Brookdale Assessment Centre

Grassland Rehabilitation Plan

ERF 1061 and 1068 Brookdale Phoenix, Durban
1143 JG Champion Drive, Phoenix, Ethekwini Municipality, Kwazulu-Natal

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Prepared by

January 2022

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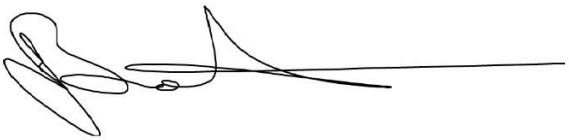
Johan Bodenstein Principal Scientist	ND Horticulture, ND Nature Conservation, B-Tech Nature Conservation	
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II. DETAILS OF THE PROJECT MANAGER

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III. CURRICULUM VITAE

Johan Bodenstein e-mail: johan@indiflora.co.za

Personal: Born on 04 January 1960 in Germiston, South Africa and is married with two children.

School Education: Grade 12 at Port Natal School in Durban from 1966 – 1977.

Training: National Diploma Horticulture at Natal Technikon, ND in Nature Conservation through Technikon RSA, B-tech Degree in Nature Conservation through Mangosuthu Technikon and Registered to complete a Masters in Nature Conservation with MUT, in 2022.

Employment: Was a Horticulturist, Conservationist and Environmental Education Officer at Durban Parks Department from 1980 to 1993. Was a Lecturer in Nature Conservation at Mangosuthu Technikon, Umlazi, from January 1994 to December 1997.

Self-employment: Established Indiflora cc in Durban, in September 1997, and renders environmental, horticultural and conservation service to developers, corporate and private clients including EIA's, ESR's and EMP's.

Experience: Johan has 20-years experience as an environment assessment practitioner. Vegetation and related environmental appraisals, Basic Assessments, EIA's, Environmental compliance monitoring, Ecological/Biodiversity studies, Game and residential estate environment assessment and planning, Environmental rehabilitation planning, Agric- economic assessments, planning and cost analysis.

Professional Organizations: South African Council for Natural Scientists as Environmentalist (400413/04), Membership: Grassland Society of Southern Africa, IAIAsaKZN

Publications: Die Wildestinkhout (*Celtis mildbraedii*) Veld & Flora March 1985, Taking your child into nature. Your family 1993, 12 Gardening articles Networking Neighbourhood from July 2000, Guidelines for Landscaping Design, Documentation and Procedures in Development Environmental Management on Golf Courses in the Compleat Golfer 2009 (4 issues), Presented paper: "An account of the rehabilitation at Simbithi Eco-Estate" at LaRSSA Conference Kimberley.

Language proficiency: Fluent Speaking, Reading and Writing Afrikaans and English, proficient in Zulu, and elementary French.
Computer skills: MS Office, AutoCAD, Planet GIS Driver's Licence: Code EC
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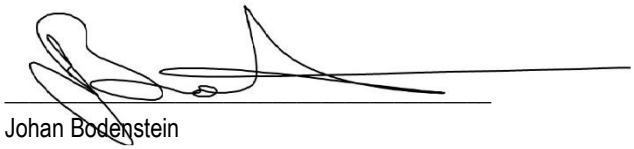
Community involvement: Chairman of the church council of Port Natal Church, Chairman of the KwaZulu-Natal *Urban Forest Forum*, Member of the Board of Management of Natal Mountain Rifles

IV.. DECLARATION OF INDEPENDENCE

I Johannes Albert Bodenstein (SA ID 6001045092089) hereby declare that the work presented here is my own, other than where I quoted specialists who prepared reports related to the project for whom due recognition is given. I have been paid an agreed professional fee for conducting this EIA process. I have nothing to gain from the outcome of this application. I have not left any information undisclosed.



Johan Bodenstein

Indiflora cc Environment Services

10 January 2022

V. EXECUTIVE SUMMARY

The Brookdale Assessment Centre was compromised when fill material was imported onto the site with the aim of establishing platforms for low cost housing. In this process the fill covered the grassland that was present on the site. The grassland was secondary in nature because the land was under sugar cane as far back as 1953 but stopped when the surrounding land was developed as the Phoenix residential area. Secondary grassland became established which suffered disturbances from community dumping waste, illegal sand winning and subsistence gardening. Infill occurred after 2014 as part of a plan for a low cost housing development that effectively destroyed much of the remainder of the grassland. The developer was taken to court and a court order has instructed the developer to remove the fill material and rehabilitate the wetland and the grassland. An integrated multi-disciplinary team of professionals has studied the fill material for potential contamination of the surface and groundwater. Samples were taken from different locations and depths of the fill and sent to independent laboratories for analysis. The results indicate certain elements being present which is elevated above the ambient levels but not high enough to declare the site to be polluted. The recommendations from the specialists are to remove visible contaminants such as plastic, metal, glass, builder's rubble and organics and dispose of it at landfill. Application will be made to have the fill material declassified as waste and once that is approved for the material to remain in situ. Fill material over the wetland buffer will be removed and the fill banks will be battered to make the banks more stable. The wetland will be rehabilitated under the guidance and according to the specification prepared by EcoPulse Conslulting.

The grassland rehabilitation will comprise of the removal of waste from the fill, from the edge of the wetland buffe, the reshaping of the land and the preparation of the soil for the seeding of grass plants through hydroseeding. An element of overlap will occur with the wetland rehabilitation in the buffer zone. The hydro-seeded area will be irrigated from water carts in the absence of natural precipitation until it is established. Follow-up hand-seeding will ensure all the areas of the site is well vegetated and that there is no evidence of bare soil or erosion on the site. The grass will be cut once in the first year to promote vegetative growth and increased tiller production. An active alien invader plant control programme will ensure the site remains alien plant free. Timing of the grassland rehabilitation is important because grass plants stop growing after March through to early September, after the first spring rain. Grassland rehabilitation is best to be done in spring, through summer but must be concluded at the beginning of autumn when grass plants begin their winter rest period. Monitoring will continue on a monthly basis after the hydro-seeding took place and after each rain event with more than 10mm of rain the Phoenix area, to confirm that erosion did not occur. Any erosion that becomes evident must be addressed and reseeded. Once the project is approved and signed off by the Department a grassland management plan becomes effective that must be carried over to any future landowner.

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1. INTRODUCTION AND BACKGROUND

1.1 PROJECT BACKGROUND AND LOCALITY

Indiflora Environmental Services cc was appointed to prepare the grassland rehabilitation plan for the Brookdale Assessment Centre in Brookdale, Phoenix (**Figure 1**) as per a court order was received for infilling over the buffer line to a wetland and into the wetland on a property in Phoenix. The land was being prepared for a low cost housing project which had not yet been authorised when a stop-work order was issued to th developer, Woodglaze Trading (Pty) Ltd. A section 24G was lodged with the Department of Economic Development Tourism and Environment Affairs. The Section 24G application was not completed and was eventually withdrawn. Charges were laid and Woodglaze Trading (Pty) Ltd appeared in court and a court order was issued to assess the fill , prepare a plan to remove the fill, dispose of the fill and to rehabilitate the wetland and the grassland. This plan is the grassland rehabilitation plan to be presented to the Department of Forestry Fisheries and Environment for consideration and approval.

The plan focused on the description of the natural vegetation as described by SANBI (2022), Scott-Shaw and Escot (2011) then the current vegetation integrity and impacts pertaining to the vegetation, as well as providing appropriate management recommendations to lower the significance of the impacts to floral communities.

1.2 SCOPE OF THE PLAN

The scope of work for the grassland rehabilitation plan was to:

- Initial desktop review of natural vegetation based on the SANBI data base to determine what was here originally at a broader scale;
- To look at the natural vegetation at a finer scale for the project area by reflecting on the composition of the Critically Endangered North Durban Coastal Grassland;
- Prepare a methodology statement for the preparation of the land to be grassed;
- Provide the methodology for the grassing by hydro-seeding;
- Describe the post-hydro-seeding care and maintenance;
- Describe the process of in-filling where plants did become established;
- Describe the maintenance of the grassland post-establishment;
- Describe the monitoring process; and
- Make recommendations to improve the quality of the rehabilitated area so that it makes a meaning contribution to biodiversity conservation in Durban..

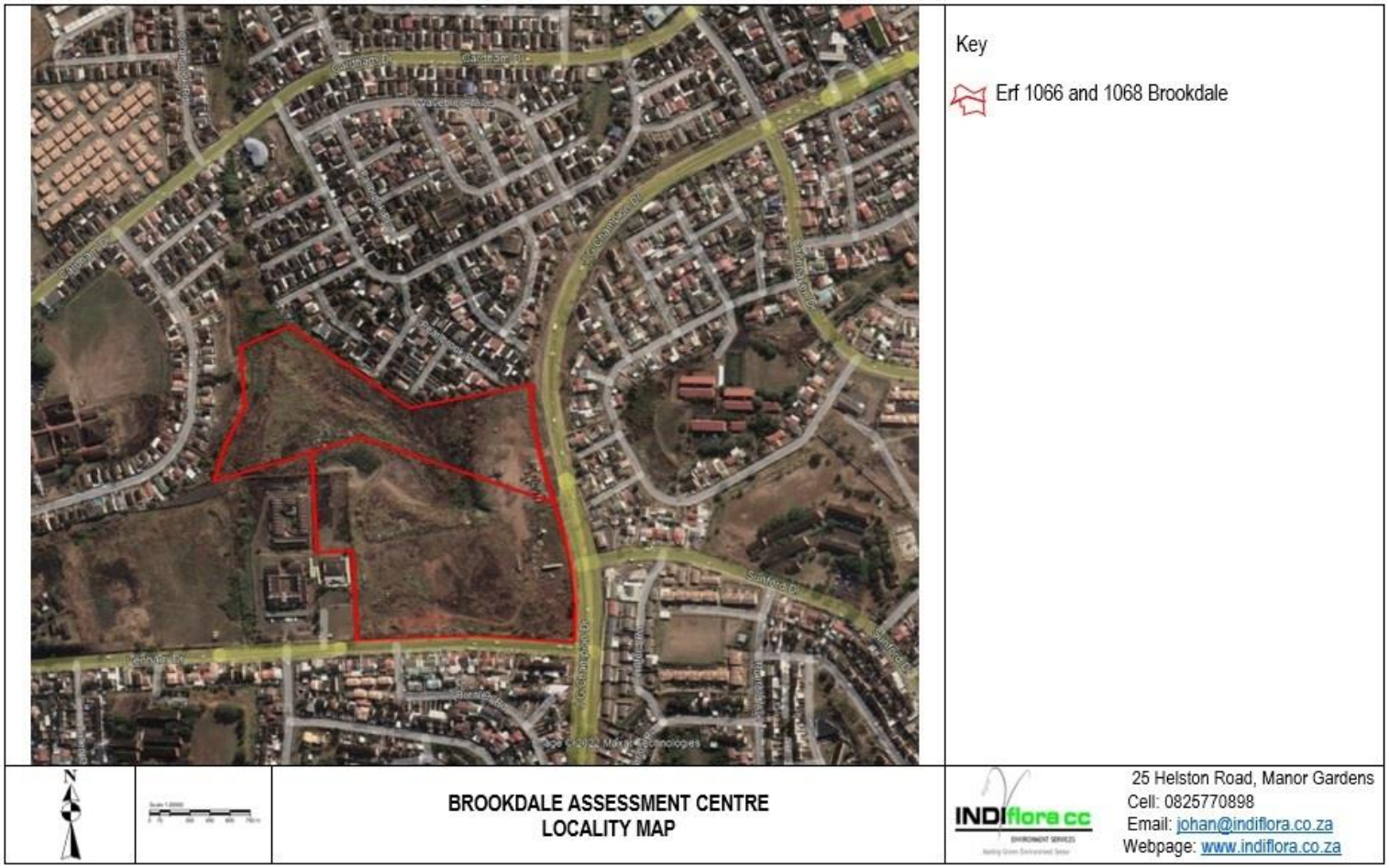

Figure 1: LOCALITY OF ERF 1061 AND 1068 BROOKDALE, PHOENIX

1.3 ASSUMPTIONS LIMITATIONS AND GAPS IN KNOWLEDGE

It is difficult to apply pure scientific methods within a natural environment without limitations or assumptions. The following constraints apply to this study:

i. The findings, results, observations, conclusions and recommendations provided in this plan are based on the author's scientific and professional knowledge.
ii. Modelled biodiversity databases have accuracy limitations.

1.4 RELEVANT LEGISLATION AND ORDINANCES

The below legislative policies are relevant to this project.

- The South African Constitution Act 108 of 1996.
    - This is the legal foundation to all other forms of legislation and ensconces the human rights including the right to a protected environment through legislative or other means.

- The National Environmental Management Act (Act 107 of 1998) (NEMA) and all subsequent amendments.
    - This legislation promotes sustainable development and cements principles such as "Duty of Care", the 'precautionary approach', 'polluter pays', and requires landowners and developers to accept responsibility for impacts throughout the life cycle of a project.
- The National Environmental Management Biodiversity Act (Act 10 of 2004) (NEMBA), including:
    - To protect species and threatened ecosystems and promote the sustainable use of indigenous biological resources .
    - and imposes a duty of care relating to listed invasive alien plants through the Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014, updated 2016).
- National Forest Act 1998 / NFA (Act No. 84 of 1998).
    - Ensures the protection of protected tree species and natural forests
- Conservation of Agricultural Resources Act / CARA (Act No. 43 of 1983)
    - To control the over-utilization of South Africa's natural agricultural resources,
    - To promote the conservation of soil and water resources and natural vegetation. This includes:
        - wetland systems and requires authorizations to be obtained for a range of impacts associated with cultivation of wetland areas.
- National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003).
    - The protection of land of high conservation, value, threatened ecosystems, unique landscapes and landscape features
- National Environment Management Waste Act

- The sustainable management of waste generated which must be disposed of in a sustainable manner by the implementation of a waste management strategy and waste management principle that diverts waste streams away from land fills and to promote a circular economy.

- The National Water Act 36 of1998.
  - This Act imposes 'duty of care' on all landowners, to ensure that water resources are not polluted and if or when they are polluted they must remedy the damage
  - It protects wetlands and regulates impacts on wetlands (within a distance of 500m upstream or downstream of a wetland) through water use license applications.

2. PLANNING AND DESIGN FOR REHABILITATION

2.1 APPLYING A RISK-BASED APPROACH

The planning for the rehabilitation of the site must be cognisant of the potential and latent risks area that may compromise the rehabilitation efforts and delay or derail efforts of rehabilitation. Latent risks in this instance at the Brookdale Assessment Centre could be the matrix of the fill material that is not conducive to the establishment of grassland. The density of the soil, the chemistry of the soil make-up, the absence of organic matter and soil biota may inhibit seed germination, root penetration or may under- or over-supply nutrients that inhibit plant growth. The movement of moisture through the fill material or the natural ground where it is exposed may be inhibited which causes the plants from moisture stress, either in under-supply or over-supply. The land is not effectively fenced and people can move through the site. Where people follow a specific route across the land the land becomes compacted and a trail is the result. Plants find it very difficult where the soil is compacted. The same applies where vehicles drive frequently and vehicle tracks become established. On steeper gradients the compacted trails promote the accelerated flow of rain water which causes erosion. Potential risks are the influx of informal settlement on vacant land that happens over-night. Even if the tenure is short-lived the grassland will suffer in the areas where huts are established. Illegal sand winning causes major disruptions in the area where material is excavated. Subsistence farming occurs periodically along the lower lying areas close to the wetland and the water course. The grassland will be destroyed in those areas. Invasive alien plants remain a constant threat and plants become established very quickly. The very aggressive Famine Weed is spreading at a phenomenal rate and is evident on the site already. Such a plant inhibits the establishment of natural vegetation. The surrounding community dispose of solid waste on vacant land and solid waste prohibits the growth of plants. Stormwater from the roads adjacent to the site on two sides flow onto the site and poses an erosion risk.

2.2. SENSITIVE HABITATS

The wetland draining along the common boundary of ERF 1061 and 1068 in a north-westerly direction, with the wetland buffer, is very sensitive and the stream flowing along the north-western boundary in a northerly direction is also sensitive habitat. The wetland and the stream, even in the present disturb state, provide habitat to micro- and macro organisms, insects, and birds with potential habitat for smaller mammals. The wetland is presently in a disturbed state and will be

rehabilitate under the guidance of EcoPulse Consulting according to the measures stipulated in the wetland rehabilitation prepared by EcoPulse.

2.3 REHABILITATION HIERARCHY

A number of obvious functions can be regained by reinstating functional ecosystems – specifically sensitive systems such as wetlands and conservation habitats. Such habitats provide ecosystem services such as feeding, breeding and nesting areas for fauna and the establishment of conservation
areas for threatened species. Other functions may include erosion control, water filtration and purification, flood attenuation, carbon sequestration and oxygen production. These functions have inherit value but also monetary value. The reinstatement and/or maintenance of these functions
form part of this rehabilitation plan.

Negative impacts on sensitive ecosystems must be mitigated as it is a legal requirement. Whenever an activity takes place and it has impacts then steps need to be taken to minimise the impacts with each level being less desirable until the last level which will require the highest level of investment to mitigate the activity that has the biggest impact. Illustrates as follows;

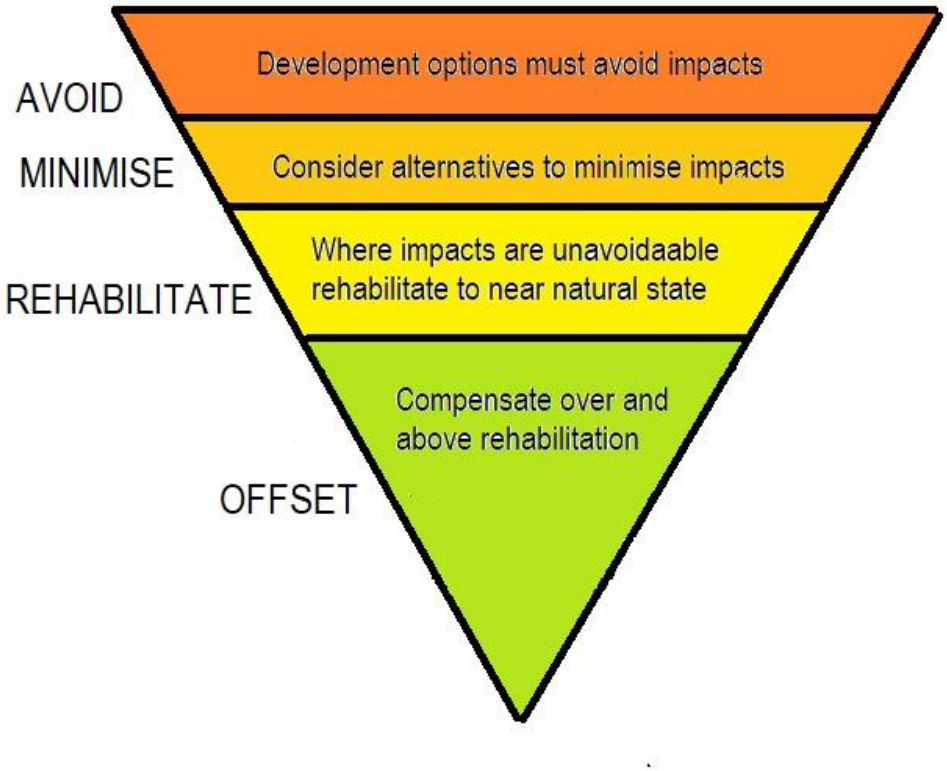

Figure 2 The Mitigation hierarchy summarised graphically

2.4 REHABILITATION AND SUCCESSION

Van Oudtshoorn (2012) described the rehabilitation of disturbed and impacted environments to be restorable by applying various veld management techniques closely linked to ecological successional theory. Succession is the change of species, or patterns of species abundance, over time, through natural dispersal by vectors. It can be directional, continuous and sequential patterns of colonisation. Creating suitable niches where grass seed can settle will allow grasses to establish naturally. Tainton (1999) advises that it is better to re-establish the original community for reach habitat. The right conditions must prevail before the grass species will become established. Soil structure, soil moisture, soil temperature, soil nutrient availability are key factors determining grass growth. Grass species present indicate the successional stage of a site. The first stage or sequence of succession, after a disturbance, is the establishment of aggressive, fast-growing, pioneering species, that colonise an area initially. These species may be short-lived annual species and some perennial species and grasses. The pioneer plant species change soil conditions and properties thereby creating micro-niches promoting the colonisation by longer-living pre-climax and climax grasses. The early and late successional species take over from the pioneer species that never really disappear but they do make way for the migration of a climax community. This is a slow and protracted process that take decades and possibly centuries. The success of rehabilitation can be measured by the successful establishment of a grass community/population within a designated area where there is good basal cover.

3. BASELINE BIOPHYSICAL DESCRIPTION

3.1 CLIMATE

The site is in a summer rainfall area with warm to hot summers and cool winters. The mean maximum and minimum temperatures are 35°C and 8°C, for October and June/July respectively. Winds are mainly from the south-west or the north-east with occasional berg winds from the west that pre-cede cold fronts. (Source: Mucina & Rutherford, 2006). Rainfall is mostly from the south-west but occasional tropical storms come from the north.

3.2 NATURAL VEGETATION STRUCTURE AND COMPOSITION

The study area is located within the KwaZulu Natal Coastal Belt (Mucina and Rutherford 2006).

a. **KwaZulu-Natal Coastal Belt (CB 3)** – The natural vegetation that formerly covered the Umbogintwini area of the Durban Metropole area according to Mucina & Rutherford (2006) is KwaZulu Natal Coastal Belt (CB 3). It is characterized by highly dissected undulating coastal plains of which presumably used to be cover a great extent with various types of subtropical coastal forest. Some primary grassland dominated by *Themeda triandra* still occurs in hilly, high-rainfall areas where pressure from natural fire and grazing regimes prevailed. Scott-Shaw and Escot (2011) This vegetation type is affected by an intricate mosaic of very extensive sugarcane fields, timber plantations and coastal holiday resorts, with interspersed secondary

Aristida grasslands, thickets and patches of coastal thornveld. It is classified as being endangered with a national conservation target set of 25% for conservation, but only a small portion is conserved in Ngoye, Mbumbazi and Vernon Crookes Nature Reserves.

b. Durban Metropole North Coast Grassland (KZN 2)

Goodman (2007) Indicate this threatened ecosystem that is a sub-set of the KwaZuluNatal Coastal Belt to cover the study area. The Critically Endangered ecosystem, is an amalgam of KwaZulu-Natal Coastal Belt vegetation and Northern Coastal Forest vegetation although there is no forest present on the study site. Important plant species in this ecosystem is Kniphofia pauciflora, but it is not present on this site. The diversity of species of natural untransformed grassland would be high. Plants found in natural grassland will include grasses and forbs. Typical grasses will include; the natural dominant species *Themeda triandra* (40%) and the second most dominant species *Tristachya leucothrix* (17%). The other grassland species are *Aristida congesta subsp. Barbicollis, Bothriochloa insculpta, Brachiaria brizantha, Chloris gayana, Cynodon dactylon, Dactylon australis, Digitaria longiflora, Eragrotis ciliaris, Eragrostis curvula, E. plana, Erharta erecta, Hyparrhenia filipendula, H. hirta, Melinis repens, Panicum maximum, Panicum natalense, Paspalum notatum, Setaria sphacelata subsp. Sericea, Sporobolus africanus*, *Sporobolus fimbriatus,* and Urochloa panicoides. Forbs in the grassland are *Berkheya rhapontica, Berkheya speciosa, Chamaechrista mimosoides, Hewittea malabarica, Indigofera confusa, Justicia flava, Nemesia denticulata, Neonotonia wightii, Sida cordifolia, S. dregei, Tephrosia polystachya*, and *Vigna vexilata*.

3.3 GEOLOGY AND TOPOGRAPHY

Pietermaritzburg Formation of the Ecca Group of the Karoo Supergroup is the main geological of the area of Durban, which shows the site is underlain by sub-horizontally bedded layers of shale and sub-ordinate bands of fine-grained sandstone of the Tillite of the Dwyka Group which is seen further to the west of the site and lies unconformably under the Pietermaritzburg Formations (Swales 2022)

4. REHABILITATION AIM AND OBJECTIVE

4.1 AIM OF THE REHABILITATION PLAN

To remedy the impacts of the infill by establishing grass cover on the site post-the removal and disposal of the fill material to a near natural vegetative state on the land that presently has exposed surfaces to create functional habitat and soil cover.

4.2 THE OBJECTIVES OF THE REHABILITATION PLAN

The objectives are the main steps that will be taken to address the requirements of the court order on the one hand and to re-establish the ecosystem services of the site.

- Describe the areas to be rehabilitated to a functional state.
- Describe the procedures to be followed to stabilize the soil and establish the grass cover.
- Plan monitoring during rehabilitation, during the grow-in period and once it is established and reporting on the successes of the rehabilitation plan.
- Define roles and responsibilities for the implementation of this plan

5. THE REHABILITATION OF THE GRASSLAND

5.1 THE AREAS TO BE REHABILITATED

The areas to be rehabilitated is the land outside the buffer to the wetland where the buffer is 20m wide from the temporary zone of the wetland which is indicated on the map below prepare by Nelson Alophi (2022). This includes the battered banks outside the wetland buffer, all other banks, the level area above the battered banks all the way to the road verge on the eastern and southern side of the site, the lower triangular area to the north west of ERF 1068 and the area along the stream along the western boundary.

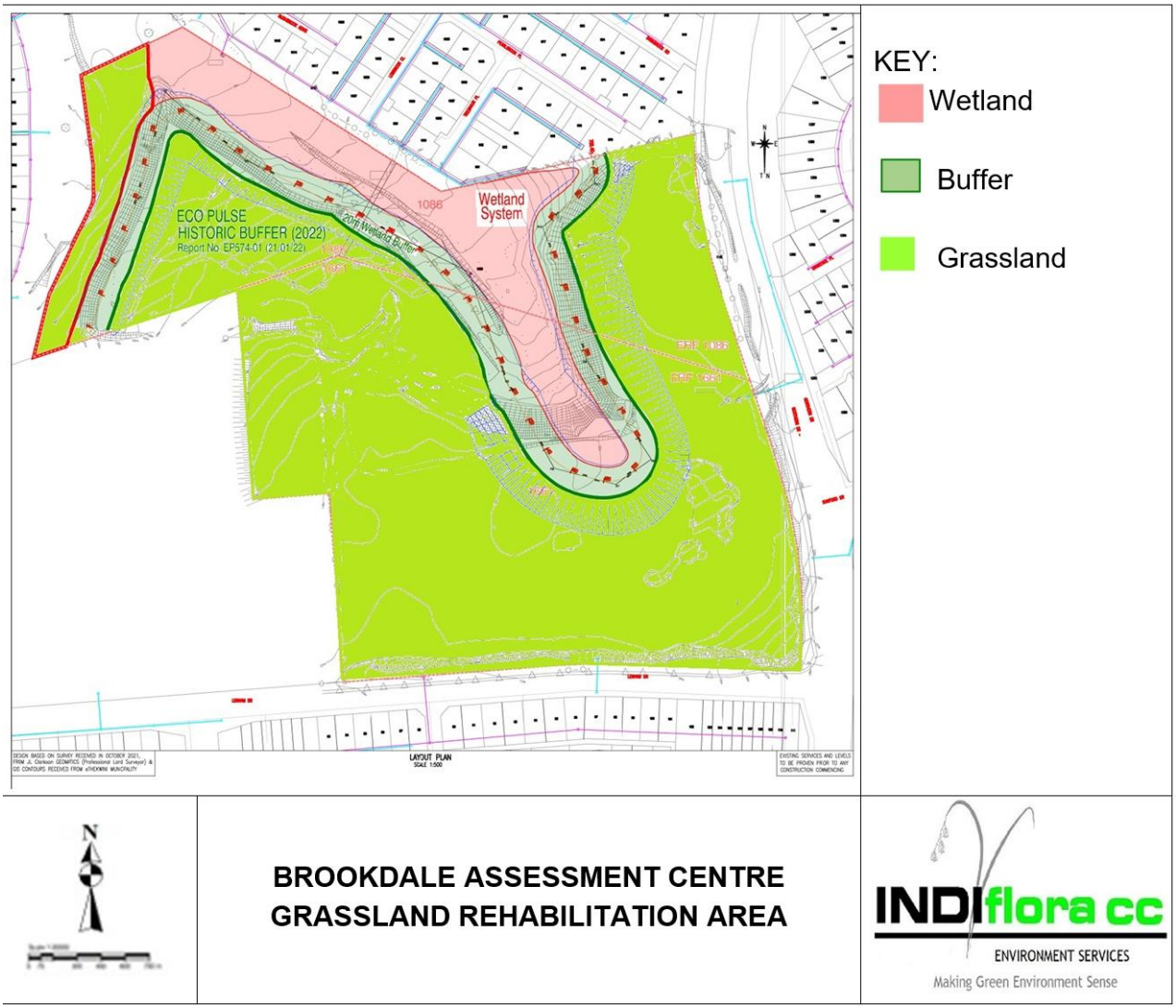

Figure 3 The grassland area to be rehabilitated.

5.2 SEASON OF REHABILITATION

The timing of rehabilitation of dry land grassland, that is grassland is critical for grasslands that are reliant on natural precipitation for survival. Grassland rehabilitation must therefore only occur in the spring months commencing immediately after the first spring rain and must not take place after march which is the seasonal change from summer to autumn. The growth rate of grass plants slow down during the winter months. The soil temperature is too low and not conducive for seed to germinate. The day-light length is too short and rain events are far apart and generally quite low in intensity. It will be enough to sustain existing growing grass but not enough for germinating seedlings. Unless the grasslands are irrigated to sustain growth there is a real risk of the young grass plants to dry out in winter and not survive until spring.

5.3 THE PREPARATION OF THE LAND FOR THE REHABILITATION

The fill over the wetland buffer and in the wetland must be removed from the buffer and the wetland and disposed of at landfill. The remainder of the fill must be declassified as waste and when that process is complete and authority is obtained for the material to remain on site then it must be shaped the have sustainable gradients. Where the application for waste declassification fails all of the fill must be taken off site and disposed of at landfill. In this instance the final levels will be achieved when all the fill is removed and the natural ground is exposed. The first of the two options is more desirable not only from a logistical and financial view point but also from a waste management point of view that landfills must first of all be avoided. Capacity at landfills is a premium commodity which municipalities cannot and will not give away freely if there is an opportunity for the material to be redirected for more sustainable use. The specialist studies done and laboratory results indicate the soil and water resources have not been unduly contaminated. All foreign material not consistent with the soil matrix must be collected and moved off-site for disposal at landfill. With the gradient of the land reshaped to near natural gradients with heavy earth moving machinery a more finer tilth is required. The soil levels must be even throughout and the surface raked. The high clay content in the fill material causes the soil to "close-up" due to the fine particles filling gaps. This effectively seals the soil surface promoting run-off of storm water. Shallow ridges must be scraped with the teeth of a TLB along the contour to create rough edges where seed can lie whilst the trenches trap rainwater and silt.

5.4 ALIEN INVASIVE PLANT CONTROL

Invasive alien plants are present on the site and are well established whilst others are new and still establishing. A systematic programme of removing the IAP's root and all and discarding them at landfill. The alien plants present are listed in the Wetland Rehabilitation Plan prepared by EcoPulse Consulting and well presented. EcoPulse identified; Ageratum conyzoides (Invading ageratum), Canna indica (Indian shot), Cardiospermum grandiflorum (Balloon-vine), Chromolaena odorata (Triffid weed), Ipomoea purpurea (Common Morning Glory), Lantana camara (Lantana), Ricinus communis (Castor-oil plant), Tecoma stans (Yellow Bells), Tithonia diversifolia (Mexican Sunflower)

The same treatment must be rolled out in the grassland using the same methodology and application rates of herbicides.

Invasive alien plants that EcoPulse did not pick up on is *Arundo donax*, the Spanish Reed, and *Parthenium hysterophorus*, the Famine Weed.

Table 1: Invasive alien plants

Species Name	CARA/NEMBA Category	Photo	Control Recommendations	
			Size	Treatment
Arundo donax (Spanish Reed)	1b		All	Mechanical removal
Parthenium hyterophorus (Famine Weed)	1b		All	Removal by hand. Gloves are recommended to prevent skin contact

5.5 SOIL SAMPLES:

Soil samples from throughout the grassland area must be taken to Cedara for analysis to determine the nutrient make up of the soil. Soil chemistry is critically important to have the proper ratios of nutrients in the soil for plants to become established. Too little of a nutrient or too much of a nutrient can be equally inhibitive to plant growth. The soil sample analysis report will indicate the levels of macro- and micro-nutrients is in the soils, what quantity of organic matter (compost) is required for the establishment of grass and which fertilisers to apply and the recommended application rate. Morgenthal and Van Rensburg (2004) indicate the importance of the application of the appropriate fertilisers to ensure healthy plants and good soil cover.

5,6 SELECTION OF SPECIES

The ideal will be to establish a sword of grass species that resemble the natural veld. Not all of the species in the grassland are available in the commercial seed supply chain. Good soil cover can be achieved with a mixture of indigenous grass seed that is available in the trade. The natural grassland has a grass species diversity of 23 species. The grass available commercially are limited to seven of which one species is not indigenous but a sterile, annual grass that lasts for one season but helps to create a micro-climate the is beneficial for the slower perennial grasses. *Eragrostis tef* is the exotic sterile grass. It germinates very rapidly grows to 10-15cm and then holds until the end of the season. As winter approaches it begins to die. *Panicum maximum*, Guinea Grass, is a local pioneer grass. It germinates rapidly, grows fast and will provide quick and dense soil cover. It is a short-lived grass that produces seeds prolifically and thereby self-seeds to ensure a crop of grass in the following season. It is very good as a bird feeding grass. *Themeda triandra* or Rooigras, is the most desirable tufted, grass because it is a perennial climax grass.

Seed availability is challenging at times and germination is sporadic. The right soil conditions must prevail in the absence of competition then the grass will become established. Rhodes grass (*Chloris gayana*) is one of the first perennial, tufted, grasses to germinate after *Panicum maximum*. It is an attractive grass that grows up to 0.75m and the seed is utilized by birds. *Aristida junciformis* or Three -awn grass as it is known is a perennial, tufted grass of good form. It establishes readily and covers the soil well. *Cynodon dactylon* known as Couch grass is a runner grass and there is a good stand of this grass type present on the site. It establishes readily from seed, does not cover the soil well but the stolons of the grass aids to bind the soil and help prevent erosion. *Stenotaphrum secundatum* of Coastal buffalo establishes readily. Its leaves are broader and more prostrate than *Cynodon* but provides excellent ground cover. It can become locally dominant in places and it out-competes other grasses. One last inclusion may be *Melinis repens*, Natal Red Top. This is a loose tufted grass that establishes easy and provide reasonable cover. The attractive red seeds are used by birds. A further possibility that is not recommended is *Eragrostis curvula*, Weeping Dropseed grass, that is readily available in the trade, becomes readily established and is very attractive. The negative aspect is that it is allelopathic which means the plant releases a chemical in the soil that inhibits the growth of other species which is beneficial for this plant because it can establish with reduced competition for resources. It is ideal to use this plant in follow-up seeding when the main mix of species has already become established and has basically covered the soil. It can be used as a supplementary species at aa later stage.

Seed is purchased in bags from the supplier in ready mixed bags to which ever quantity is ordered up to 50kg. The seed can also be purchased if there is a preferred ratio of seed in the mix or the seed mix is to be changed for different settings. Little areas of local dominance by one or two species is quite natural.

5.7 SEEDING

The most cost-effective way of dispersing the seed evenly, with organic matter mixed with water is through hydro-seeding. Hydro seeding delivers high volumes of water with the seed evenly mixed with organic matter mixed in the water in a short space of time. A truck with a 10 000 liter tank delivers the seed by praying it with a nozzle that is directed by the operator ensuring all areas receive seed. Seed is applied at 20g per square meter or 200kg per hectare.

The seed having soaked in the water before being sprayed is turgid, and with the organic matter has the right conditions to promote rapid germination. It is the process used to grass road banks during road construction.

After a period of allowing the grass to grow a walk-over is required by a team to identify blank spots where the seed did not get to during application or where there is some other form of inhibition. Seed can be applied to these bare areas by hand and they should be hand-raked to ensure good contact with the soil to ensure good germination.

After a two month period a further fill-in seeding can take place to ensure there are no bare areas remaining. In stubborn areas where grasses do not want to grow special attention is required. Soil conditions may not be suitable for seed to germinate or there are other elements such as rodents or birds that remove the seed, or stormwater washed it away. To be certain the soil is good for germination it may be necessary to collect soil samples and have it retested at Cedara to be sure of the nutrient loading in the soil.

Other methods can be applied such a fixing GeoJute, Soil Saver or some other geo fabrik on the soil to prevent erosion whilst it is left to be seeded by the grass plants surrounding the area.

5.8 GRASSLAND ADJACENT TO WETLAND AND THE INFILLED AREAS BUT DISTURBED BY AMONGST OTHER TRAMPLING, EROSION, AND INVASIVE SPECIES.

The grassland adjacent to the wetland that was disturbed by human mand vehicular movement, soil erosion or invasive alien species must be freed of the listed impacts. Human and vehicular movement through the area must be prevented by controlling access to the site. Physical disturbance must be restored through manipulating the landscape by raking or moving soil with spades and hoes until the natural topography is restored. Hans-seeding can then take place. Movement through the area whilst the seed is germinating and emerging must be restricted. Causes of erosion, general originates from a higher area and the problem must be addressed at the source. Erosion means there is concentrated flow somewhere upstream. That flow must be dissipated and spread out over a wide area. Install fascine work if necessary to prevent the water from regaining its natural flow path and concentrating flow again. Alien plants must be taken out before rehabilitation commences and must remain in the maintenance state where only new emergents appear from time to time.'

5.9 GRASSLAND ADJACENT TO THE WETLAND AND INFILLED AREAS BUT POLLUTED

The area of grassland that is adjacent the wetland that had fill over it that contained pollutants must have the fill and the pollutants removed first. In -field water and soil samples taken and analyzed in laboratories did not indicate that there were any pollutants present. Should any be detected whilst the fill is removed then immediate control measures must be installed to contain the pollutants. The waste specialist will have to inspect and classify the waste and give guidance on the appropriate manner to remove the contaminants and contain it before it is sent for disposal at an appropriate landfill. Tests need to be carried by the waste specialist to confirm the site is now pollutant-free. The landscape must be shaped to follow natural levels and then the area can be seeded. Erosion control measures must be maintained until the grass is established.

5.10 GRASSLAND COVERED BY RUBBLE

Where rubble is found where grassland is meant to be the builder's rubble and any other form of solid waste must be hand-lifted and placed in a skip. Cement is builder's rubble has an impact on the soil as it is an alkaline substance. Soil samples must be analyzed where builder's rubble was concentrated. Steps will need to be taken to balance the pH of the soil. Organic compost must be applied to assist in this process. Once all the rubble is removed and the land has been shaped to follow the natural ground level then seeding can commence. These previously contaminated areas must be monitored to ensure the grass seed establishes well there.

6. POST-SEEDING MONITORING AND MAINTENANCE

6.1 MONITORING:

Weekly site inspections must be conducted by the over-seer to identify issues that may become apparent and to guide the contractor and the staff on appropriate steps to take to remedy the situation. Rehabilitation a grassland is not a sprint race. It is rather a marathon with many laps. Not all species germinate evenly across the entire site and may reseeding. To increase diversity of the grassland more species can be added at later opportunities.

Once the grassland is established, after three months the monitoring can be reduced to monthly visits for the first year. The monitoring can then be reduced to quarterly for the following two years and from the third year on annual audits of the grassland should be done.

Five fixed quadrat sample plots should be set up which is assessed for species diversity and soil cover during each monitoring session. Five random quadrats of 1m x 1m must be done randomly amongst the fixed sample sites and at least one quadrat should be done at grassland area close by as a control.

6.2 MAINTENANCE

The grassland must be maintained free of invasive alien plants with specific focus on the Famine Weed. A mature plant produces as many as 10 000 seeds in a season. The seed germinate readily which attaches itself to shoes, tyres, wheels, hooves and is dispersed aiding its rapid spread. The plant is resistant to herbicide and cause injury to staff if they are exposed to the plant for a long period causing serious illness.

The grass must be cut once in the first year, six months after seed sowing, but not in the winter. An end-of-winter cut is recommended. It will help to reduce the fire risk. All cut material must be moved off site and disposed of at landfill or sent to a composting operation. Fertiliser can be applied twice a year depending on the advise Cedara provides after soil samples were submitted.

Care must be taken to prevent woody species such as trees and shrubs becoming established in the grassland area. Trees and shrubs create a new micro-climate that is not favorable for grasses. Natural successional processes will drive the grassland to become forest so a special effort is required to keep the forest components out. If at all possible the grassland must be burnt every two to three years if sufficient fuel material is present. This can be done with the help of Working for Fire that do, do control burns in the eThekwini Municipal Area.

7. CONCLUSION

The main aim of the plan was to provide context to the need to rehabilitate, to identify the end-state which is the long-term target vegetation integrity to strive for, methodology to establish the vegetation, and the need for monitoring and auditing the grassland. Establishing grassland on bare soil is a long drawn out process and cannot be rushed. Allowance must be made for natural succession to take its course.

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