

Chapter 5

SITE SELECTION

The Pretoria Botanical Gardens.



Fig 5.1: NBG site features (Author 2015)

5.1 Introduction

Stemming from the research in the theoretical discourse, a site had to be chosen where the design approach based on the author's Landscape Architecture Manifesto could be applied. The Pretoria National Botanical Garden was chosen for this purpose. In this chapter, the chosen site will be analyzed according to the design principles that apply to landscape performance to see whether the site is performing, where it fits in according to the development of botanical gardens over the centuries, and how this designer needs to approach it to increase its performative abilities and bring it up to the standard of contemporary best practice in botanical gardens. Local and international botanical gardens will be discussed to assist in this analysis.

5.2 Brief history

The Pretoria National Botanical Garden is located in the eastern suburbs of South Africa's administrative capital, the City of Tshwane. The Garden has delivered nearly six decades of conservation, research, exploration, development and service to the greater Pretoria community. Although formal approval was granted by the University of Pretoria for the development of the area as a botanical garden in 1946, the Garden was only officially opened by the Minister of Agriculture, Mr P.K. le Roux, in 1958. Before its proclamation, the Garden formed part of the University of Pretoria's Experimental Farm. The main reason for the transfer of land from the University of Pretoria was that the land had been found to be unsuitable for experimental agricultural purposes, owing partly to its isolation and also to the presence of an abundance of Poison Leaf (Gifblaar; *Dichapetalum cymosum*), a plant which is poisonous to livestock and can form extensive colonies in grasslands, particularly in sandy soils (Dyer 1960:11).

The first trees were planted in the Garden in 1946. Up until 1989 the Garden was managed by the Department of Agriculture's Botanical Research Institute (BRI), which was established in 1903. Construction of the National Herbarium building was started in 1970, and it was formally opened in 1973 as the new head office building for the BRI. During 1989, with the formation of the parastatal National Botanical Institute (NBI) through the amalgamation of the BRI with the National Botanic Gardens of South Africa, the Garden joined the other seven national botanical gardens as part of South Africa's network of eight national botanical gardens, managed by a single institution. In the mid-2000s, the Garden became the Head Office of the South African National Biodiversity Institute (SANBI), after the proclamation of the National Environmental Management: Biodiversity Act (NEMBA) in September 2004.

5.3 Pretoria Garden declared a national monument

On 25 October 1979 the Pretoria National Botanical Garden was declared a National Monument. Although the Government Gazette cites the scientific interest of the Garden as "containing one of the most important and comprehensive collections of indigenous flora in the country", correspondence between various parties indicates the primary reason for the site to be declared was to prevent the further alienation of land for road building (the N1 Freeway) and the erection of other government buildings. With the proclamation of the National Heritage Resources Act (NHRA), No. 25 of 1999, all National Monuments became Provincial Heritage Sites reporting to the Provincial Heritage Resources Authority (PHRA) under the South African Heritage Resources Agency (SAHRA).

5.4 The Garden's animal biodiversity

Since the formation of the SANBI, the Garden has been active in documenting and exploring the biodiversity riches within its boundaries. Several biodiversity surveys have been conducted, including an insect diversity survey and preliminary survey of butterflies.

5.5 International agenda

In 2003 the Pretoria Garden committed itself to implementing the International Agenda for Botanic Gardens in Conservation, an international initiative led by Botanic Gardens Conservation International (BGCI) and linked to the Global Strategy for Plant Conservation. By the end of 2005, five years since its development, 443 organisations in 82 countries, including the SANBI, had registered their commitment to use the International Agenda as a framework for developing institutional policies and programs for plant conservation. The Pretoria Garden plays an important role in conserving one of the last remaining patches of natural grassland in the eastern suburbs of Pretoria, as well as providing a natural corridor for animal movement along the Silverton Ridge.

5.6 Botanic Garden Conservation International (BGCI)



BGCI
Plants for the Planet

The goal of BGCI is to re-evaluate the philosophies, values and practices of botanical gardens in order to create social and environmental awareness and change. It highlights the importance of understanding plant diversity and the need for conservation. It focuses on unlocking the potential of botanical



Fig 5.2: Site plan NBG (Author 2015)

gardens to help educate and reconnect local communities with the world of plants, as well as showcase models for sustainable living (BGCI).

5.7 Site analysis

5.7.1 Area, climate and seasonal variation

The 76 ha garden incorporates part of the Silverton Ridge, and receives rainfall mostly during the summer months, from November to March. Most of the rainfall is associated with summer thunderstorms. Of the total area of the garden, an area of 43 ha is regarded as landscaped, with the remaining 33 ha being either natural or low-maintenance areas.

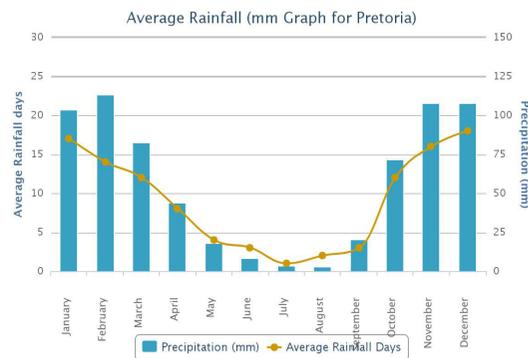


Fig 5.3: Rainfall in Pretoria

Situated on the highveld, the garden experiences frost in winter, particularly visible in the early mornings on the lawns on the southern side of the garden. Black frost does occur infrequently in the garden, usually about once every few years during the winter months.

Similar to other botanical gardens situated on the highveld, namely the Walter Sisulu and Free State National Botanical Gardens, seasonal changes are quite noticeable in the garden. In winter the grass turns brown, with colour being added to the garden by various species of flowering aloes and other succulents, such as *Cotyledon orbiculata* with its drooping red flowers. During spring/summer the garden becomes transformed with new spring growth and the first summer rains seem to turn it into a green oasis.

5.7.2 Altitudinal/topographical variation, rainfall and geology

The garden is situated at an altitude of 1,350 m above sea level (with the highest point recorded at 1,385 m), and receives on average 750 mm rainfall per annum.

A 35 m high east-west running quartzitic sandstone ridge divides the garden into a cooler southern and warmer northern section. The ridge forms part of the Daspoort range (separated from the Magaliesberg range by the shales of the Silverton Formation) that extends from Botswana in the west to Delmas (Mpumalanga) in the east. Most of the natural areas are restricted to the ridge, which comprises relatively hard quartzitic sandstone of the Daspoort Formation (deposited some 2,200 million years ago), and the natural grassland areas south-east of the ridge. Areas north and south of the central ridge are relatively flat.

GEOLOGY

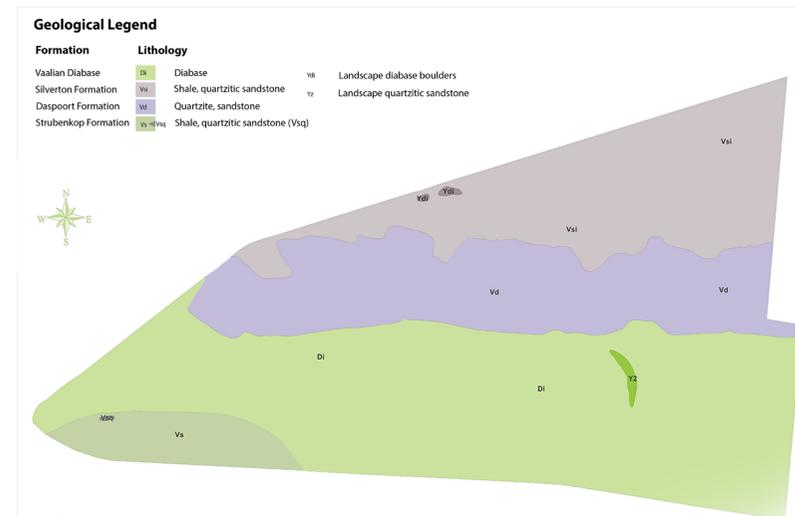


Fig 5.4: Geology of NBG (Author 2015)

5.7.3 Fauna and flora



Fig 5.5: Grassland at NBG (Author 2015)

The garden comprises various different habitats. These include the ridge, natural grasslands, a landscaped section and the savanna area north of the ridge. Almost 200 bird species have been recorded in the garden, each associated with a variety of different habitats in the garden.

SILVERTON RIDGE: Bankenveld vegetation
Description: (-+) 40% slope
 Conservation of natural ridge vegetation
Botanical use: Scientific: Herbarium & Biodiversity Centre
 Ecological: Conservation
 Economic: Research
Users experience: Recreation: Exploring/walking trails
 Didactic: Plant collections



Description: (-+) 4,5% slope
 Most active central area of Pretoria NBG
 Economic: Entrance
 Point of dispersion
Users experience: Recreational: Urban park/Picnic/Tea garden
 Didactic: Pockets of themed plant gardens



Description: (-+) 2,9% slope
 Grassland
Botanical use: Ecological: Conservation
 Economic: Environmental Education Centre
Users experience: Didactic: Grassland/Environmental Education



Description: (-+) 3.9% slope
 Lawn with scattered trees
 Empty pond
 Borders wetland and restaurant
 Undeveloped
 Underused area
Users experience: Didactic: Tree route/Wetlands
 Recreation: Picnic/Restaurant
 Economic: Exhibitions/Functions

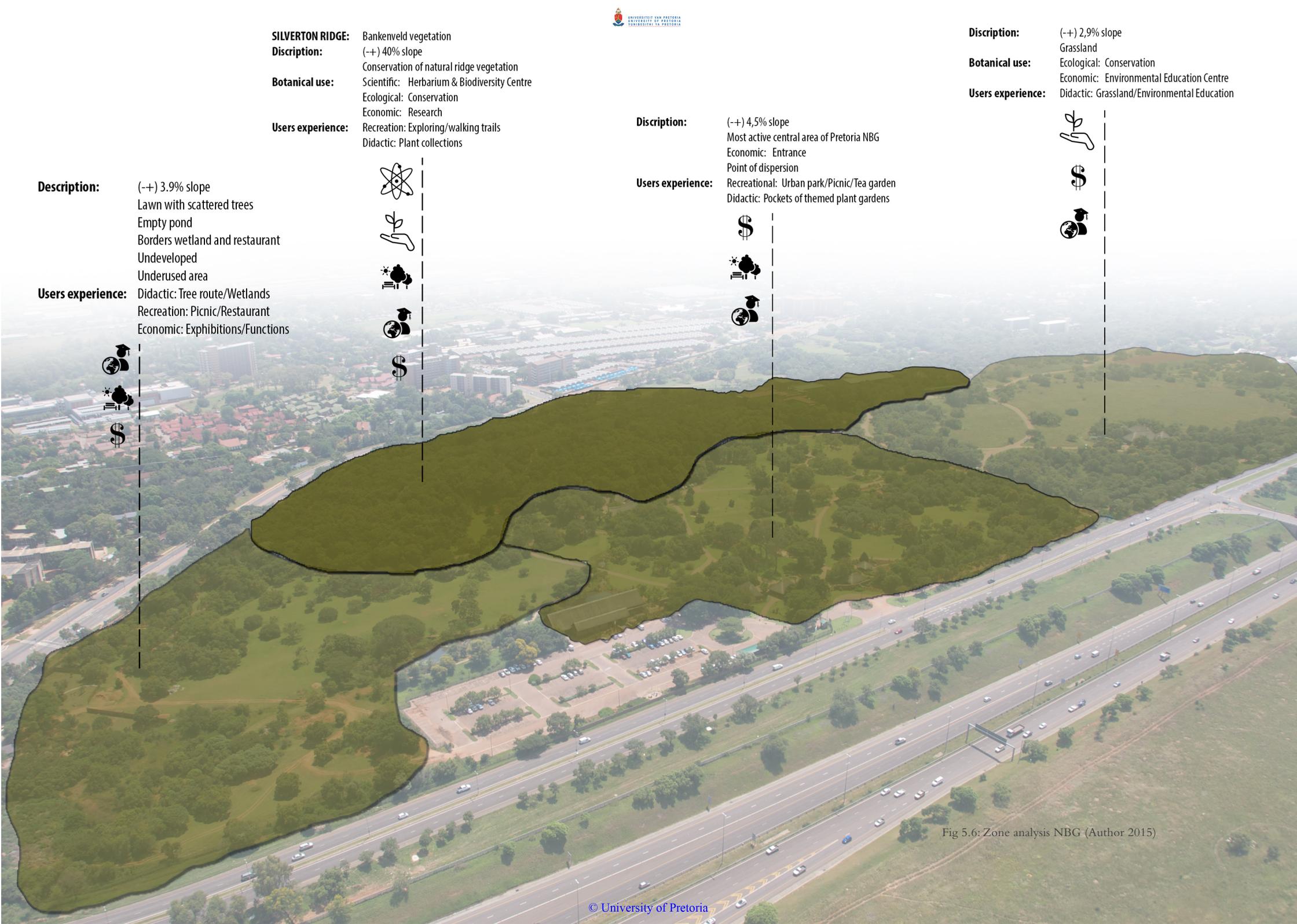


Fig 5.6: Zone analysis NBG (Author 2015)

5.7.4 Water in the garden

No perennial water flows through the garden, and most of the water used for irrigation purposes originates from boreholes, mostly sunk in 1946, situated to the north of the ridge. There are seven boreholes on the site. These provide a total of 1 529 186 million litres of borehole water. Artificial water features that have been created in the garden include a waterfall in the middle of the garden (1992), a few ponds situated west of the Tea Garden and in the north-western corner of the garden, as well as a wetland completed as part of the restaurant development in 2004. The water from the wetland overflows into a depression (± 30 –40 metres away at the south-east corner of the site) when flood rains occur. Several birds can be observed in the ponds near the Cycad Garden.



Fig 5.7: Waterfall at NBG (Author 2015)



Fig 5.8: Wetland at NBG (Author 2015)

5.7.5 Walking trails

An interpretive trail known as the Dassie Trail has been laid out along the length of the ridge, and was named after the rock dassies frequently found on the ridge. The trail starts at the waterfall next to the Tea Garden and meanders along the ridge in the centre of the garden.

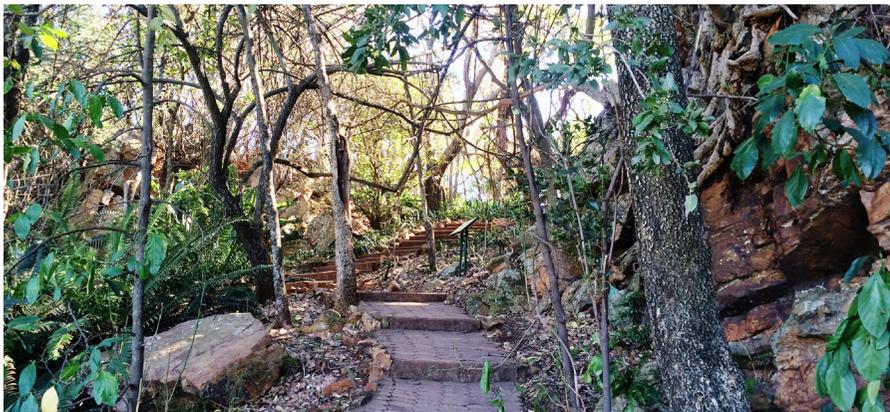


Fig 5.9: Ridge routes at NBG (Author 2015)

5.7.6 Vegetation types

The vegetation type naturally occurring in the garden is Marikana Thornveld.

5.7.7 Special collections

The garden incorporates South Africa's National Herbarium, housing over 1.2 million pressed plant specimens from southern and tropical Africa. The herbarium building in the centre of the garden incorporates the Mary Gunn Library, generally regarded as the most comprehensive and largest botanical library in Africa.

West of the Tea Garden is a planted special collection of cycads (*Encephalartos* spp.) indigenous to southern Africa.

5.8 Conservation activities

5.8.1 Alien invasive plants

Alien invasive plants that have been recorded in the garden, all originating from South America and which need to be continually monitored, include Lantana (*Lantana camara*, a proclaimed noxious weed), the Moth Catcher (*Araujia sericifera*), Bugweed (*Solanum mauritanium*), the Potato Creeper (*Solanum seafortianum*), recorded as a climber on trees along the ridge, and the grassland-associated Pom-pom Weed (*Campuloclinium macrocephalum*) with its pink flowers that invades grasslands and roadsides. Lantana is difficult to eradicate because of the ease with which the seeds are distributed in bird droppings. Illness and death in children have been reported after eating green lantana fruits, but ripe fruits are reported to be edible. Lantana and the two solanum species are all bird-dispersed plants, whereas both the pom-pom weed and moth catcher are wind-dispersed.

Other weeds known to occur in the garden include the Madagascar Periwinkle (*Catharanthus roseus*; drought resistant and common on disturbed sites, such as along pathways and roadways), Jacaranda (*Jacaranda mimosifolia*), Cat's Claw Creeper (*Macfadyena unguis-cati*), Syringa (*Melia azedarach*), various privet species (*Ligustrum* spp.), the Inkberry (*Cestrum laevigatum*), and the succulent Queen of the Night (*Cereus jamacaru*).

5.8.2 Silverton Seismological Station

The Council for Geoscience has established the Silverton Seismological Station on the northern side of the garden, below the Silverton Ridge. Excavated to bedrock, this station that was built in 1981 is currently used to record seismic events worldwide. The Silverton Seismological Station is a duplicate of the system used by the Council for Geoscience in Antarctica, and together with another five seismological stations

around the country, is used to supply continuous data from South Africa to the Indian Ocean Tsunami Warning System based in Mauritius.

5.9 Movement analysis

According to Johnson (2007), some of the main functions of a botanical garden is to provide recreational and didactic experiences to the visitor. Movement through the garden, as well as the way visitors interact with the plants and what they learn on their visit, has a big influence on the experience a visitor has. The main critique would be that the botanical garden is very much “purist” in its composition. In the landscaped area the plants are confined to plant beds, which form borders along which movement takes place. Thus, plants become a means to define pathways for one to get to a destination, which in most cases is recreational. The focus is not on the plants, as it should be in a botanical garden, but on the romantic idea of a park.

However, some plant collections are concentrated at specific points in the garden. The visitor is drawn onto more intimate pathways that explode on either side with a variety of plant species, all relating to a similar theme. Strong borders are kept in place to confine plants to their beds and cause a separation between man and plant. These borders give the message quite clearly that interaction between visitors and nature is largely frowned upon. Also, these collections focus mostly on horticultural activities, but the way the information is conveyed to the user is merely through information boards throughout the garden. The plant collections themselves do not care much for the way man experiences them. Can these themed plant collections be designed in such a way that they actually start to teach the visitor something about nature without physically having to spell it out?

The ridge is covered with trails that meander throughout the northern and southern slopes. Here one can already start to get a better idea of the essence of nature, as the visitor becomes immersed in it rather than viewing it from the side. However, one must keep in mind that this is a botanical garden and not a nature reserve. Thus, how can the visitor be presented with the essence of nature in a way that allows him to perceive its beauty on every possible level and allows nature to perform in its intuitive way without confining it, but also design in a way that tells visitors that it is the plants that they should be focusing on and appreciating?



Fig 5.10: Movement through recreational park (Author 2015)



Fig 5.11: Theme garden plant beds, NBG (Author 2015)



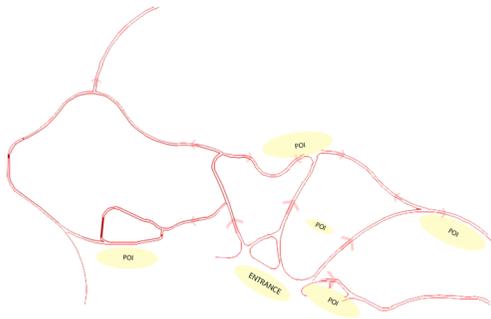
Fig 5.12: Ridge route edging, NBG (Author 2015)

EXISTING MOVEMENT SYSTEMS

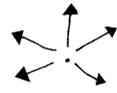
MOVEMENT ANALYSIS
(SIMMONDS 1983)

SPATIAL EXPERIENCE

SPATIAL ANALYSIS



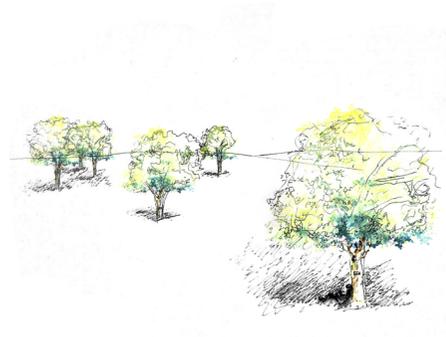
RECREATIONAL PARK



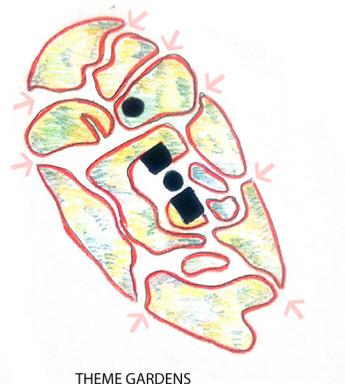
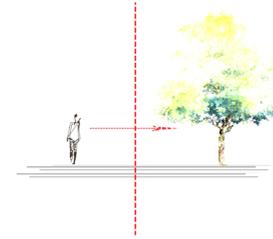
DISPERSING



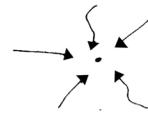
CURVILINEAR



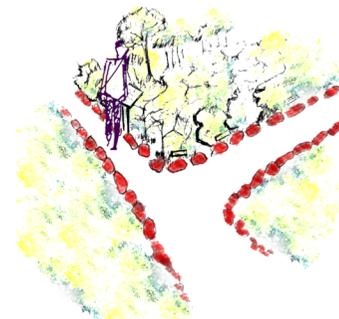
Prospect ive views over the garden. Recreational. Minimum interaction with plants. Movement defined by plant beds, plant are not the main focus.



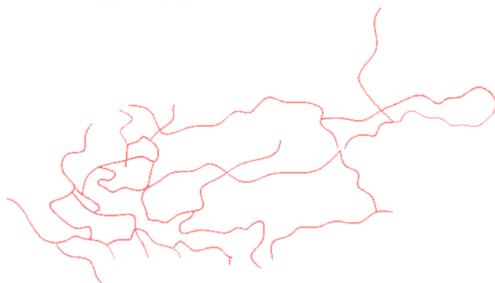
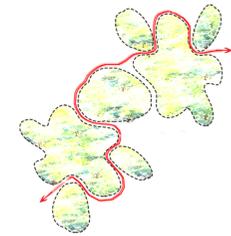
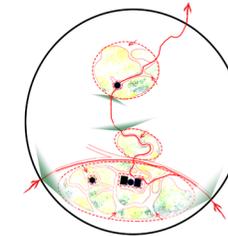
THEME GARDENS



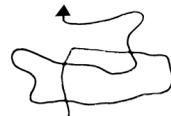
ASSEMBLE



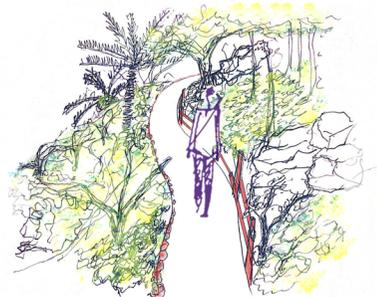
Themed gardens pull you in from vast open spaces to more intimate spaces. Plants are confined to strong borders and do not allow for active exploration.



RIDGE TRAILS



MEANDERING



Exploratory trails through the Silverton ridge immerse the audience in nature. However, experience similar to a nature reserve rather than a botanical garden.

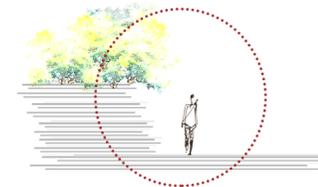
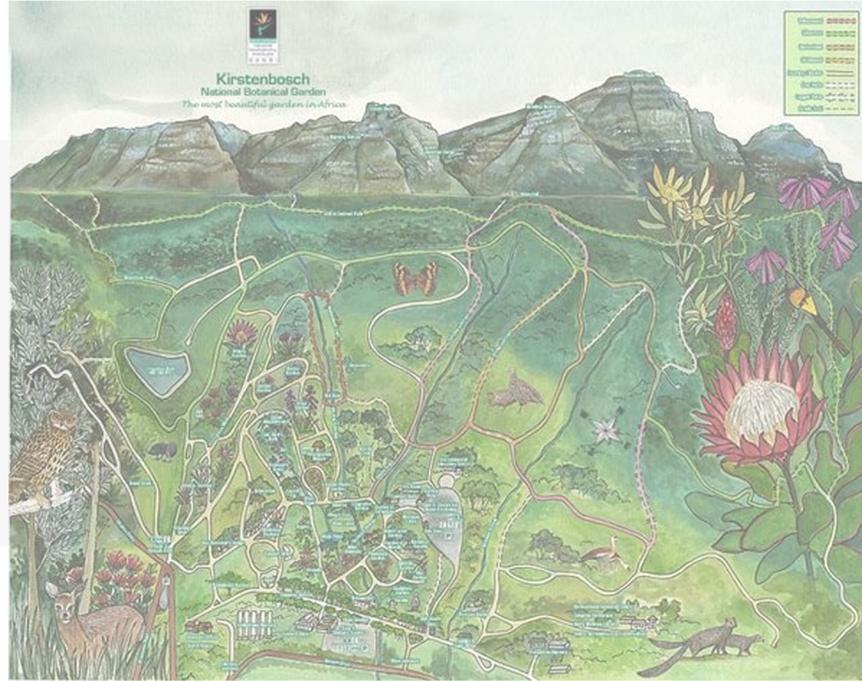


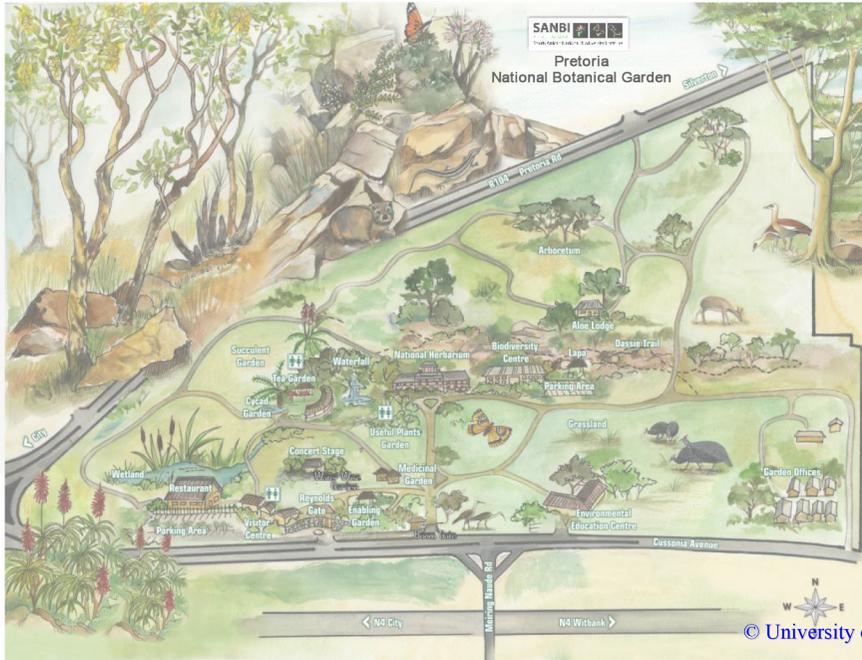
Fig 5.13: Movement analysis NBG (Author 2015)

PRECEDENT STUDIES

KIRSTENBOSCH NATIONAL BOTANICAL GARDENS



PRETORIA NATIONAL BOTANICAL GARDENS



“They serve to educate, to explore, to fascinate, and to discover. They will continue to reflect our relationship with plants and the rest of the natural world, and they will continue to remind us of wonders of life here on earth.”

Brian Johnson (2007)



- Research
- Environment specific gardens
- Medicinal advances
- Botanical exploration
- Assessing economic value of species
- Relationships of plants and growth patterns

- Plant genetics
- Biodiversity
- Conservation of plants, diversity and habitats

- Research: Local and regional
- Study relationships between plants
- Name and describe new plant species
- Millennium Seed Bank Partnership
- Document plant diversity of Cape Floristic Region

- Conservation of natural vegetation of Kirstenbosch: Fynbos (Restio, Protea, Fynbos, Buchu and Erica garden) and Forest.
- Xerophytic plants from the arid regions of South Africa
- Conservation of succulent Karoo Biome
- Conservation of Cape Peninsula vegetation.
- Vlei gardens, pond biodiversity, stream, natural spring at dell.

- Exotic/Rare plant collections
- Library
- Environmental & specie education
- Horticultural experiments: Theme gardens

- Plant collection gardens (Cycad Amphitheatre, Protea garden, Erica garden, Arboretum, vygies, Pelargonium)
- Historic collections: Camphor Avenue, Van Riebeeck's hedge, Magic tree
- Library
- Conservation programs
- Theme demonstration gardens: Fragrance garden, Garden of Extinction, Water-Wise, Garden of Weeds, Wildlife, Useful Plants, Annuals.

- Aesthetic enjoyment
- Public leisure
- Restaurants
- Commercial
- Social spaces
- Exercise
- Escape from city

- Stage
- Three restaurants
- Multiple shops
- Lawn for picnics
- Green civic escape
- Trails and walks
- Childrens play areas
- Attractions (tree canopy walkway)
- Sculpture/Art

- Plant nursery
- Cultivation
- Event spaces
- Stage

- Conference and exhibition centre
- Function venue,
- Lecture halls
- Concert stage
- Kirstenbosch Guesthouse
- Restaurants
- Tree canopy walk
- Various shops and art sales
- Wholesale Plant sales

volving
the many

"...botanic gardens will continue to be humanity's main scientific, aesthetic and social link to plants."

Brian Johnson (2007)

- Research
- Collect plants to fill the gaps in distribution data of southern African plants
- Study relationships between plants
- Name and describe new plant species
- Millennium Seed Bank Partnership

- Plant collection which represents the flora of the country as accurately as possible.
- Madagascar Plant Collection, Grassland, Wetland, Succulents, Cycads

- Houses the Mary Gunn Library, which is the largest botanical library in Africa.
- Theme demonstration gardens (Water-wise, Enabling, Medicinal, Succulent, Wetland, Grassland, Traditional plant use).
- Workshops

- Stage
- Tea garden and restaurant
- Shop
- Lawn for picnic
- Boot camp and park run
- Green civic escape
- Trails (Dassie trail, tree route)
- Lapa
- Sculptures/Art

- Adventure Boot Camp for Women,
- Concerts,
- Picnics,
- Natural history courses,
- Private functions,
- Expos (e.g. Gardener Live)
- Restaurant

Fig 5.14: NBG vs. Kirsstenbosch (Author 2015)

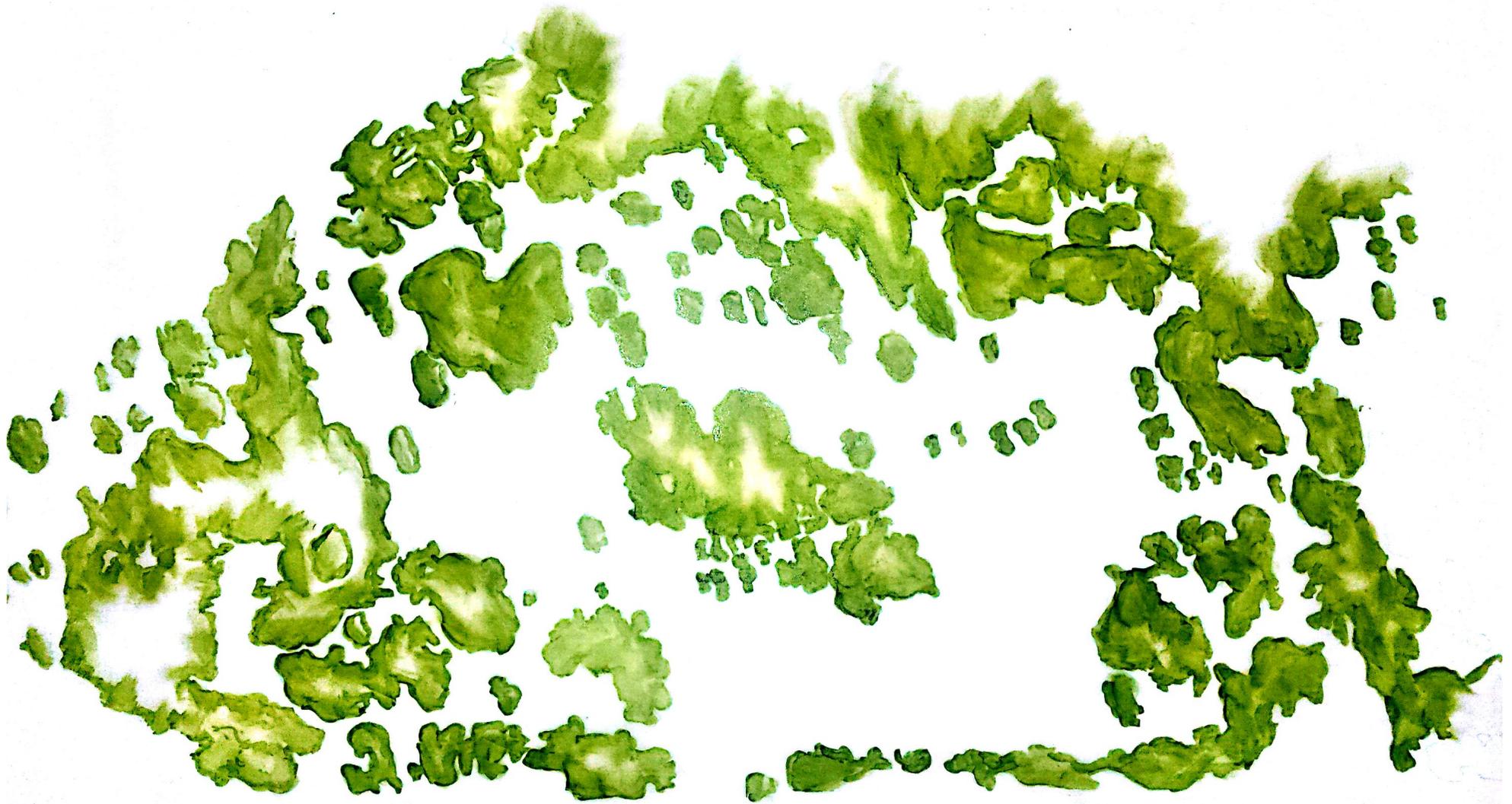


Fig 5.15: Existing vegetation mapping (Author 2015)

The precedent in fig 5.14 on p. 46–47, shows a clear comparison between the best practice in South Africa regarding botanical gardens, Kirstenbosch National Botanical Gardens, and the chosen botanical garden where the design project is focussed on. Through this comparison one can start noticing in which areas the Pretoria NBG is lacking. Noticeably the ecological and didactic qualities of Pretoria NBG is lacking and would be ideal to use as a focus point in the design to improve on.

5.10 Framework

Regional Context: Tshwane Spatial Development Framework (Region 6)

The Spatial Planning and Land Use Management Act (2013) and Gauteng Planning and Development Act (2003) determined that a municipality must formulate a spatial framework. The City of Tshwane (CoT) embarked on processes to compile seven Regional Spatial Development Frameworks (RSDFs). The Tshwane National Botanical Garden falls within Region 6 for administrative and planning purposes.

An important element of the spatial development framework is the ‘environmental structuring concept’. Tshwane’s urban form and identity is closely linked to the influence of its natural and cultural elements. The developed areas are intimately intertwined with open spaces, creating a city with an unique character. The spatial development of the city intends to continue to value the role and prominence of the natural environment that sustains and informs the city. The natural structuring elements of Tshwane are those physical features that have to a great extent influenced the historical growth and settlement development pattern and that have an important ecological role to play in the ecological integrity of the metropolitan area.

A well-defined open space network is an important part of the Spatial Development Concept of the MSDF. The Tshwane Open Space Framework (2005) informed the SDF with regard to open spaces and conservation areas. The development of an open space network is an integral part of shaping the city. Ecological resources are irreplaceable and should thus be one of the major structuring elements guiding the development of the city instead of unplanned urban growth taking precedence and open space becoming merely land that is not desirable for urban development and thus ‘left over’ space. An important step in shaping urban form is thus the determination of an open space network, which contains natural; processes and systems. The Tshwane open space network is concerned with the spatial structure of green areas in the urban landscape and with all planning activities that are essential to create conditions for green areas to perform ecological services and to contribute to the quality of urban life. It is thus used to indicate the position of green areas in the urban landscape. As such it has spatial, social and technical dimensions. An open space network is also a planning concept, indicating the intention to develop

planning and management tools for the structuring role of green areas in the urban fabric and the urban organization.

An open space network contains not only the elements that constitute the open space itself (vegetation, water, animals, natural materials, etc.), but above all how the various open spaces are shaped in relation to the concepts of distribution and organization, to form a system of open spaces. An open space network incorporates a wide variety of open spaces into one system. Open spaces cease to be discreet elements within the city but together form a network in which each component contributes to the whole.

It must be stressed that an open space network does not focus only on ‘green’ spaces, but also on more urban or ‘brown’ spaces as well as spaces that contribute to the place-making of the city. (Tshwane SDF: Region 6: 2013)

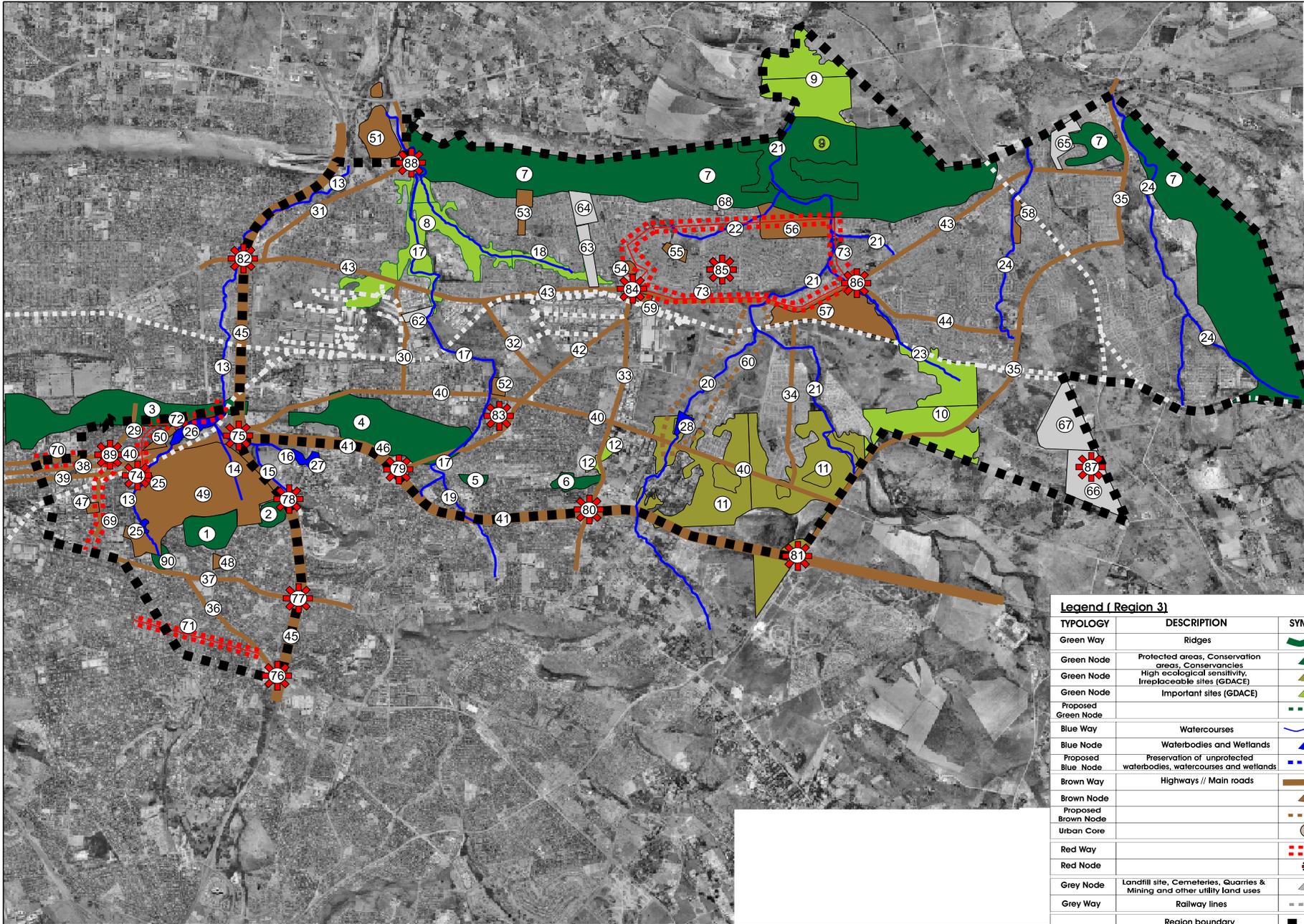
The Tshwane Open Space Network is developed on the basis of a lattice concept of soft (natural, green) and hard (urban, brown) linear spaces crossing each other to form a range of soft and hard nodes. The National Botanical Gardens is categorized in terms of this as a ‘green node’.

Green Nodes are areas within which ecological systems, processes and value are concentrated. They include important habitats for fauna and flora, and areas representative of local biomes, vegetation types and high ecological sensitivity such as Protected Areas, GDACE irreplaceable and important sites. Green Nodes are the most important elements in the provisioning of environmental goods and services, the protection of biodiversity, endangered species and ecological systems, as well as eco-based activity. Green Nodes must be protected for conservation purposes.

Green Nodes can occur in a pristine or natural state, but are generally characterised as natural. Every attempt must be made to retain Green Nodes in as pristine a state as possible. As little as possible human intervention must be allowed: Human intervention must be sensitively located with a minimum footprint (cluster and space principle). A network of low impact movement between human interventions can be allowed. Activities must focus on ecological research, education, conservation of biodiversity, ecotourism, trails, guided walks.

According to the open space framework, only endemic vegetation must be allowed. It can be complemented with a network of trails. Strict control of development and invader species must be practiced. Rehabilitation of disturbed areas must be sought at all times. (Tshwane Open Space Framework, 2005:24)

The surrounding area of the National Botanic Garden is characterised by the following environmental aspects:



- Significant ridge systems in the northern parts, notably the Magaliesberg system;
- Significant water course systems throughout most notably the Pienaars Rivier, Moreleta, Vlakfontein, Hatherly and Hartbeest Spruite;
- Significant wetlands systems at the University of Pretoria Sport Grounds, Colbyn, Cussiona Spruit, Nelmapius;
- The Frank Struben Bird Sanctuary.
- Ecological sensitive areas associated with ridge and watercourse systems and at Hatherley;
- Limited CTMM (City of Tshwane Metropolitan Municipality) maintenance actions around the ridge system;
- Limited CTMM maintenance data on all types of open space resources;
- Low ratio of developed open space, especially in the eastern most extent of the region;
- Various regional recreational open space facilities such as Moretele Park, Derdepoort and regional sport facilities such as HM Pitse, Silverton, Eersterust, Stanza Bopape;
- Potential Placemaking opportunities around the N\$, N1 and at the Urban Core for Eerste Fabrieke.

POLICY STATEMENTS FOR DEVELOPMENT/MANAGEMENT OF GREEN NODES

- Protected areas are strategically important Ecological Structuring Elements within the Tshwane Open Space network and must be conserved.
- CTMM managed conservation areas, designated by GDACE as Protected Areas, need to be formally declared as Protected Areas
- The management of Protected Areas must aim to maximise ecological functioning and environmental goods and services rendering and must facilitate the improved utilisation and exposure of such Open Space resources.
- The Gauteng Department of Agriculture, Conservation and Environment (GDACE) Departmental Policy on Red Data Plants, 2004 must be used as a decision making and decision support tool in the evaluation of development applications. However, the site specific relaxation of the required buffer area can be considered by the CTMM if supported by the outcomes of an Environmental Impact Assessment.
- The Gauteng Department of Agriculture, Conservation and Environment (GDACE), Departmental Policy on Ridges, 2004 must be used as a decision making and decision relaxation of the required buffer area can be considered

by the CTMM if supported by the outcomes of the Environmental Impact Assessment.

- Alternative Service Delivery Partnerships within Protected Areas will only be considered after and in accordance with the outcomes of an SEA and/or EMF.
- Integrated Environmental Management Plans must be drafted for each Protected Area, managed and maintained in line with such plans.
- Proposed green nodes as indicated on the Regional Open Space network are created at the confluence of green and blue typologies. Development interventions can be considered here if responsive towards high and medium-high site specific Open Space integration of such sensitivities within the Open Space network is facilitated and if the creation of such node is enabled.

On the Open Space Framework map on pg. 50, the green node no. 4 is the Pretoria NBG. The design will be done in accordance with the spatial framework of Tshwane and integrated into the design approach. Also noticeable on the map, is the wetland adjacent to the botanical gardens. This can be utilised as a green link within the city to create a green belt that connects the ecosystems of the fragmented sites to ultimately create a higher biodiversity within the city.