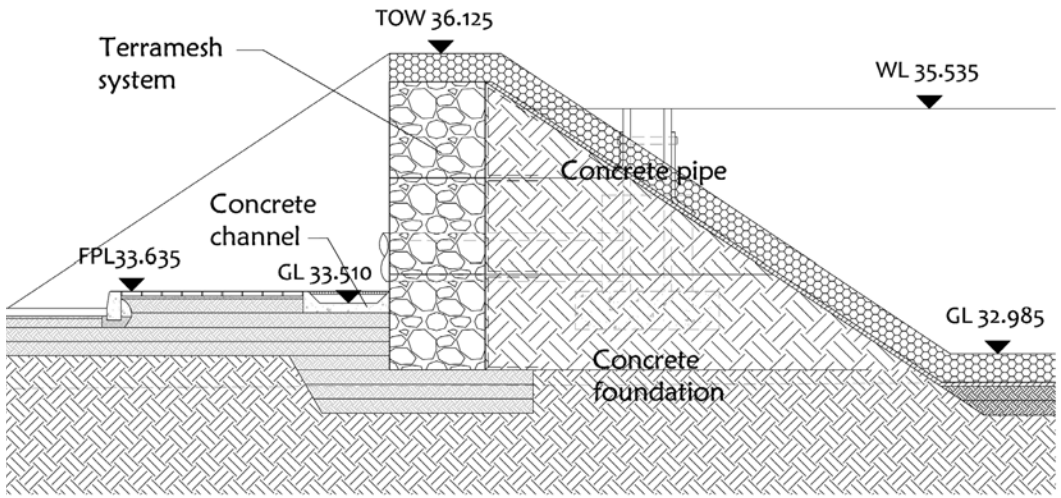


Fig. 185: Detail 3 - Overflow and channel (Author, 2013)

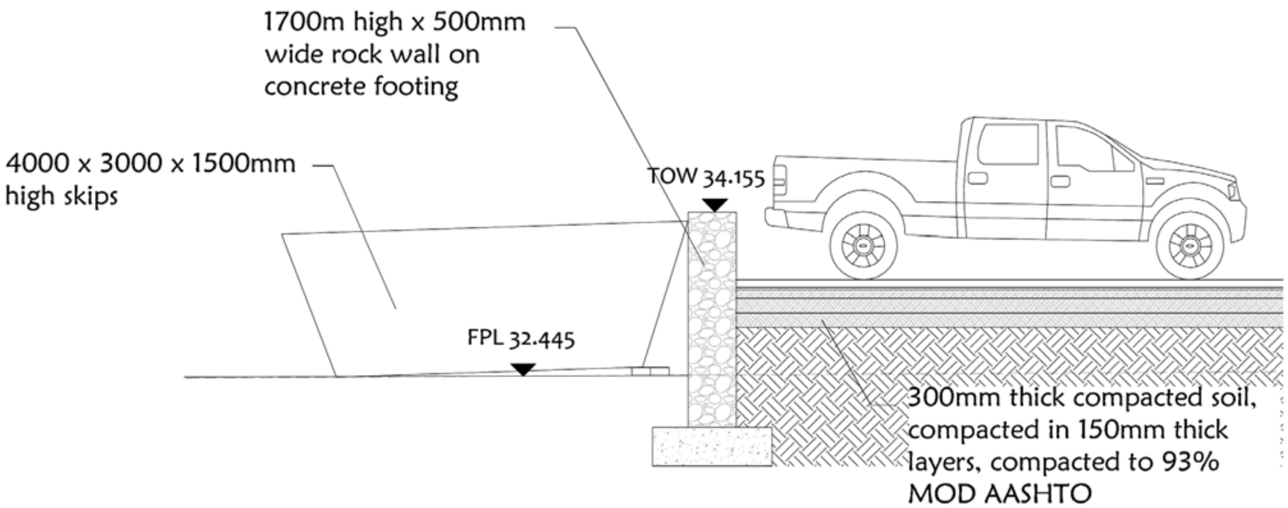


Fig. 184: Detail 2 - Waste drop-off (Author, 2013)

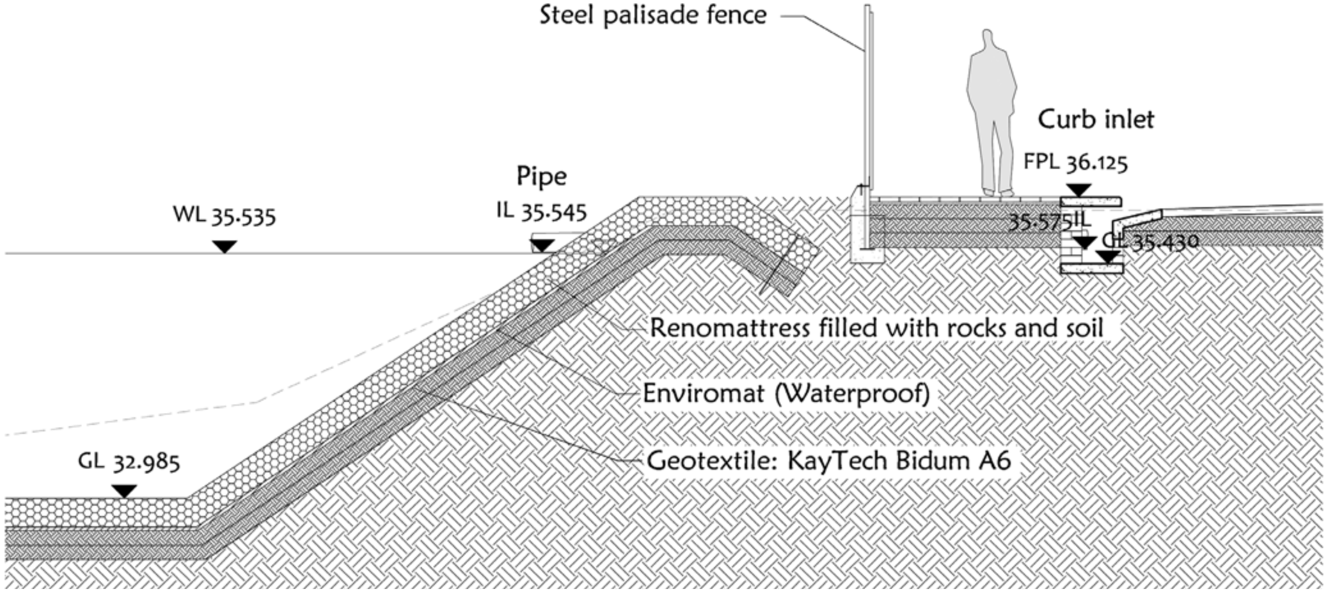


Fig. 186: Detail 4 - Curb inlet (Author, 2013)

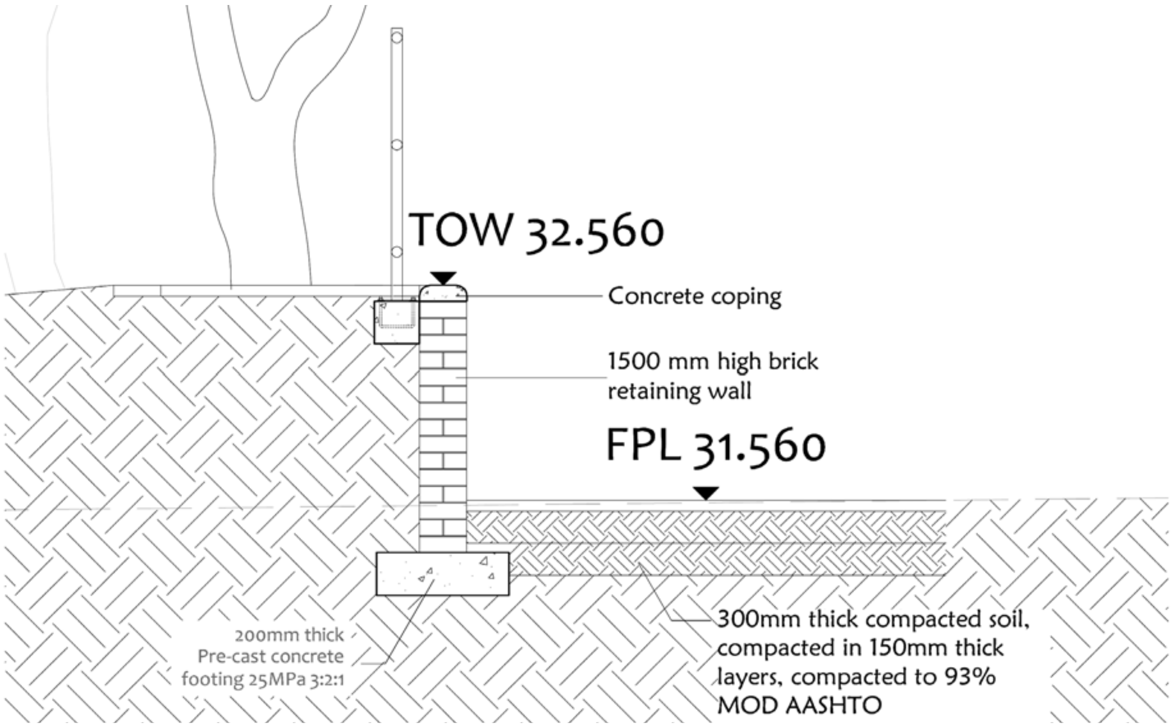


Fig. 187: Detail 5 - Retaining wall (Author, 2013)

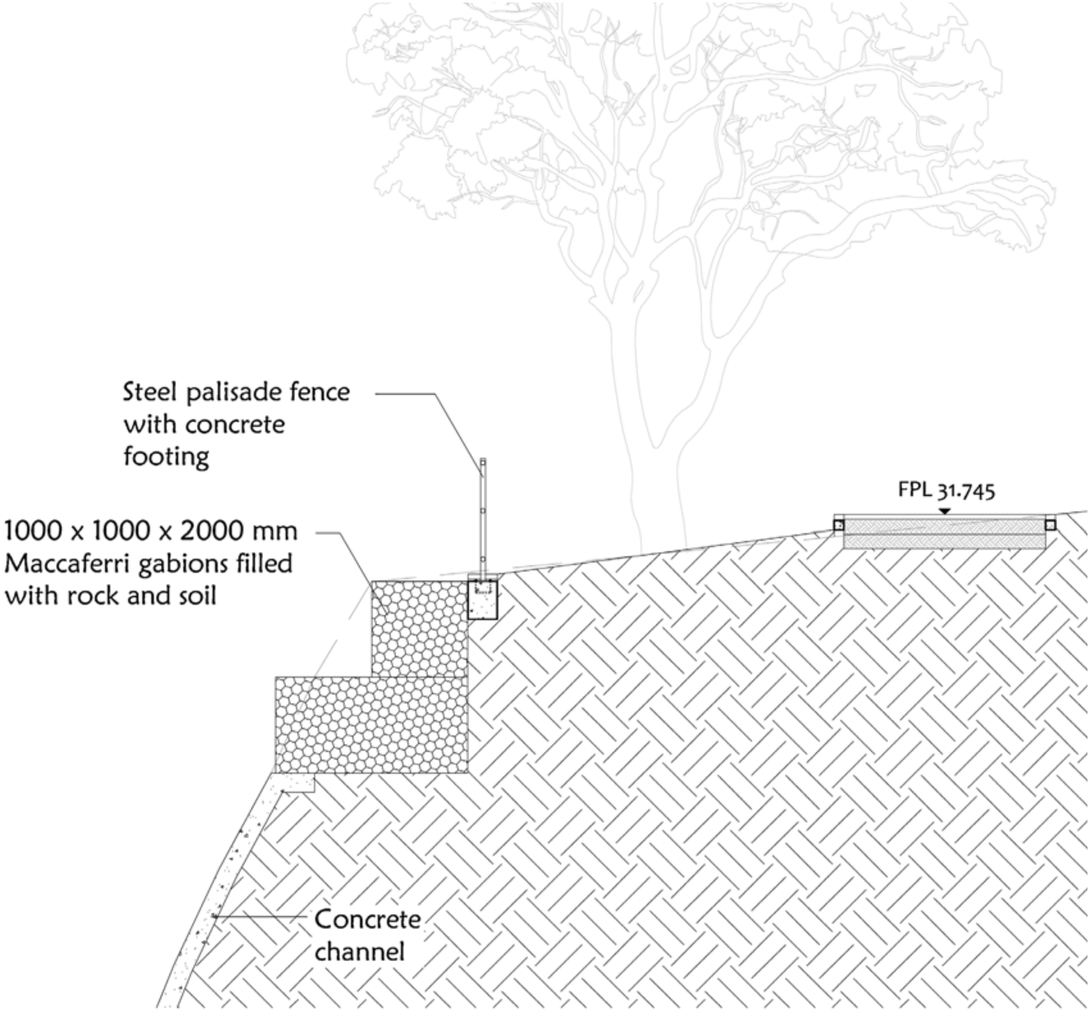


Fig. 188: Detail 6 - River edge E (Author, 2013)

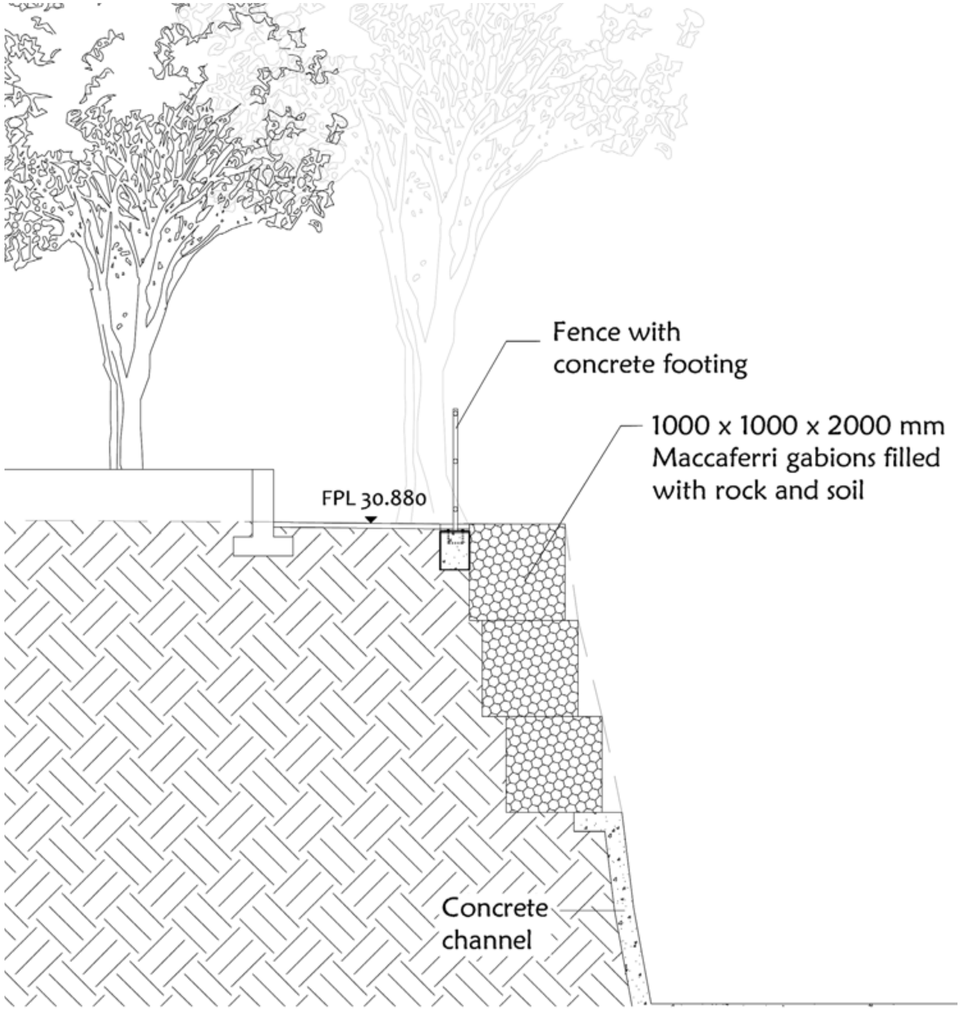


Fig. 189: Detail 7 - River edge D (Author, 2013)

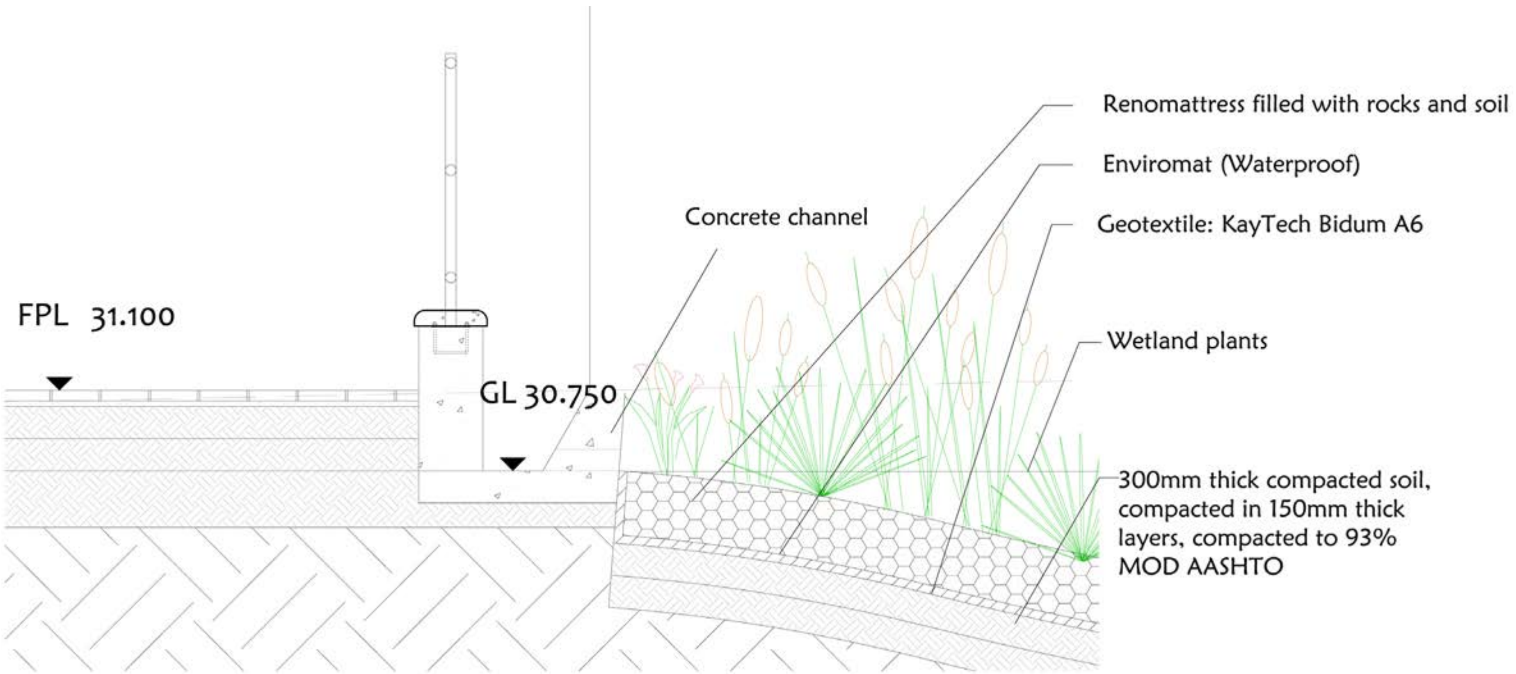


Fig. 190: Detail 8 - Channel and fence next to wetland (Author, 2013)

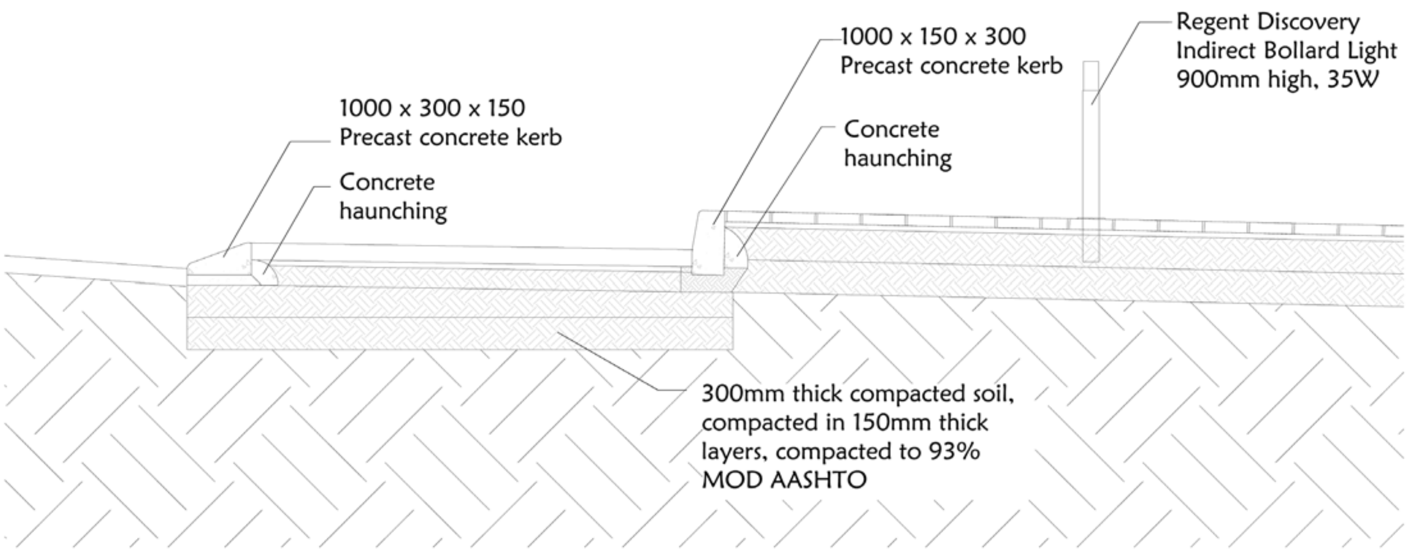


Fig. 191: Detail 9 - Road edge (Bus drop-off) (Author, 2013)

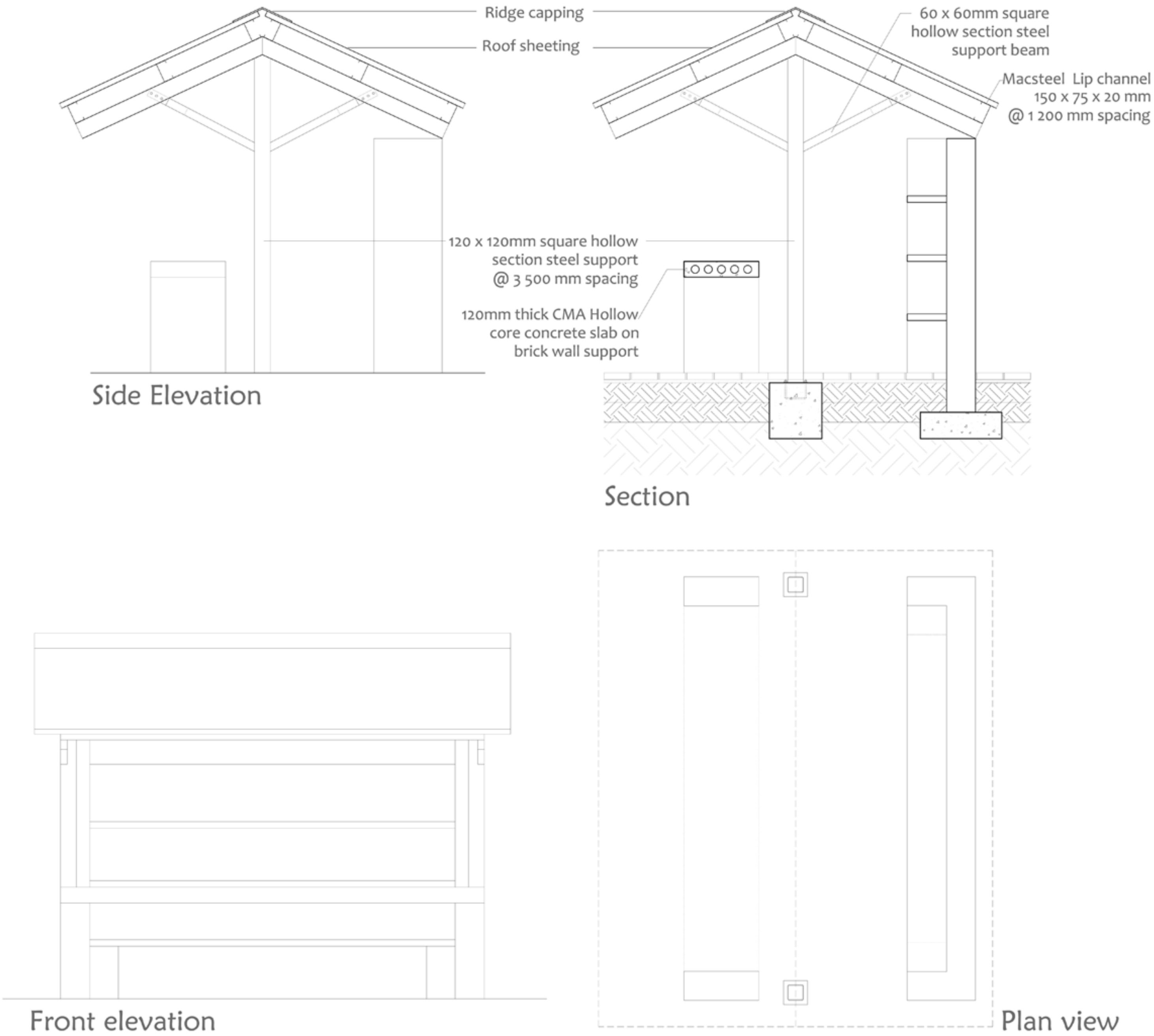


Fig. 192: Detail 10 - Market stalls (Author, 2013)

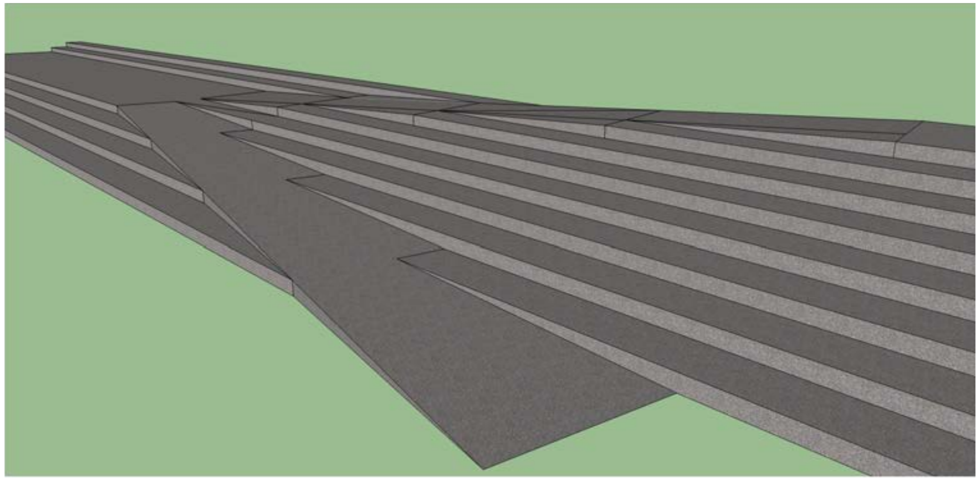


Fig. 193: Stramp 3D (Author, 2013)

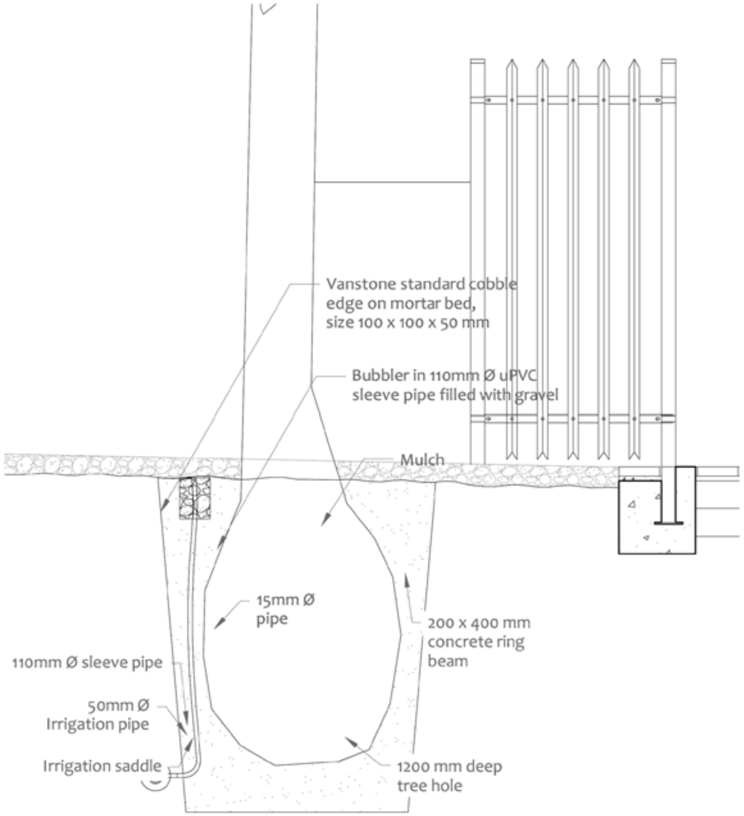


Fig. 194: Detail 11 - Tree planting and palisade fence (Author, 2013)

CHAPTER 9

Conclusion

CHAPTER 9: Conclusion

An organic waste recycling facility was designed in a safe and accessible park-like setting, called the Berea Waste Park. The park will provide the opportunity for people from different parts of the city to meet and experience the story of waste.

The Berea Waste Park won't be able to solve the problem of waste we face today. The project is merely a drop in the ocean, but it is the ripple-effect of that one drop that matters. That one person whose perception of waste will be changed by visiting the park will make a difference.

"Waste not the smallest thing created, for grains of sand make mountains and atomies infinity." (Knight, no date)

The project will be economically, environmentally, socially and aesthetically sustainable, focusing on the problem of waste and communicating it to the visitors in a fun and exciting manner.

Natural features will be embraced and natural processes implemented by using waste as resource, recycling organic waste, composting green waste, vermicomposting and the cleansing of water through wetlands. This will encourage the social involvement with nature.

We are stewards of the earth and need to take care of it. If only everyone could understand that the problem of landfill space running out affects each one of us, we would all surely live differently by trying to change our lifestyles for the better.

The Berea Waste Park has the ability to tell a successful story and succeed in changing visitors' perception of waste by applying the important guidelines discovered throughout the dissertation - this means that the battle is already halfway won…

"You have made them a little lower than the angels and crowned them with glory and honour. You made them rulers over the works of your hands; you put everything under their feet" (NIV, Psalm 8:5-6).

CHAPTER 10

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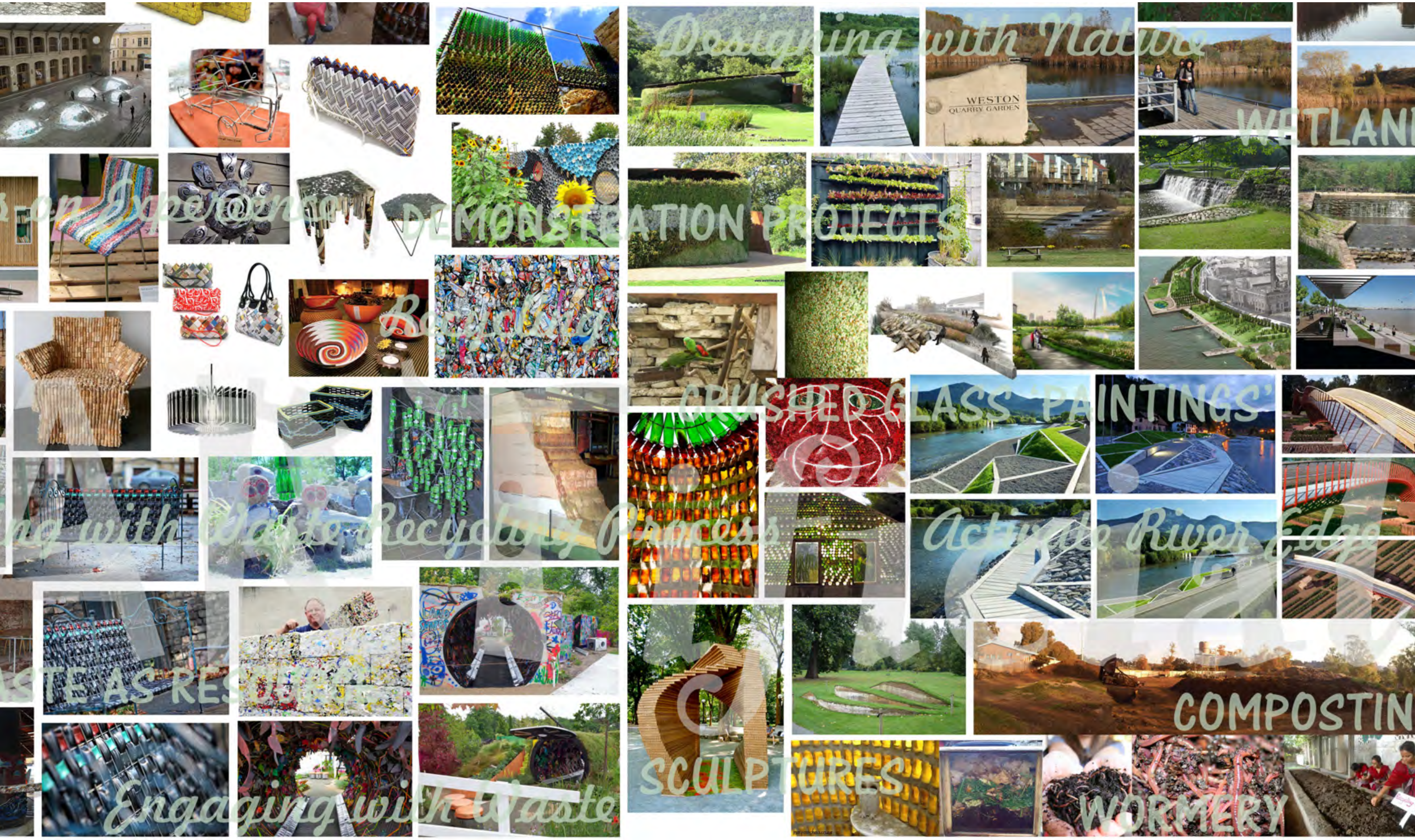
CHAPTER 11

Appendices

Fig. 195: Story board (Author, 2012)


Designing with Nature
WESTON
QUARRY GARDEN
DEMONSTRATION PROJECTS
CRUSHED GLASS 'PAINTINGS'
Activate River Edge
SCULPTURES
WORMERY
Engaging with Waste

RESOURCE / SUPPLY

RAINWATER

Stormwater calculations of Catchment area 1 - Shopping centre

						Shopping centre Catchment Area (m^2)	18 451.75	
	Average rain (mm)	Ave. Rain (m)	Evaporation (mm)	Evaporation (m)	Rain - evapo (m)	**Paving (A= 0.8)**	Runoff (m^3)	Runoff (ℓ)
January	136	0.136	35	0.035	0.101	8 852.08	715.25	715 248.06
February	75	0.075	35	0.035	0.04	8 852.08	283.27	283 266.56
March	82	0.082	35	0.035	0.047	8 852.08	332.84	332 838.21
April	51	0.051	35	0.035	0.016	8 852.08	113.31	113 306.62
May	13	0.013	35	0.035	-0.022	8 852.08	-155.80	-155 796.61
June	7	0.007	35	0.035	-0.028	8 852.08	-198.29	-198 286.59
July	3	0.003	35	0.035	-0.032	8 852.08	-226.61	-226 613.25
August	6	0.006	35	0.035	-0.029	8 852.08	-205.37	-205 368.26
September	22	0.022	35	0.035	-0.013	8 852.08	-92.06	-92 061.63
October	71	0.071	35	0.035	0.036	8 852.08	254.94	254 939.90
November	98	0.098	35	0.035	0.063	8 852.08	446.14	446 144.83
December	110	0.11	35	0.035	0.075	8 852.08	531.12	531 124.80
Average rainfall per year	674					**Total**	**1 798.74**	
per week	12.96	0.013	35	0.035	-0.022	8 852.08	-97.54	-97 543.11

Average runoff per month 149.90

Source: http://www.pretoria-south-africa.com/pretoria-weather.html

	Average rain (mm)	Ave. Rain (m)	Evaporation (mm)	Evaporation (m)	Rain - evapo (m)	**Roofs (A= 0.9)**	Runoff (m^3)	Runoff (ℓ)
January	136	0.136	35	0.035	0.101	8 402.21	763.76	763 760.89
February	75	0.075	35	0.035	0.04	8 402.21	302.48	302 479.56
March	82	0.082	35	0.035	0.047	8 402.21	355.41	355 413.48
April	51	0.051	35	0.035	0.016	8 402.21	120.99	120 991.82
May	13	0.013	35	0.035	-0.022	8 402.21	-166.36	-166 363.76
June	7	0.007	35	0.035	-0.028	8 402.21	-211.74	-211 735.69
July	3	0.003	35	0.035	-0.032	8 402.21	-241.98	-241 983.65
August	6	0.006	35	0.035	-0.029	8 402.21	-219.30	-219 297.68
September	22	0.022	35	0.035	-0.013	8 402.21	-98.31	-98 305.86
October	71	0.071	35	0.035	0.036	8 402.21	272.23	272 231.60
November	98	0.098	35	0.035	0.063	8 402.21	476.41	476 405.31
December	110	0.11	35	0.035	0.075	8 402.21	567.15	567 149.18
Average rainfall per year	674					**Total**	**1 920.75**	
per week	12.96	0.013	35	0.035	-0.022	8 402.21	-92.59	-92 585.89

Average runoff per month 160.06

Table 11: Storm water calculations for Catchment 1 (Author, 2012)

	Average rain (mm)	Ave. Rain (m)	Evaporation (mm)	Evaporation (m)	Rain - evapo (m)	**Gardens (A= 0.13)**	Runoff (m^3)	Runoff (ℓ)
January	136	0.136	35	0.035	0.101	1 197.46	15.72	15 722.65
February	75	0.075	35	0.035	0.04	1 197.46	6.23	6 226.79
March	82	0.082	35	0.035	0.047	1 197.46	7.32	7 316.48
April	51	0.051	35	0.035	0.016	1 197.46	2.49	2 490.72
May	13	0.013	35	0.035	-0.022	1 197.46	-3.42	-3 424.74
June	7	0.007	35	0.035	-0.028	1 197.46	-4.36	-4 358.75
July	3	0.003	35	0.035	-0.032	1 197.46	-4.98	-4 981.43
August	6	0.006	35	0.035	-0.029	1 197.46	-4.51	-4 514.42
September	22	0.022	35	0.035	-0.013	1 197.46	-2.02	-2 023.71
October	71	0.071	35	0.035	0.036	1 197.46	5.60	5 604.11
November	98	0.098	35	0.035	0.063	1 197.46	9.81	9 807.20
December	110	0.11	35	0.035	0.075	1 197.46	11.68	11 675.24
Average rainfall per year	674					**Total**	**39.54**	
per week	12.96	0.013	35	0.035	-0.022	1 197.46	-13.20	-13 195.09

Water Budget Calculations	
CATCHMENT 1 - water harvested by storage dam	
	Harvestable water / month (m^3)
January	1 494.73
February	591.97
March	695.57
April	236.79
May	-
June	-
July	-
August	-
September	-
October	532.78
November	932.36
December	1 109.95
	5 594.14

Table 12: Water budget for Catchment 1 (Author, 2012)

IRRIGATION REQUIREMENTS / DEMAND

AGRICULTURE

Irrigation requirements for Demonstration gardens

	(m/month)	area (m^2)	irrigation/month (m^3)		irrigation/year (m^3)
Demonstration gardens	0.16	515	49.44		593.28
	(40mm/week)	**Total irrigation/year**			**593.28**
			54.38	(10% added)	682.27

Irrigation requirements for Proposed Community-based Agriculture

	(m/month)	area (m^2)	irrigation/month (m^3)		irrigation/year (m^3)
Earth mound Agriculture	0.16	1 145	109.92		1 319.04
	(40mm/week)	**Total irrigation/year**			**1 319.04**
			120.91	(10% added)	1 516.90

Irrigation requirements for Proposed Agriculture

	(m/month)	area (m^2)	irrigation/month (m^3)		irrigation/year (m^3)
Agriculture	0.16	2 345	225.12		2 701.44
	(40mm/week)	**Total irrigation/year**			**2 701.44**
			247.63	(10% added)	3 106.66

Irrigation requirements for Roof vegetable garden

	(m/month)	area (m^2)	irrigation/month (m^3)		irrigation/year (m^3)
Agriculture	0.16	575	55.20		662.40
	(40mm/week)	**Total irrigation/year**			**662.40**
			60.72	(10% added)	761.76

Table 13: Irrigation requirements for Demonstration gardens and agriculture (Author, 2012)

WASTE MANAGEMENT

Irrigation requirements for Composting area

	(m/month)	**area (m²)**	**irrigation/month (m³)**		**irrigation/year (m³)**
Composting area	0.28	1 050	176.40		2 116.80
	(70mm/week)	**Total irrigation/year**			**2 116.80**
			194.04	(10% added)	2 434.32

Irrigation requirements for Worm bins

	(m/month)	**area (m²)**	**irrigation/month (m³)**		**irrigation/year (m³)**
Worm bins	0.75	12	5.40		64.80
	(180mm/week)	**Total irrigation/year**			**64.80**
			5.94	(10% added)	74.52

Irrigation requirements for Waste wash-up area

	(m/month)	**area (m²)**	**irrigation/month (m³)**		**irrigation/year (m³)**
Waste wash-up	1.12	24	16.13		193.54
	(40mm/day)	**Total irrigation/year**			**193.54**
	(280mm/week)		17.74	(10% added)	222.57

RECREATION

Irrigation requirements for Recreation area

	(m/month)	**area (m²)**	**irrigation/month (m³)**		**irrigation/year (m³)**
Recreation area	0.16	5 303	509.09		6 109.06
	(40mm/week)	**Total irrigation/year**			**6 109.06**
			560.00	(10% added)	7 025.41

Irrigation requirements for Soccer field

	(m/month)	**area (m²)**	**irrigation/month (m³)**		**irrigation/year (m³)**
Recreation area	0.16	2 690	258.24		3 098.88
	(40mm/week)	**Total irrigation/year**			**3 098.88**
			284.06	(10% added)	3 563.71

Table 14: Irrigation requirements for Composting and Recreation area (Author, 2012)

RESOURCE / SUPPLY

Stormwater calculations of Catchment area 2 (7602 m²)

Stormwater calculations of Demonstration gardens	Areas (m^2)	Harvestable water/ month	
	Cultivated (A= 0.3)	Runoff (m^3)	Runoff (ℓ)
January	515.00	15.60	15 604.50
February	515.00	6.18	6 180.00
March	515.00	7.26	7 261.50
April	515.00	2.47	2 472.00
May	515.00	-3.40	-3 399.00
June	515.00	-4.33	-4 326.00
July	515.00	-4.94	-4 944.00
August	515.00	-4.48	-4 480.50
September	515.00	-2.01	-2 008.50
October	515.00	5.56	5 562.00
November	515.00	9.73	9 733.50
December	515.00	11.59	11 587.50
		39.24	**39 243.00**

Stormwater calculations of Proposed Community-base Agriculture	Areas (m^2)	Harvestable water/ month	
	Cultivated (A= 0.3)	Runoff (m^3)	Runoff (ℓ)
January	1 145.00	34.69	34 693.50
February	1 145.00	13.74	13 740.00
March	1 145.00	16.14	16 144.50
April	1 145.00	5.50	5 496.00
May	1 145.00	-7.56	-7 557.00
June	1 145.00	-9.62	-9 618.00
July	1 145.00	-10.99	-10 992.00
August	1 145.00	-9.96	-9 961.50
September	1 145.00	-4.47	-4 465.50
October	1 145.00	12.37	12 366.00
November	1 145.00	21.64	21 640.50
December	1 145.00	25.76	25 762.50
		87.25	**87 249.00**

Table 15: Storm water calculations for catchment 2 (Author, 2012)

Stormwater calculations of Wetland 2			
	Areas (m²)	Harvestable water/ month	
	Cultivated (A= 0.3)	Runoff (m³)	Runoff (ℓ)
January	680.00	20.60	20 604.00
February	680.00	8.16	8 160.00
March	680.00	9.59	9 588.00
April	680.00	3.26	3 264.00
May	680.00	-4.49	-4 488.00
June	680.00	-5.71	-5 712.00
July	680.00	-6.53	-6 528.00
August	680.00	-5.92	-5 916.00
September	680.00	-2.65	-2 652.00
October	680.00	7.34	7 344.00
November	680.00	12.85	12 852.00
December	680.00	15.30	15 300.00
		51.82	**51 816.00**

Stormwater calculations of Paving			
	Areas (m²)	Harvestable water/ month	
	Paving (A= 0.8)	Runoff (m³)	Runoff (ℓ)
January	-2 340.00	-189.07	-189 072.00
February	-2 340.00	-74.88	-74 880.00
March	-2 340.00	-87.98	-87 984.00
April	-2 340.00	-29.95	-29 952.00
May	-2 340.00	41.18	41 184.00
June	-2 340.00	52.42	52 416.00
July	-2 340.00	59.90	59 904.00
August	-2 340.00	54.29	54 288.00
September	-2 340.00	24.34	24 336.00
October	-2 340.00	-67.39	-67 392.00
November	-2 340.00	-117.94	-117 936.00
December	-2 340.00	-140.40	-140 400.00
		-475.49	**-475 488.00**

Water Budget Calculations	
CATCHMENT 2 - water harvested by wetland 2	
	Harvestable water / month (m³)
January	496.07
February	196.46
March	230.85
April	78.59
May	-
June	-
July	-
August	-
September	-
October	176.82
November	309.43
December	368.37
	1 856.58

Table 16: Water budget for catchment 2 (Author, 2012)

Stormwater calculations of Catchment area 3

Stormwater calculations of Proposed Agriculture	Areas (m²)	Harvestable water/ month	
	Cultivated (A= 0.3)	Runoff (m³)	Runoff (ℓ)
January	2 345.00	71.05	71 053.50
February	2 345.00	28.14	28 140.00
March	2 345.00	33.06	33 064.50
April	2 345.00	11.26	11 256.00
May	2 345.00	-15.48	-15 477.00
June	2 345.00	-19.70	-19 698.00
July	2 345.00	-22.51	-22 512.00
August	2 345.00	-20.40	-20 401.50
September	2 345.00	-9.15	-9 145.50
October	2 345.00	25.33	25 326.00
November	2 345.00	44.32	44 320.50
December	2 345.00	52.76	52 762.50
		178.69	**178 689.00**

Stormwater calculations of Composting area	Areas (m²)	Harvestable water/ month	
	Composting/ soil (A= 0.2)	Runoff (m³)	Runoff (ℓ)
January	1 050.00	21.21	21 210.00
February	1 050.00	8.40	8 400.00
March	1 050.00	9.87	9 870.00
April	1 050.00	3.36	3 360.00
May	1 050.00	-4.62	-4 620.00
June	1 050.00	-5.88	-5 880.00
July	1 050.00	-6.72	-6 720.00
August	1 050.00	-6.09	-6 090.00
September	1 050.00	-2.73	-2 730.00
October	1 050.00	7.56	7 560.00
November	1 050.00	13.23	13 230.00
December	1 050.00	15.75	15 750.00
		53.34	**53 340.00**

Stormwater calculations of Wash-Up area	Areas (m²)	Harvestable water/ month	
	Paving (A= 0.8)	Runoff (m³)	Runoff (ℓ)
January	24.00	1.94	1 939.20
February	24.00	0.77	768.00
March	24.00	0.90	902.40
April	24.00	0.31	307.20
May	24.00	-0.42	-422.40
June	24.00	-0.54	-537.60
July	24.00	-0.61	-614.40
August	24.00	-0.56	-556.80
September	24.00	-0.25	-249.60
October	24.00	0.69	691.20
November	24.00	1.21	1 209.60
December	24.00	1.44	1 440.00
		4.88	**4 876.80**

Stormwater calculations of Lawn areas	Areas (m²)	Harvestable water/ month	
	Lawn (A= 0.2)	Runoff (m³)	Runoff (ℓ)
January	450.00	9.09	9 090.00
February	450.00	3.60	3 600.00
March	450.00	4.23	4 230.00
April	450.00	1.44	1 440.00
May	450.00	-1.98	-1 980.00
June	450.00	-2.52	-2 520.00
July	450.00	-2.88	-2 880.00
August	450.00	-2.61	-2 610.00
September	450.00	-1.17	-1 170.00
October	450.00	3.24	3 240.00
November	450.00	5.67	5 670.00
December	450.00	6.75	6 750.00
		22.86	**22 860.00**

Table 17: Storm water calculations for catchment 3 (Author, 2012)

Stormwater calculations of Wetland 1	Areas (m²)	Harvestable water/ month	
	Cultivated (A= 0.3)	Runoff (m³)	Runoff (ℓ)
January	1 230.00	37.27	37 269.00
February	1 230.00	14.76	14 760.00
March	1 230.00	17.34	17 343.00
April	1 230.00	5.90	5 904.00
May	1 230.00	-8.12	-8 118.00
June	1 230.00	-10.33	-10 332.00
July	1 230.00	-11.81	-11 808.00
August	1 230.00	-10.70	-10 701.00
September	1 230.00	-4.80	-4 797.00
October	1 230.00	13.28	13 284.00
November	1 230.00	23.25	23 247.00
December	1 230.00	27.68	27 675.00
		93.73	**93 726.00**

Stormwater calculations of Paving - Pathways	Areas (m²)	Harvestable water/ month	
	Paving (A= 0.8)	Runoff (m³)	Runoff (ℓ)
January	1 540.00	124.43	124 432.00
February	1 540.00	49.28	49 280.00
March	1 540.00	57.90	57 904.00
April	1 540.00	19.71	19 712.00
May	1 540.00	-27.10	-27 104.00
June	1 540.00	-34.50	-34 496.00
July	1 540.00	-39.42	-39 424.00
August	1 540.00	-35.73	-35 728.00
September	1 540.00	-16.02	-16 016.00
October	1 540.00	44.35	44 352.00
November	1 540.00	77.62	77 616.00
December	1 540.00	92.40	92 400.00
		312.93	**312 928.00**

Stormwater calculations of Paving	Areas (m²)	Harvestable water/ month	
	Paving (A= 0.8)	Runoff (m³)	Runoff (ℓ)
January	-4 684.00	-378.47	-378 467.20
February	-4 684.00	-149.89	-149 888.00
March	-4 684.00	-176.12	-176 118.40
April	-4 684.00	-59.96	-59 955.20
May	-4 684.00	82.44	82 438.40
June	-4 684.00	104.92	104 921.60
July	-4 684.00	119.91	119 910.40
August	-4 684.00	108.67	108 668.80
September	-4 684.00	48.71	48 713.60
October	-4 684.00	-134.90	-134 899.20
November	-4 684.00	-236.07	-236 073.60
December	-4 684.00	-281.04	-281 040.00
		-951.79	**-951 788.80**

Water Budget Calculations	
CATCHMENT 3 - water harvested by wetland 1	
	Harvestable water / month (m³)
January	778.15
February	308.18
March	362.11
April	123.27
May	-
June	-
July	-
August	-
September	-
October	277.36
November	485.38
December	577.84
	2 912.30

Table 18: Water budget for catchment 3 (Author, 2012)

Stormwater calculations of Catchment area 4 (8665 m^2)

Stormwater calculations of Recreation

	Areas (m^2)	Harvestable water/ month	
	Lawn (A= 0.2)	Runoff (m^3)	Runoff (ℓ)
January	5 303.00	107.12	107 120.60
February	5 303.00	42.42	42 424.00
March	5 303.00	49.85	49 848.20
April	5 303.00	16.97	16 969.60
May	5 303.00	-23.33	-23 333.20
June	5 303.00	-29.70	-29 696.80
July	5 303.00	-33.94	-33 939.20
August	5 303.00	-30.76	-30 757.40
September	5 303.00	-13.79	-13 787.80
October	5 303.00	38.18	38 181.60
November	5 303.00	66.82	66 817.80
December	5 303.00	79.55	79 545.00
		269.39	**269 392.40**

Stormwater calculations of Paving

	Areas (m^2)	Harvestable water/ month	
	Paving (A= 0.8)	Runoff (m^3)	Runoff (ℓ)
January	-7 993.00	-645.83	-645 834.40
February	-7 993.00	-255.78	-255 776.00
March	-7 993.00	-300.54	-300 536.80
April	-7 993.00	-102.31	-102 310.40
May	-7 993.00	140.68	140 676.80
June	-7 993.00	179.04	179 043.20
July	-7 993.00	204.62	204 620.80
August	-7 993.00	185.44	185 437.60
September	-7 993.00	83.13	83 127.20
October	-7 993.00	-230.20	-230 198.40
November	-7 993.00	-402.85	-402 847.20
December	-7 993.00	-479.58	-479 580.00
		-1 624.18	**-1 624 177.60**

Stormwater calculations of Soccerfield

	Areas (m^2)	Harvestable water/ month	
	Lawn (A= 0.2)	Runoff (m^3)	Runoff (ℓ)
January	2 690.00	54.34	54 338.00
February	2 690.00	21.52	21 520.00
March	2 690.00	25.29	25 286.00
April	2 690.00	8.61	8 608.00
May	2 690.00	-11.84	-11 836.00
June	2 690.00	-15.06	-15 064.00
July	2 690.00	-17.22	-17 216.00
August	2 690.00	-15.60	-15 602.00
September	2 690.00	-6.99	-6 994.00
October	2 690.00	19.37	19 368.00
November	2 690.00	33.89	33 894.00
December	2 690.00	40.35	40 350.00
		136.65	**136 652.00**

Table 19: Storm water calculations for catchment 4 (Author, 2012)

Water Budget Calculations	
CATCHMENT 4 - water harvested by soccer field	
	Harvestable water / month (m^3)
January	215.76
February	85.45
March	100.40
April	34.18
May	-
June	-
July	-
August	-
September	-
October	76.90
November	134.58
December	160.22
	807.48

Table 20: Water budget for catchment 4 (Author, 2012)

Stormwater calculations of Catchment area 5 - Water going directly back to storage dam

Stormwater calculations of Paving - Market area			
	Areas (m^2)	Harvestable water/ month	
	Paving (A= 0.8)	Runoff (m^3)	Runoff (ℓ)
January	6 575.00	531.26	531 260.00
February	6 575.00	210.40	210 400.00
March	6 575.00	247.22	247 220.00
April	6 575.00	84.16	84 160.00
May	6 575.00	-115.72	-115 720.00
June	6 575.00	-147.28	-147 280.00
July	6 575.00	-168.32	-168 320.00
August	6 575.00	-152.54	-152 540.00
September	6 575.00	-68.38	-68 380.00
October	6 575.00	189.36	189 360.00
November	6 575.00	331.38	331 380.00
December	6 575.00	394.50	394 500.00
		1 336.04	**1 336 040.00**

Stormwater calculations of Paving (workshops & infront of buildings)			
	Areas (m^2)	Harvestable water/ month	
	Paving (A= 0.8)	Runoff (m^3)	Runoff (ℓ)
January	4 000.00	323.20	323 200.00
February	4 000.00	128.00	128 000.00
March	4 000.00	150.40	150 400.00
April	4 000.00	51.20	51 200.00
May	4 000.00	-70.40	-70 400.00
June	4 000.00	-89.60	-89 600.00
July	4 000.00	-102.40	-102 400.00
August	4 000.00	-92.80	-92 800.00
September	4 000.00	-41.60	-41 600.00
October	4 000.00	115.20	115 200.00
November	4 000.00	201.60	201 600.00
December	4 000.00	240.00	240 000.00
		812.80	**812 800.00**

Stormwater calculations of Roofs - Entrance Building (planted)			
	Areas (m^2)	Harvestable water/ month	
	Cultivated (A= 0.3)	Runoff (m^3)	Runoff (ℓ)
January	615.00	18.63	18 634.50
February	615.00	7.38	7 380.00
March	615.00	8.67	8 671.50
April	615.00	2.95	2 952.00
May	615.00	-4.06	-4 059.00
June	615.00	-5.17	-5 166.00
July	615.00	-5.90	-5 904.00
August	615.00	-5.35	-5 350.50
September	615.00	-2.40	-2 398.50
October	615.00	6.64	6 642.00
November	615.00	11.62	11 623.50
December	615.00	13.84	13 837.50
		46.86	**46 863.00**

Stormwater calculations of All Roofs			
	Areas (m^2)	Harvestable water/ month	
	Roofs (A= 0.9)	Runoff (m^3)	Runoff (ℓ)
January	2 360.00	214.52	214 524.00
February	2 360.00	84.96	84 960.00
March	2 360.00	99.83	99 828.00
April	2 360.00	33.98	33 984.00
May	2 360.00	-46.73	-46 728.00
June	2 360.00	-59.47	-59 472.00
July	2 360.00	-67.97	-67 968.00
August	2 360.00	-61.60	-61 596.00
September	2 360.00	-27.61	-27 612.00
October	2 360.00	76.46	76 464.00
November	2 360.00	133.81	133 812.00
December	2 360.00	159.30	159 300.00
		539.50	**539 496.00**

Table 21: Storm water calculations for catchment 5 (Author, 2012)

Stormwater calculations of Roofs - North Building			
	Areas (m^2)	Harvestable water/ month	
	Roofs (A= 0.9)	Runoff (m^3)	Runoff (ℓ)
January	1 380.00	125.44	125 442.00
February	1 380.00	49.68	49 680.00
March	1 380.00	58.37	58 374.00
April	1 380.00	19.87	19 872.00
May	1 380.00	-27.32	-27 324.00
June	1 380.00	-34.78	-34 776.00
July	1 380.00	-39.74	-39 744.00
August	1 380.00	-36.02	-36 018.00
September	1 380.00	-16.15	-16 146.00
October	1 380.00	44.71	44 712.00
November	1 380.00	78.25	78 246.00
December	1 380.00	93.15	93 150.00
		315.47	**315 468.00**
		26.29	26 289.00

	Total capacity (ℓ)
∴ Jojo storage tank	27 000

Stormwater calculations of Roofs - South Building			
	Areas (m^2)	Harvestable water/ month	
	Roofs (A= 0.9)	Runoff (m^3)	Runoff (ℓ)
January	980.00	89.08	89 082.00
February	980.00	35.28	35 280.00
March	980.00	41.45	41 454.00
April	980.00	14.11	14 112.00
May	980.00	-19.40	-19 404.00
June	980.00	-24.70	-24 696.00
July	980.00	-28.22	-28 224.00
August	980.00	-25.58	-25 578.00
September	980.00	-11.47	-11 466.00
October	980.00	31.75	31 752.00
November	980.00	55.57	55 566.00
December	980.00	66.15	66 150.00
		224.03	**224 028.00**
		18.67	18 669.00

	Total capacity (ℓ)
∴ Jojo storage tank	18 000

GREYWATER

Greywater calculations

Greywater per family of 6 190 000 - 250 000 ℓ per year

	Occupants	(ℓ) Per day	(ℓ) per Month	(m^3) per month	(ℓ) per year	(m^3) per year
Greywater	1	136.38	4 227.78	4.23	49 778.70	49.78
North building	16	2 182.08	67 644.48	67.64	796 459.20	796.46
South building	22	3 000.36	93 011.16	93.01	1 095 131.40	1 095.13
Entrance building	8	1 091.04	33 822.24	33.82	398 229.60	398.23
Total		**6 409.86**	**198 705.66**		**2 339 598.90**	

	ℓ	m^3
Average Greywater for site/year	2 339 598.90	2 339.60
per month	198 705.66	198.71

Source: RSG Radio Interview - http://www.youtube.com/watch?v=UZcXm3gE1aQ&feature=player_detailpage

Table 22: Greywater calculations (Author, 2012)

Construction of Berea Park ~Organic Waste Recycling Park~			
THE SUSTAINABLE SITES INITIATIVE RATING SYSTEM 2009			
SECTION		POSSIBLE POINTS	RECEIVED POINTS
1. Site Selection	21 possible points		15
Select locations to preserve existing resources and repair damaged systems			
Prerequisite 1.1: Limit development of soils designated as prime farmland, unique farmland, and farmland of statewide importance **Prerequisite 1.2:** Protect floodplain functions **Prerequisite 1.3:** Preserve wetlands **Prerequisite 1.4**: Preserve threatened or endangered species and their habitats 24			
Credit 1.5: Select brownfields or greyfields for redevelopment		5 - 10	5
Credit 1.6: Select sites within existing communities		6	6
Credit 1.7: Select sites that encourage non-motorized transportation and use of public transit		5	4

2. Pre-Design Assessment and Planning	4 possible points		4
Plan for sustainability from the onset of the project			
Prerequisite 2.1: Conduct a pre-design site assessment and explore opportunities for site sustainability **Prerequisite 2.2:** Use an integrated site development process			
Credit 2.3: Engage users and other stakeholders in site design		4	4

3. Site Design - Water	44 possible points		29

Table 23: The Sustainable Sites Initiative rating for Berea Park (Author, 2012)

Protect and restore processes and systems associated with a site's hydrology		
Prerequisite 3.1: Reduce potable water use for landscape irrigation by 50 percent from established baseline		
Credit 3.2: Reduce potable water use for landscape irrigation by 75 percent or more from established baseline	2 - 5	3
Credit 3.3: Protect and restore riparian, wetland, and shoreline buffers	3 - 8	3
Credit 3.4: Rehabilitate lost streams, wetlands, and shorelines	2 - 5	2
Credit 3.5: Manage stormwater on site	5 - 10	8
Credit 3.6: Protect and enhance on-site water resources and receiving water quality	3 - 9	8
Credit 3.7: Design rainwater/stormwater features to provide a landscape amenity	1 - 3	3
Credit 3.8: Maintain water features to conserve water and other resources	1 - 4	2

4. Site Design - Soil and Vegetation	51 possible points		33
Protect and restore processes and systems associated with a site's soil and vegetation			
Prerequisite 4.1: Control and manage known invasive plants found on site **Prerequisite 4.2:** Use appropriate, non-invasive plants **Prerequisite 4.3:** Create a soil management plan			
Credit 4.4: Minimize soil disturbance in design and construction		6	3
Credit 4.5: Preserve all vegetation designated as special status		5	5
Credit 4.6: Preserve or restore appropriate plant biomass on site		3 - 8	5
Credit 4.7: Use native plants		1 - 4	4
Credit 4.8: Preserve plant communities native to the ecoregion		2 - 6	5

Credit 4.9: Restore plant communities native to the ecoregion	1 - 5	1
Credit 4.10: Use vegetation to minimize building heating requirements	2 - 4	2
Credit 4.11: Use vegetation to minimize building cooling requirements	2 - 5	2
Credit 4.12: Reduce urban heat island effects	3 - 5	3
Credit 4.13: Reduce the risk of catastrophic wildfire	3	3

5. Site Design - Materials Selection	36 possible points		28
Reuse/recycle existing materials and support sustainable production practices			
Prerequisite 5.1: Eliminate the use of wood from threatened tree species			
Credit 5.2: Maintain on-site structures, hardscape, and landscape amenities		1 - 4	1
Credit 5.3: Design for deconstruction and disassembly		1 - 3	1
Credit 5.4: Reuse salvaged materials and plants		2 - 4	2
Credit 5.5: Use recycled content materials		2 - 4	4
Credit 5.6: Use certified wood		1 - 4	3
Credit 5.7: Use regional materials		2 - 6	6
Credit 5.8: Use adhesives, sealants, paints, and coatings with reduced VOC emissions		2	2
Credit 5.9: Support sustainable practices in plant production		3	3
Credit 5.10: Support sustainable practices in materials manufacturing		3 - 6	6

6. Site Design - Human Health & Well-Being	32 possible points		29
Build strong communities and a sense of stewardship			
Credit 6.1: Promote equitable site development		1 - 3	3
Credit 6.2: Promote equitable site use		1 - 4	3
Credit 6.3: Promote sustainability awareness and education		2 - 4	4
Credit 6.4: Protect and maintain unique cultural and historical places		2 - 4	2
Credit 6.5: Provide for optimum site accessibility, safety, and wayfinding		3	3

Credit 6.6: Provide opportunities for outdoor physical activity	4 - 5	5
Credit 6.7: Provide views of vegetation and quiet outdoor spaces for mental restoration	3 - 4	4
Credit 6.8: Provide outdoor spaces for social interaction	3	3
Credit 6.9: Reduce light pollution	2	2

7. Construction	21 possible points		19
Minimize effects of construction-related activities			
Prerequisite 7.1: Control and retain construction pollutants **Prerequisite 7.2:** Restore soils disturbed during construction			
Credit 7.3: Restore soils disturbed by previous development		2 - 8	6
Credit 7.4: Divert construction and demolition materials from disposal		3 - 5	5
Credit 7.5: Reuse or recycle vegetation, rocks, and soil generated during construction		3 - 5	5
Credit 7.6: Minimize generation of greenhouse gas emissions and exposure to localized air pollutants during construction		1 - 3	3

8. Operations and Maintenance	23 possible points		16
Maintain the site for long-term sustainability			
Prerequisite 8.1: Plan for sustainable site maintenance **Prerequisite 8.2:** Provide for storage and collection of recyclables			
Credit 8.3: Recycle organic matter generated during site operations and maintenance		2 - 6	6
Credit 8.4: Reduce outdoor energy consumption for all landscape and exterior operations		1 - 4	1
Credit 8.5: Use renewable sources for landscape electricity needs		2 - 3	2
Credit 8.6: Minimize exposure to environmental tobacco smoke		1 - 2	2
Credit 8.7: Minimize generation of greenhouse gases and exposure to localized air pollutants during landscape maintenance activities		1 - 4	3
Credit 8.8: Reduce emissions and promote the use of fuel-efficient vehicles		4	2

9. Monitoring and Innovation	18 possible points		13
Reward exceptional performance and improve the body of knowledge on long-term sustainability			
Credit 9.1: Monitor performance of sustainable design practices		10	8
Credit 9.2: Innovation in site design		8	5

Total	**Possible points**	**250**	186

2009 Rating System:	**250 Points Total**
One Star:	100 points (40% of total points)
Two Stars:	125 points (50% of total points)
Three Stars:	150 points (60% of total points)
Four Stars:	200 points (80% of total points)

Rating	3 Stars

Fig. 196 - 198: Presentation Photos (Boshoff, 2013)

Fig. 199 - 201: Photos of Model (Author, 2013)