HABITAT RESTORATION AND PLANT RELOACTION PLAN FOR ONDERSTEPOORT 2 SOLAR PHOTOVOLTAIC DEVELOPMENT, RUSTENBURG, NORTH WEST PROVINCE

Prepared for:

Onderstepoort Solar 2 (Pty) Ltd

Prepared by:

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Tarryn has over thirteen years of experience working as a botanist, twelve of which are in the environmental sector and has worked as a botanical specialist and project manager on projects within South Africa, Mozambique, Lesotho, Zambia, Tanzania, Cameroon and Malawi. Tarryn also spent nine years working as an Environmental Assessment Practitioner, understanding the need to balance development requirements with implementable mitigation measures that are feasible and reasonable.

She has extensive experience writing botanical impact assessments, critical habitat assessments, biodiversity management plans, biodiversity monitoring plans and rehabilitation and restoration plans to South African and International Standards such as those of the International Finance Corporation (IFC). Her experience includes working on large renewable energy projects in South Africa as well as large mining projects in Mozambique, including multiple graphite mines and a heavy mineral mine, all of which were to international lenders standards.

Tarryn holds a BSc (Botany and Zoology), a BSc (Hons) in African Vertebrate Biodiversity and an MSc with distinction in Botany from Rhodes University. Tarryn's Master's thesis examined the impact of fire on the recovery of C_3 and C_4 Panicoid and non-Panicoid grasses within the context of climate change for which she won the Junior Captain Scott-Medal (Plant Science) for producing the top MSc of 2010 from the South African Academy of Science and Art as well as an Award for Outstanding Academic Achievement in Range and Forage Science from the Grassland Society of Southern Africa. Tarryn is a professional member of the South African Council for Natural Scientific Professionals (since 2014).

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Glossary of Terms

Alien Invasive Species refers to an exotic species that can spread rapidly and displace native species causing damage to the environment.

Biodiversity is the term that is used to describe the variety of life on Earth and is defined as "*the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems*" (Secretariat of the Convention on Biological Diversity, 2005).

Critical Biodiversity Areas (CBAs) are areas of high biodiversity and ecological value that are required to meet biodiversity targets for species, ecosystems or ecological processes and infrastructure. These include:

- All areas required to meet biodiversity pattern (e.g. species, ecosystems) targets;
- Critically Endangered (CR) ecosystems (terrestrial, wetland and river types);
- All areas required to meet ecological infrastructure targets, which are aimed at ensuring the continued existence and functioning of ecosystems and delivery of essential ecosystem services; and
- Critical corridors to maintain landscape connectivity (MBSP, 2014).

Ecological Support Areas (ESAs) are areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services. They support landscape connectivity, encompass the ecological infrastructure from which ecosystem goods and services flow, and strengthen resilience to climate change. They include features such as regional climate adaptation corridors, water source and recharge areas, riparian habitat surrounding rivers or wetlands, and Endangered vegetation (MBSP, 2014).

Habitat Fragmentation occurs when large expanses of habitat are transformed into smaller patches of discontinuous habitat units isolated from each other by transformed habitats such as farmland.

Natural Habitat refers to habitats composed of viable assemblages of plant and/or animal species of largely native origin and/or where human activity has not essentially modified an area's primary ecological function and species composition.

Abbreviations

AIPS	Alien Invasive Plant Species
CBA	Critical Biodiversity Area
EA	Environmental Authorisation
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
ESA	Ecological Support Area
INNP	Invasive Non-Native Plants
MW	Mega Watt
NEM:BA	National Environmental Management Biodiversity Act
ONA	Other Natural Area
PAOI	Project Area of Influence
SANBI	South African National Biodiversity Institute
SEF	Solar Energy Facility

1. INTRODUCTION

1.1. PROJECT BACKGROUND

Onderstepoort Solar 2 (Pty) Ltd, proposes the development of a 190 MW solar photovoltaic (PV) Facility and associated infrastructure, located approximately 32 km northwest of Rustenberg in the North West Province (Figure 1). The Onderstepoort Solar 2 facility, covering nearly 367 hectares, is located within the jurisdiction of the Rustenburg Local Municipality in the Bojanala Platinum District Municipality and has been selected as preferred bidder in REIPPPP Round 7.

A recommendation from the Terrestrial Biodiversity Assessment was to compile site-specific Habitat Restoration and Plant Relocation as part of the final Environmental Management Plan (EMPr).

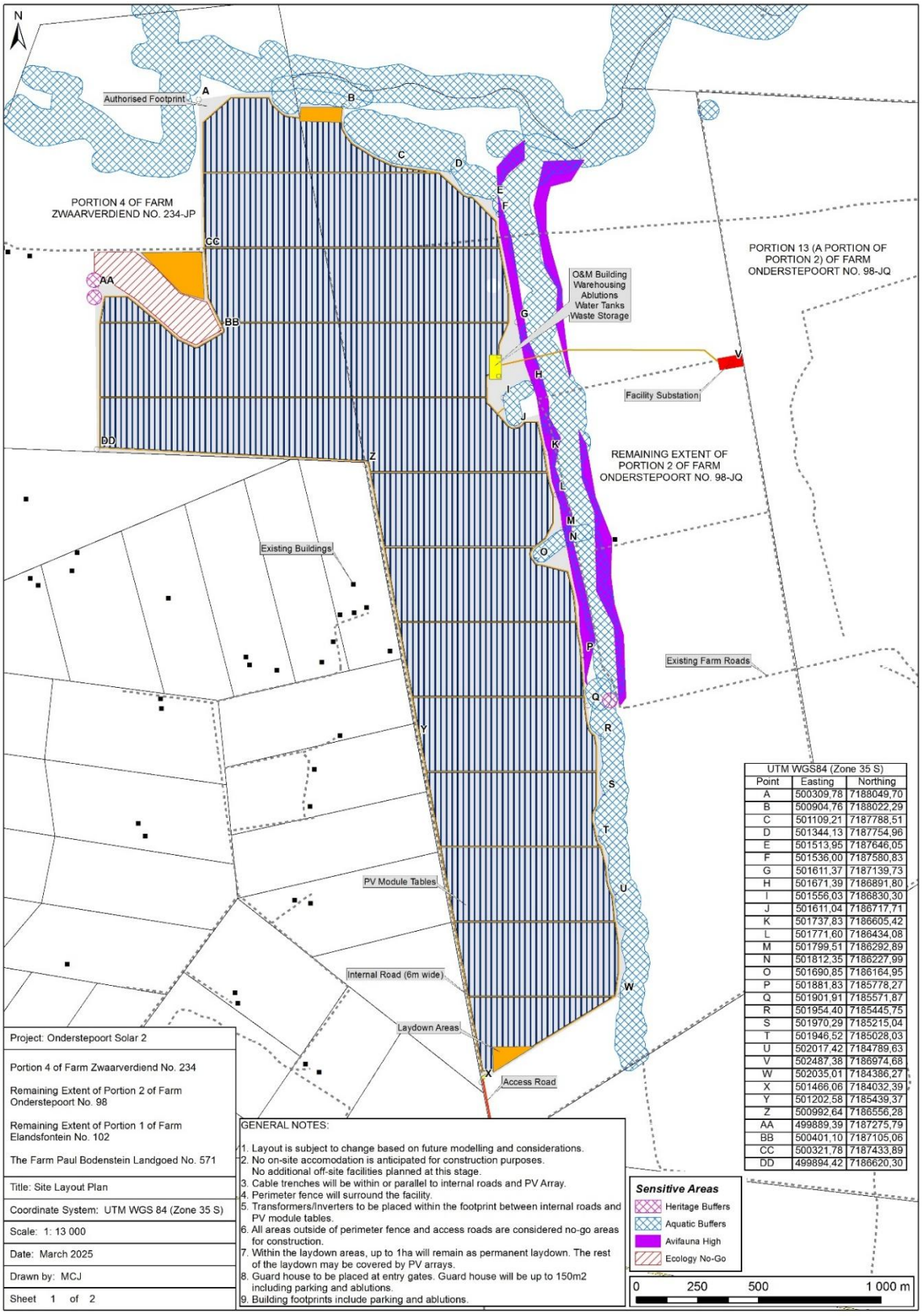
1.2. PURPOSE AND OBJECTIVES

The purpose of this plan is to ensure that areas that are cleared or impacted on during the construction phase, but which are not required during the operational phase, are re-vegetated and rehabilitated to ensure the following:

- Re-vegetate disturbed areas to an acceptable state by re-establishing vegetation cover with suitable indigenous species so that remaining biodiversity features are not compromised.
- Re-instate ecological processes and function and ensure that further degradation does not occur.
- Re-vegetate the impacted and disturbed areas to reduce the risk of wind and water erosion in these areas which, if not managed properly, could result in further and unnecessary degradation of biodiversity within the project area.
- Prevent infestation of the project area with alien invasive plant species.
- Soften the visual impact of the development.

This management plan is closely aligned with several other management plans for the project, and as such, must be read in conjunction with these. Of relevance to this plan is the Alien Invasive Management Plan.

Figure 1.1: Locality map illustrating the project area (indicated in red & white) in relation to Rustenburg.



UTM WGS84 (Zone 35 S)		
Point	Easting	Northing
A	500309,78	7188049,70
B	500904,76	7188022,29
C	501109,21	7187788,51
D	501344,13	7187754,96
E	501513,95	7187646,05
F	501536,00	7187580,83
G	501611,37	7187139,73
H	501671,39	7186891,80
I	501556,03	7186830,30
J	501611,04	7186717,71
K	501737,83	7186605,42
L	501771,60	7186434,08
M	501799,51	7186292,89
N	501812,35	7186227,99
O	501690,85	7186164,95
P	501881,83	7185778,27
Q	501901,91	7185571,87
R	501954,40	7185445,75
S	501970,29	7185215,04
T	501946,52	7185028,03
U	502017,42	7184789,63
V	502487,38	7186974,68
W	502035,01	7184386,27
X	501466,06	7184032,39
Y	501202,58	7185439,37
Z	500992,64	7186556,28
AA	499889,39	7187275,79
BB	500401,10	7187105,06
CC	500321,78	7187433,89
DD	499894,42	7186620,30

Figure 1.2: Site Layout Plan for the proposed project

2. CURRENT STATUS OF THE PROJECT AREA

2.1. ECOLOGICAL CONTEXT AND IMPORTANCE OF THE SITE

According to the National Vegetation Map (SANB, 2018), the project area occurs within two vegetation types, namely Zeerust Thornveld and Gold Reef Mountain Bushveld, both of which are classified as Least Concern (LC) in terms of the Revised List of Ecosystems that are Threatened and in Need of Protection (DFFE, 2022).

The Terrestrial Biodiversity Specialist Assessment for the Onderstepoort Solar 2 compiled by Nitai Consulting (2023) mapped the plant communities present within the project area on a finer scale, taking into consideration historical anthropogenic disturbance. According to the report, a large portion of the vegetation within the project area (approximately 31%) has been heavily modified largely due to agricultural practices, including cultivation and grazing by livestock. The following vegetation/habitat types were classified by Nitai Consulting (2023):

- **Natural Savanna:** Consists of medium-height savanna with disturbed vegetation. The area features predominantly red soils, with clay soils found in lower-lying regions.
- **Open Savanna:** Characterised by homogenous vegetation throughout most of the study area, with noticeable disturbance such as erosion and bare patches of open soil.
- **Mountain Bushveld:** Characterised by dense ridge vegetation with a number of exotic plant species recorded, particularly in disturbed areas.
- **Wetlands and Riparian Areas:** Found in the northern part of the project area, these regions are characterized by seasonally wet clay soils, aquatic vegetation like sedges, and minimal disturbance.
- **Old Lands:** Areas that were once ploughed but have since regenerated, now dominated by perennial grasses. These secondary grasslands are species-poor, with the original diversity of resprouting species typically absent, though several pioneer species are present.

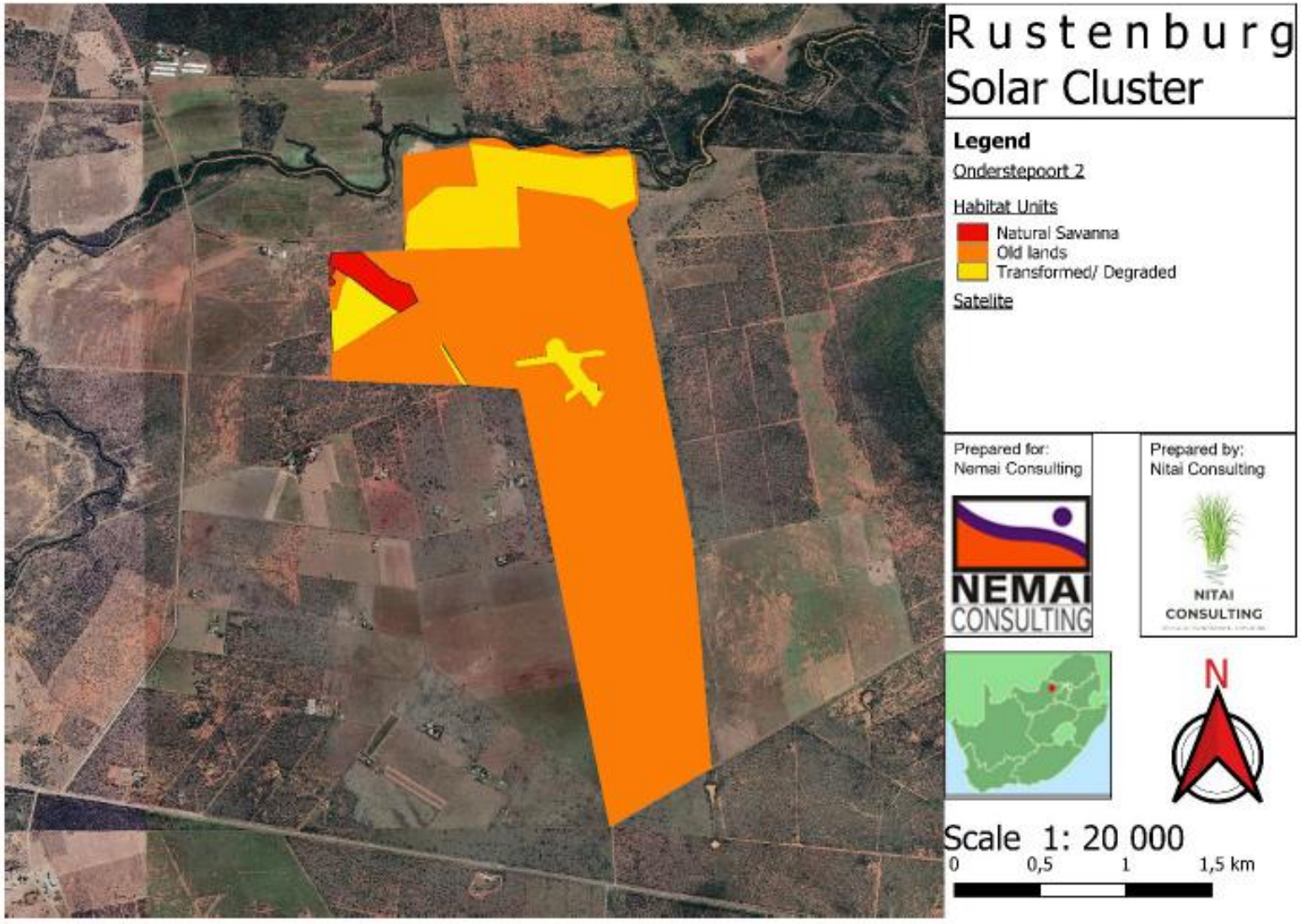


Figure 2.1: Fine scale vegetation map showing the habitats recorded in the project area.

3. CONSTRAINTS TO SUCCESSFUL REHABILITATION

Ecosystem drivers such as life-history characteristics of savanna plants, climate, fire regimes, grazing can influence the success of the re-vegetation programme in the savanna biome.

Central Bushveld and associated Mountain Bushveld (the type of savanna in which the project is located) are characterised as:

- Warm, wet summers with a growing season that usually extends for six months, followed by cool, dry winters and less productive winter months.
- Ecosystem has a quick response to rainfall which is between 350-650mm per annum.
- Grass layer with scattered tree.
- Natural incidence of fires which help to exclude bush encroachment.
- Reasonably good adaptation to grazing pressure under low to moderate stocking rates which also assist in excluding bush encroachment.

Risks and constraints associated with successful rehabilitation of disturbed areas located in this biome includes:

- Scale of clearing
- Climate seasonality
- Weed and alien plant infestation
- Soil management
- Revegetation techniques

3.1. SCALE OF CLEARING

The development of the project will result in the clearing of approximately 400 ha of natural and modified vegetation[1]. Areas requiring re-vegetation will include the access road verges, temporary laydown areas, site camps, temporary haul roads (within the footprint), material stockpile sites, PV Module population areas (these wont be cleared, but will have some trampling and compaction impacts), MV Cable Trenches (adjacent to internal road network) and the long term topsoil stockpile. Since the areas to be rehabilitated are relatively small, it is recommended that focus is placed on the retention of topsoil (as this includes a viable seedbank), rainfall infiltration, and replanting of species collected during the plant search and rescue or purchased/grown as plugs. It is further recommended that to ensure ecological stability and minimise erosion, clearing and re-vegetation is done sequentially to minimise the exposure of bare soil to wind and rainfall and that the grass layer and topsoil is not cleared. Only woody species should be removed.

[1] This report does not include the decommissioning rehabilitation strategy for the project. The rehabilitation at the time of decommissioning must be done in compliance with the regulatory requirements at that time.

3.2. CLIMATE SEASONALITY

The project area is located within savanna biome where rainfall is relatively predictable and strongly seasonal with wet warm summers and cool, dry winters. These distinct seasonal patterns will influence the success of rehabilitation efforts. It is therefore recommended that re-vegetation efforts of disturbed areas is done at the start of the rainy season (from late October to March) to give the plants and seeds the best possible chance of survival.

Seeding and planting during the dry winter period must be avoided as species survival rates will be extremely low. The re-vegetation schedule must therefore be included in the construction schedule since it is undesirable to have large areas of dry, bare soil exposed to wind during the dry months as these areas will become susceptible to wind and water erosion at the start of the rainy season, if not properly managed.

If planting is done during the correct season, risks associated with climate seasonality will be moderate but if done outside of the optimal season they will be high to very high.

3.3. WEED AND ALIEN PLANT INFESTATION

Disturbed sites that are highly susceptible to colonisation by weedy, invasive non-native plants (INNPs) and alien invasive plant species (AIPs) due to the high resource availability and low competition associated with these sites (Carbutt and Kirkman, 2022). In the project area, four INNPs and four AIPs were recorded indicating this area is susceptible to infestation of undesirable species (Nitai Consulting, 2023). Controlling these species is therefore important to ensure rehabilitation is successful. As such, it is important to implement the Alien Invasive Plant Management Plan that has been drafted for the project (Biodiversity Africa, 2025).

Risks of infestation of weeds and Alien Invasive Plant Species are high but can be controlled if the Alien Invasive Plant Management Plan is rigorously implemented.

3.4. SOIL MANAGEMENT

Topsoil is an important resource for successful re-vegetation in the project area as this contains a seedbank of naturally occurring species and provides the right conditions for these species to re-establish. As such, topsoil that is cleared must be carefully managed and stockpiled to ensure it does not become degraded. This is considered to be a high risk, however if properly managed, this can be reduced to a low risk.

3.5. REVEGETATION TECHNIQUES

Revegetation techniques should not solely rely on establishing vegetation cover through seeding techniques as this technique has had a limited success rate. This is because indigenous tufted grass species are not easily propagated from seed (Carbutt and Kirkland, 2022). Carbutt and Kirkland (2022)

indicate that revegetation of the grass layer should include planting plugs and sods in addition to seeding.

Planting plugs can provide a rapid form of cover when planted at high densities and is effective when re-establishing biodiversity in an area. Grass sods from neighbouring areas can be used but this method is more labour intensive, requires source material from intact areas and requires watering during the initial establishment phase. It is not the intention of this plan to disturb areas of intact habitat outside of the project footprint and therefore the use of grass sods should only be considered if an area is being cleared for construction and the sods can be moved directly to an area that requires rehabilitation.

It is recommended that grass plugs and sods are sourced from areas that are being cleared of vegetation and that they are planted in the topsoil stockpiles. This approach serves multiple purposes, namely, a) stabilise the topsoil stock pile, b) keep the topsoil micro and macro flora and fauna viable and, c) provide a readily available source of grass sods and plugs for rehabilitation purposes, rather than sourcing these from neighbouring intact grasslands.

If a combination of re-vegetation methods (i.e. seeding, mulching, planting and returning healthy topsoil to the site) is used to encourage growth of indigenous vegetation, risk associated with successful rehabilitation is moderate to low.

4. RE-VEGETATION AND HABITAT REHABILITATION PLAN

This section summarises the specific management actions required to successfully re-vegetate the areas within the project footprint that have been impacted on during the construction phase but are no longer required during the operational phase (e.g. laydown areas, road verges, site camps, temporary haul roads (within the footprint), material stockpile sites, PV Module population areas (these wont be cleared, but will have some trampling and compaction impacts), MV Cable Trenches (adjacent to internal road network) and the long term topsoil stockpile).

The aim of the Re-vegetation and Habitat Rehabilitation Plan is to ensure that the loss of vegetation and disruption of ecosystem functioning is minimised.

This Plan has been divided into three phases, each of which is described below.

4.1. PHASE 1: SITE CLEARING AND REMOVAL OF VEGETATION

4.1.1. IDENTIFICATION OF SENSITIVE AREAS

Ecologically sensitive areas have been identified in the various specialist reports undertaken as part of the Environmental Impact Assessment and include the Terrestrial Biodiversity (including Plants and Animals) Report, Avifaunal Report, and Aquatic Report. Sensitive areas identified in each of these reports must be identified and delineated (using painted pegs, danger tape, or other appropriate methods) by the Environmental Site Officer (ESO), appointed by the Contractor, prior to vegetation clearing or the commencement of any construction activities. It is important that the construction footprint of the development is kept to a minimum and that no areas outside of the approved footprint are disturbed. It is recommended that the perimeter fence is erected at the start of the project and prior to clearing so that the construction area is clearly defined.

4.1.2. VEGETATION CLEARING

Vegetation clearing should only be done when required and it should be done in phases to retain the vegetation cover for as long as possible and limit the amount of time bare soil is exposed to the elements. Areas outside of the project footprint must remain vegetated.

Prior to clearing, all protected species that occur within the construction footprint and which can be successfully relocated, must be lifted and either transplanted to a newly rehabilitated area or potted and placed in a nursery for future translocation. Individuals of the same species must be planted in clusters rather than scattered singly throughout the rehabilitated area. This will allow for pollination and seed dispersal of these species. Furthermore, species must be transplanted to a similar environment from which they were removed.

Grass and small shrubs that are not translocated but are either uprooted or brush cut, must be collected and stockpiled for re-vegetation purposes. For woody vegetation that is a potential fire risk, this should be converted to wood chips or the landowner should be given permission to collect the wood for use as firewood. The plant material serves multiple purposes as it is a source of seeds that will assist with the re-vegetation of the sites, it can be used as mulch to protect the topsoil and improve surface water infiltration, and it is a source of organic matter that is returned to the topsoil. The dumping of cleared vegetation onto areas adjacent to construction areas must be avoided.

During clearing of vegetation, the following principles must be applied:

- Vegetation clearing must remain within the construction footprint and must be cleared in a phased approach, as and when required. Re-vegetation of disturbed areas must therefore be carried out concurrently with construction as far as possible.
- Vegetation and topsoil under the PV modules should not be cleared in its entirety. Woody species can be mechanically removed and the Grass layer can be brush cut.
- Standing vegetation must not be mixed with soil but must be cleared separately, either mechanically or with a brush-cutter.
- Vegetation that is free of alien invasive plant species must be stockpiled for use as mulch and a source of seeds.
- Mulch should be stored for as short a time as possible to retain seed viability.
- Seeds released from stockpiles should be collected and used for re-vegetation of disturbed areas.

4.2. PHASE 2: SOIL PREPARATION AND TOPSOIL MANAGEMENT

Topsoil is the most important resource for ensuring the success of the re-vegetation of disturbed areas and as such, must be carefully managed to ensure its continued viability and health. As such, the following principles apply to the management of the topsoil:

- Soil must only be stripped from areas that are to be disturbed during construction and not from areas outside of the areas approved footprint.
- Topsoil must be kept separate from subsoil.
- Where feasible, topsoil must be immediately used in the nursery or to cover previously disturbed areas that require re-vegetation as this will minimise double handling[2]. Where this is not feasible, it must be stockpiled on site (within the authorised footprint) for subsequent rehabilitation.
- Where feasible, grass sods and plugs should be sourced from areas that are about to be cleared directly to re-vegetate areas that are being rehabilitated, if this is occurring simultaneously.

[2] Topsoil contains viable seed, nutrients and microbes that promote more effective revegetation than soil that has been stored.

- Topsoil that is stored must be placed in a designated area and stockpiles should not be more than 2m high. Topsoil should be used as soon as possible with a maximum limit of six months storage.
- Topsoil piles will likely be susceptible to erosion from wind and water. A number of approaches to stabilise the stockpile should be used, including vegetating the stock pile with indigenous grass seeds and planting of grass sods and plugs. It may take some time for the vegetation to establish and therefore it is recommended that the stock pile is covered with hessian or porous material in which grass plugs may be planted and through which seeds may germinate, whilst still protecting the stock pile from wind and water erosion. Plastic sheeting must not be used as it will generate additional heat that is likely to kill off seeds and microbes present.

Sites that are to be rehabilitated must be prepared prior to re-vegetation. The following steps must be followed:

- The area must be contoured to the natural contours of the landscape.
- All foreign and inorganic material must be removed from the site.
- Compacted soil must be ripped to a depth of 600mm, except where there is underlying hardpan or bedrock, to allow for root penetration and aeration of the soil. It is recommended that an agricultural cultivator is used rather than a grader or dozer to ensure that boulders are not brought back up to the surface.
- The areas that are to be re-vegetated must be covered with either stockpiled or newly stripped topsoil to the original depth.
- Vehicles must be restricted from travelling over newly prepared areas but must rather use demarcated roads.
- No construction equipment or unauthorised persons should be allowed into recently prepared areas.
- Livestock must be prohibited from entering newly prepared areas.

4.3. PHASE 3: RE-VEGETATION OF DISTURBED AREAS

A combination of seed sowing, active planting, mulching and topsoil management should be used to restore plant cover to the project area in areas that were considered natural habitat. The final vegetation cover should resemble the original indigenous vegetation composition and structure with a target of achieving 60% of the original species composition within five years. If sufficient vegetation cover and diversity is passively achieved after 24 months, then additional planting is not required.

4.3.1. ACTIVE PLANTING

Active planting of vegetation should include a combination of grass plugs[3], grass sods[4] and any protected plant species that need to be translocated. The use of grass sods must be done under the following conditions and must be approved by the ECO:

- Grass sods obtained from natural vegetation that is free of INNPs and AIPs and from an area in the construction footprint that is being cleared. No grass sods must be harvested from intact grassland outside of the construction footprint.
- Grass sods must be planted directly into newly prepared areas that are being rehabilitated or into topsoil stockpiles for later use.

Plant species should be translocated at the start of the rainy season to give them the best chance of survival. Where this is not possible, species should be potted and stored in a nursery until they can be replanted at the start of the following rainy season. Principles that apply to the use of mature plants for re-vegetation efforts include:

- Only individuals from areas that have been cleared may be harvested for the purposes of revegetation. Individuals from outside of the construction footprint must not be harvested.
- Harvesting may only occur once the relevant plant permits have been obtained.
- Individuals must be dug up carefully ensuring the root ball remains intact and stored in a way to prevent the loss of moisture. Plastic bags and plastic boxes are recommended for temporary storage. Plants should not remain in these containers for more than three days.
- Individuals must be planted out into rehabilitated areas immediately or, where this is not feasible, they should be placed into pots and cared for in a nursery until they can be planted out.
- Individuals must be planted out in colonies rather than scattered throughout the site. This will ensure that individuals can cross pollinate and produce viable seeds that can aid in the recolonisation of the disturbed area over time.
- Individuals should be planted out at the start of the rainy season to give them the highest chance of survival.
- Individuals must be planted out in similar habitat to which they were harvested.
- Where passive rehabilitation has not been successful, it is recommended that grass plugs should be planted at densities of 5-10 plugs m^2 (50,000-100,000 plugs ha) for small tufted species and 2-5 plugs m^2 (20,000-50,000 plugs ha) for large tufted species.
- If plugs are purchased from nurseries, these should be placed in an onsite nursery to allow them time to adapt to local climatic conditions and "harden off". This will increase their survival rate when planted out into the landscape.
- If sods are used, the above ground biomass (i.e. leaves and stems) should be trimmed back. This will ensure a higher chance of survival.

[3] Grass plugs refer to vegetative material used as start-up sources of growth, usually established from nursery seedling trays.

[4] Grass sods are aggregates of grass swards obtained directly from natural grasslands **under discretion.**

- Grass sods should be harvested on cool, humid or even wet days, preferably during or after a period of wet weather. This will assist the root systems to be more easily removed with less disturbance and will reduce desiccation rates of the sods.
- Grass sods should be watered after planting and during the initial establishment phase.

4.3.2. SEEDING

Indigenous seed from the naturally occurring vegetation should be used to supplement revegetation efforts. Seeds can either be sown directly onto a prepared soil surface or, in the case of over-seeding (also known as "thatching"), applied to the recovery area using grass clippings that are mown while in full seed (Carbutt and Kirkland, 2022). Seeds of surrounding shrubs, trees, herbaceous and geophytic species from the surrounding intact grassland may also be used to re-populate the rehabilitated area with a variety of species.

If indigenous seeds are collected, the following principles apply:

- Seeds must be collected from areas that are free of alien vegetation.
- Seeds may be collected by hand or harvested using a vacuum harvester. If the latter is used, seeds collected via vacuum harvester must be kept separate from hand collected seed.
- Seeds that are collected must be used immediately or dried and stored appropriately and used at the start of the wet season. Seeds can be dried by laying them out on a sheet in a suitably ventilated room and turned twice a day until they are dry. They should be stored in paper bags in a cool, dry room until required for planting out.
- Seeds should be harvested on hot, dry days with low relative humidity to reduce the probability of fungal infections and therefore increase seed viability.
- Seeds should be broadcast onto the site following scarification of the soil surface and watered in to prevent them from blowing away. This will also improve germination success rates and seedling survival rates.
- Seeds should be broadcast during the rainy season.
- No seeds from alien invasive plant species or exotic species should be harvested or brought onto the site.

The use of commercial seed mix should be used at the discretion of the ECO and must only be considered where rehabilitation using topsoil, direct planting and seed collected from indigenous species has not been successful (i.e. not resulted in 80% vegetation cover in two years). If commercial seed mixes are used, then locally occurring grass species should be prioritised. The following principles apply to the use of commercial seed mixes:

- The mix should include a mix of annual and perennial species.
- The mix should include fast growing pioneer species that are not at risk of becoming invasive.
- Selected species must be able to successfully grow in the area where they are planted.
- The mixture used must not cause an ecological imbalance of species in the project area.

4.3.3. MULCHING

Mulching can be used to protect and cover the soil surface as well as provide a source of seed for revegetation purposes. It also adds organic matter back to the soil as it decomposes. The following principles must be applied to mulching:

- Mulch must be made from vegetation that was cleared for construction and which is free of alien invasive plant species.
- Mulch can be put through a chipper to break down the plant material.
- Mulch must be applied over the topsoil, after seeding has occurred.

4.3.4. ADDITIONAL GENERAL CONSIDERATIONS

Additional measures that should be considered to ensure the success of the Re-vegetation and Habitat Rehabilitation Plan include:

- Erosion control measures may be required to prevent surface water and wind erosion. Low, porous fences that break the wind flow over rehabilitated areas will assist in stabilising newly rehabilitated areas and assist in trapping wind blown dust, organic matter and seeds. They will also create microclimates that aid in the germination of seeds by providing shade and protection from wind.
- If erosion damage occurs after re-vegetation has taken place and forms channels/gullies or wash-aways, backfilling must be done to restore areas to an appropriate condition.
- Areas that need to be backfilled, must be done in a way to ensure that water does not accumulate.
- Subsoil must be used for backfilling and not topsoil. Furthermore, subsoil must not be used to re-vegetate areas.
- The re-instatement of faunal habitats is often overlooked. Faunal microhabitats (e.g. rock stacks and logs) in the construction footprint must be relocated to the same habitat immediately adjacent to the removal site. E.g. Rock stacks should be restacked.
- Temporary infrastructure (laydown areas, widened roads, etc.) must include the provision of microhabitat to attract faunal species to the area by placing logs and rocks at strategic sites to provide shelter for small mammals and reptiles. These rock stacks should mimic the surrounding environment.
- Temporary cameras should be places at the re-vegetated areas to monitor unauthorised access in these areas. Any contractor found to be entering an area after it is rehabilitated must be fined and is responsible for reinstating any damage they have caused.

5. SPECIES OF CONSERVATION CONCERN PRESENT ON SITE

No threatened (i.e. CR, EN or VU) plant SCC were recorded during the ecological walkthrough of the project area (Biodiversity Africa, 2025). However, five plant species protected under Schedule 11 of the Transvaal Nature Conservation Ordinance (No. 12 of 1983) were recorded in the development footprint, along with two species protected under Schedule A of the Publication of the Annual List of Tree Species, which are protected under Section 12 of the National Forests Act (1998) (refer to Table 5.1). These species will require permits for their removal.

No species are nationally protected in terms of the NEM:BA TOPS List (2023) were recorded in the project area.

To offset the loss of protected tree species, it will likely be a condition of the permit that additional ones are planted to offset their loss. If this is the case, it is recommended that these are used for rehabilitation of the project area.

Table 5.1: Plant SCC recorded within the project area.

Family	Species	Red List Status	Transvaal Nature Conservation Ordinance (No. 12 of 1983)	Protected Tree Species
IRIDACEAE	*Gladiolus sericeovillosus*	LC	X	-
APOCYNACEAE	*Orbea lutea*	LC	X	-
AMARYLLIDACEAE	*Crinum macowanii*	LC	X	-
AMARYLLIDACEAE	*Ammocharis coranica*	LC	X	-
EUPHORBIACEAE	*Spirostachys africana*	LC	-	X
BRASSICACEAE	*Boscia albitrunca*	LC	-	X
FABACEAE	*Vachellia erioloba*	LC	-	X

6. GUIDELINES AND METHODS FOR THE PLANT SEARCH AND RESCUE

Section 6.1 to 6.4 below provides guidelines and details on the methods required for the Relocation of protected plant species present within the project area.

6.1. ECOLOGICAL WALKTHROUGH (PLANT SEARCH)

Responsible Person: Botanical Specialist / Horticulturalist

The first step in the plant relocation process is to determine the SCC present by undertaking an ecological walkthrough of the project infrastructure/development footprint. During the ecological walkthrough, data on the SCC and protected plant species present, their location and densities are collected so that permits can be applied for from the relevant authorities. This walkthrough was completed in February 2025 (Biodiversity Africa, 2025).

6.2. ACQUISITION OF PLANT REMOVAL PERMITS

Responsible Person: Botanical Specialist/ECO

Once data on the SCC present within the development footprint has been collected, the relevant permits for the removal and/or translocation of these species must be obtained from the relevant issuing authority. Permits must be obtained prior to any vegetation clearance or the removal and/or translocation of SCC. No SCC may be removed and/or translocated prior to obtaining the relevant permits.

- The issuing authority for plant species protected in terms of the Transvaal Nature Conservation Ordinance (Act No. 12 of 1983)[5] is the Department of Economic Development, Environment, Conservation and Tourism (DEDECT)

- The issuing authority for any protected tree species is the DFFE (Forestry).

The permit application is currently in progress and the holder of the Environmental Authorisation will be responsible for complying with any condition set out in these permits.

6.3. NURSERY ESTABLISHMENT

Responsible Person: Environmental Site Officer (ESO) and ECO together with Horticulturalist

If direst planting is not feasible, an onsite nursery will need to be established prior to the rescue of any plant species. The onsite nursery should be located within a previously disturbed area near to

[5] This Ordinance will be repealed when the North West Bioidversity Management Act, 2017 comes into force.

the site office or temporary laydown area. The nursery must have a water source and storage area of adequate capacity. The nursery must be fenced off from herbivores to avoid loss of species.

The horticulturalist appointed to undertake the plant relocation must provide input on the establishment of the on-site nursery.

6.4. PLANT RESCUE

Responsible Person: Horticulturalist

The following guidelines must be considered:

- An experienced horticulturalist must be appointed to undertake the plant rescue and manage the establishment and operation of the onsite nursery.
- The appointed horticulturalist must establish the resource requirements in terms of the workforce required to undertake the plant rescue and compile a species-specific methodology for the removal and/or translocation of SCC. The plant rescue methodology should consider overall genetic variability and alternatives to preserving genetic variability (i.e. in addition to transplanting whole plants, plants can be propagated from seed and/or cuttings).
- The plant search should be undertaken during the flowering season, preferably at the start of flowering season, to ensure the correct identification and the rescue of the relevant SCC should occur during the dormant season, before the spring rains arrive. SCC should be marked with metal tags, and their location recorded using a GPS, during the search so that they can be located for rescue once dormant.
- Data on the original location of rescued plants, survival success, and relocation site (i.e. GPS co-ordinates, soil type, slope, aspect, etc) must be collected and stored in the site environmental file. This file must be maintained by the holder of the EA for a period of 5 years post-construction, or as specified in the EA.
- Individuals must be dug up carefully ensuring the root ball remains intact.
- Where feasible, plants should be immediately transplanted to a new location, preferably where revegetation and rehabilitation is taking place elsewhere within the project area, but outside of the permanent development footprint. These individuals must be protected from construction activities (e.g. areas should be delineated using painted pegs or danger tape) and monitored, and where necessary watered, to ensure survival. Individuals of the same species must be grouped together to form colonies to ensure cross pollination can occur rather than scattered individually throughout the re-vegetated site.
- Where direct transplanting of plants is not possible, rescued plants must be stored within the onsite nursery. Rescued plants should be placed into a container labelled with the species name and date of rescue. The growing medium should be sourced from the original site at which the individual plant was rescued. Topsoil from the stockpile can be used.
- Rescued plants cannot be transplanted into intact areas that fall outside of the project area (i.e. adjacent properties) but they can be transplanted into degraded habitat.
- Individuals must be planted out in a similar habitat to which they were harvested.
- Rescued plants cannot be transplanted into intact areas that fall outside of the project area (i.e. adjacent properties).
- Intact areas within the project area (but outside of the development footprint) should be avoided as receiving sites for rescued plants as rescued plants could outcompete the naturally

occurring indigenous species, introduce pathogens and viruses, and disrupt ecological processes leading to the degradation of the vegetation within these areas.

7. MONITORING PLAN

7.1. REVEGETATION AND HABITAT REHABILITATIONMONITORING REQUIREMENTS

Monitoring is required to ensure that the recommended management actions are effective and successful. Indicators that should be monitored are outlined below and in Table 7.1.

- Fixed point photographs of the re-vegetated sites should be taken at regular intervals to show the progression and success of re-vegetation efforts over time.
- Species composition in the disturbed areas must be recorded and compared to neighbouring control sites to track the success of re-vegetation efforts. It is recommended that this is done during the peak flowering season.
- Vegetation canopy cover must be measured using a consistent and standard method. Since vegetation cover varies with seasonality it is recommended that this is done at the same time each year.
- Presence of alien invasive plant species in disturbed areas must be monitored. If noted, the steps for their removal outlined in the Alien Invasive Management Plan must be implemented.
- Evidence of soil erosion must be monitored. If soil erosion occurs, measures outlined in the erosion management plan/method statement must be implemented.

Monitoring should be carried out annually until re-vegetation has been deemed successful. Re-vegetation will be deemed successful once the desired plant cover has been established and there is no evidence of alien invasive plant species or erosion. If re-vegetation methods show poor surface coverage after 12 months (<20%) then the re-vegetation process must be repeated.

Table 7.1: Monitoring Actions, indicators, and timeframes for the implementation of the Re-Vegetation and Habitat Rehabilitation Plan.

Monitoring Action	Indicator	Timeframe	Responsible
Fixed point photographs of the re-vegetated sites.	Evidence showing progression of re-vegetation through increased canopy cover.	Annually	Botanist & ECO. After completion of construction, the O&M contractors HSE manager will replace the role of ECO.
Regular visual inspections of the re-vegetated sites where the following indicators are recorded: • Species composition • Canopy Cover	• Species composition is comprised 70% of the original composition of the control sites. • No alien invasive plant species are present. • No evidence of erosion.	Annually	Botanist & ECO

• Canopy height • Presence of alien invasive plant species • Evidence of soil erosion			
Document and review management actions implemented to record the success of the re-vegetation within the project area.	Clear, documented record of management activities and review of success.	Annually	Botanist & ECO

7.2. PLANT RELOCATION MONITORING REQUIREMENTS

The following general monitoring requirements for plant relocation are recommended to ensure maximum success (Table 7.2):

- All plants housed within the on-site nursery should be inspected weekly for pathogens and viruses. Any diseased or infested plants should be treated appropriately and where required, isolated. If plants do not respond to treatment, plant material must be disposed of in the same manner as any cleared Alien and Invasive Plant Species (see Alien Invasive Plant Management Plan).
- All rescued plants that have been translocated into receiving environments must be monitored and inspected weekly until they have become established. If plants have not established, input regarding alternative methods should be obtained from the horticulturalist.
- It is recommended that post-relocation monitoring is undertaken at the start and end of the growing season for the first two years. A brief report should be compiled following each monitoring event. Each report should be stored in the site environmental file. This file must be maintained by the holder of the EA for a period of 5 years post-construction, or as specified in the EA. The monitoring reports should include the following:
    - Fixed-point photographs illustrating the receiving sites over time.
    - Survival and/or death rates of each species.

Specific monitoring actions required are outlined in Table 7.2 below.

Table 7.2: Monitoring actions, indicators, and timeframes for the implementation of the Plant Relocation Plan

Monitoring Action	Indicator	Timeframe	Responsible
Inspect nursery grown plants for pathogens and viruses.	Evidence of pathogens and viruses on nursery grown plants.	Weekly	Contractor/ESO
Inspect translocated plants until established.	Evidence of success of establishment of translocated plants.	Weekly	Contractor/ESO
Monitoring report indicating survival and death rates for each translocated species.	Clear, documented record of survival and death rates of individual species.	Year 1 and 2: Start and end of growing season	ECO
Fixed point photographs of the re-vegetated sites.	Evidence showing progression of re-vegetation through increased canopy cover.	Year 1 and 2: Start and end of growing season	ECO

7.3. STORAGE OF DATA

All monitoring data must be collected and stored electronically on the Digital Site Environmental Files as required by the EMPr where it is easily accessible to all parties.

Data from each monitoring event must be entered into a spreadsheet so that this can be easily analysed at any given time.

All photographs must be labelled with the date taken and location in which they were taken.

7.4. REPORTING

Management measures implemented and success achieved should be clearly documented. Compliance with this plan must be documented by the ECO and all reports should be maintained within the site office and for a period of 5 years post construction.

This plan must be seen as a working document and must be updated as and when required or if any of the recommended measures need to be revised. In terms of the EIA regulations, the relevant actions within this plan can be updated without approval from the competent authority as long as the outcomes and objectives of this plan remain unchanged.

A detailed annual report should be submitted (by the ECO during the construction phase and by the HSE officer/manager during the operational phase) to the managing authority/holder of the EA. If the management plan needs to be adjusted, it is recommended that the monitoring report is reviewed by an ecologist who can make recommendations on adjustments that are required.

8. ROLES AND RESPONSIBILITIES

The holder of the EA, the Contractors and the ECO are responsible for ensuring the Re-vegetation and Habitat Rehabilitation Plan is implemented. The roles and responsibilities for each of them are outlined in Table 8.1 below.

Table 8.1: Roles and responsibilities associated with implementing the Re-vegetation and Habitat Rehabilitation Plan.

Role	Responsibility
Applicant (Holder of EA)	The Applicant (holder of Environmental Authorisation (EA)) bears the overarching responsibility for ensuring compliance with the conditions outlined within the EA. Furthermore, they are responsible for appointing appropriately qualified Contractors to co-ordinate and supervise the different tasks outlined in this plan, ensuring the appointed contractor has sufficient resources to implement the plan and to appoint an independent and suitably qualified ECO to perform the responsibilities outlined in this report.
Contractor	The Contractor appointed is responsible for implementing the Re-Vegetation and Habitat Rehabilitation Plan during the construction phase of the project. Specific actions for which the contractor is responsible include the following (this is not a comprehensive list, but only indicative of the duties to be carried out in this regard): • Implementing this management plan. • Ensuring all personnel comply with the requirements of the plan. • Reporting on the effectiveness of the implementation and monitoring of the re-vegetated sites. • Monitoring the site. • Analysing the data. • Making recommendations on remedial action when required. • Writing progress and annual reports.
ECO	The ECO is responsible for auditing and verifying the implementation of the management plan during the relevant phases of the project. This includes the following: • Identifying and demarcating sensitive areas. • Appointing a botanist to inspect the re-vegetated areas and reporting on these findings throughout the construction phase to the developer and environmental authorities. • Keeping a photographic record of the re-vegetation progress. • Reviewing and approving construction method statements related to re-vegetation of the site.

	• Reviewing and inspecting Contractor's written records that illustrate compliance with the Environmental Management Plan (EMPr). • Recommending and/or developing corrective actions when there is non-compliance or when the measures to re-vegetate the disturbed area is not working. • The ECO, with input from a qualified botanist, must sign off on when the re-vegetated areas have successfully reached a state where no further monitoring and interventions are required.

9. CONCLUDING REMARKS

The project area is currently comprised of a mosaic of natural and modified habitat. Re-vegetation of disturbed areas is costly and as such, keeping the development footprint to a minimum will reduce the costs associated with re-vegetation and subsequent monitoring of the project area.

Since there are protected species present within the construction footprint that need to be translocated to a new receiving environment (i.e. *Orbea lutea*), it is recommended that these species are used for the re-vegetation of disturbed areas.

The applicant, contractor and ECO will need to ensure that this plan is reviewed periodically for efficacy and necessary revisions made to the document where applicable.

10. REFERENCES

Biodiversity Africa. 2025. Ecological Walkthrough Report for the Onderstepoort 2 Solar Photovoltaic development, Rustenburg, North West Province.

Carbutt, C.; Kirkman, K. 2022. Ecological Grassland Restoration—A South African Perspective. Land. Vol 11. P. 575. https://doi.org/10.3390/land11040575

Government of South Africa (2022) South African Red List of Terrestrial Ecosystems: assessment details and ecosystem descriptions. Government Notice 2747, Gazette 4526. Technical Report #7664, SANBI Pretoria, South Africa.

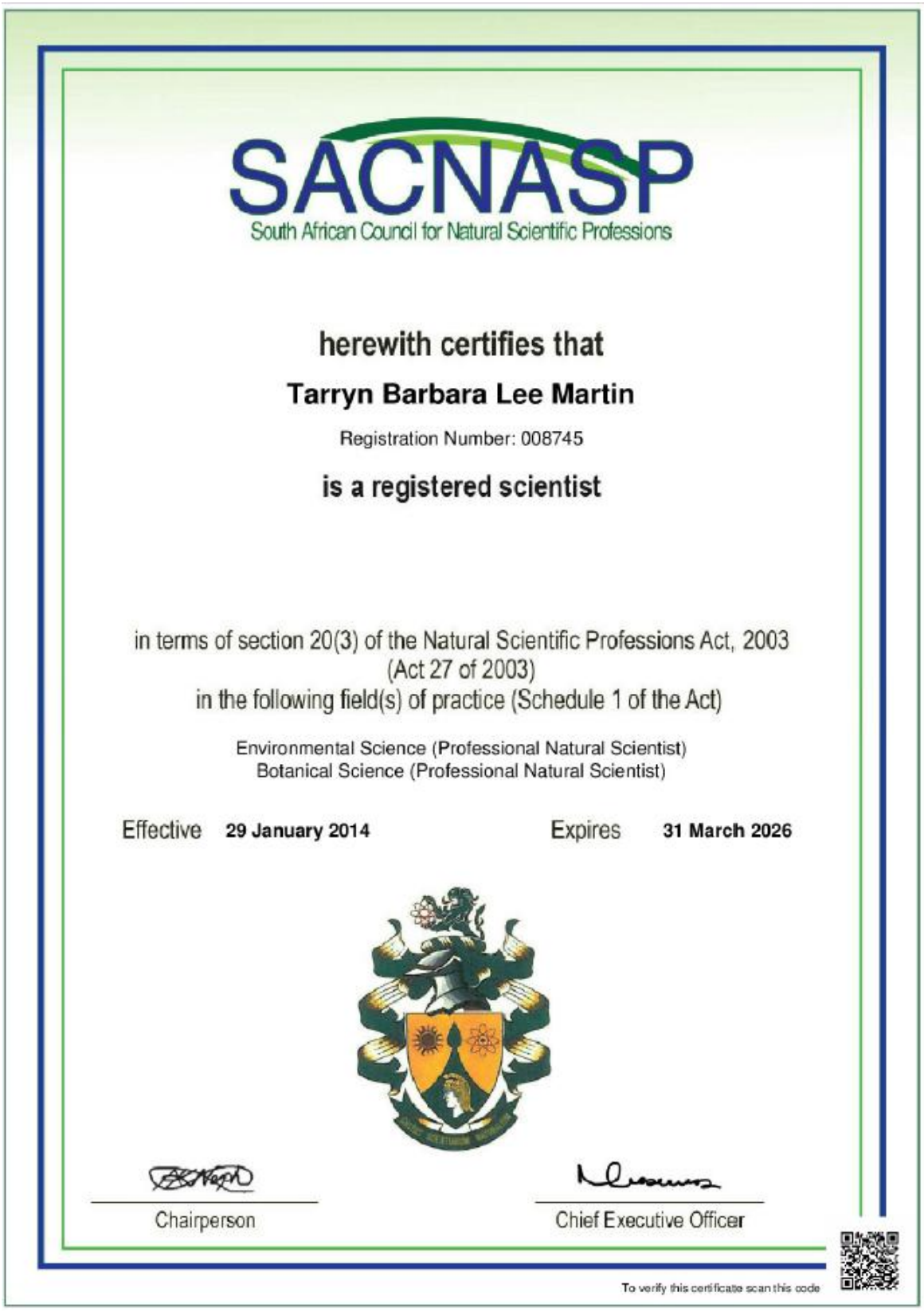
Coetzee, K. 2016. Practical Techniques for Habitat and Wildlife Management. New Voices Publishing Services, Cape Town. ISBN: 978-0-620-70843-2.

Nitai Consulting (Pty) Ltd, 2023. Terrestrial Biodiversity Specialist Assessment for the Proposed Solar development for Onderstepoort 2, Pty (LTD), Rustenburg, North West Province, South Africa.

South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.2020.

SANBI. 2013. Grasslands Ecosystem Guidelines: landscape interpretation for planners and managers. Compiled by Cadman, M.,de Villiers, C., Lechmere-Oertel, R. and D. McCulloch. South African National Biodiversity Institute, Pretoria. 139 pages.

APPENDIX 1: PROOF OF SACNASP REGISTRATION AND HIGHEST QUALIFICATION



SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Tarryn Barbara Lee Martin

Registration Number: 008745

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Environmental Science (Professional Natural Scientist)
Botanical Science (Professional Natural Scientist)

Effective **29 January 2014** Expires **31 March 2026**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

RHODES UNIVERSITY

THIS IS TO CERTIFY THAT

TARRYN BARBARA LEE MARTIN

WAS THIS DAY AT A CONGREGATION OF THE UNIVERSITY
ADMITTED TO THE DEGREE OF

MASTER OF SCIENCE

IN

BOTANY

WITH DISTINCTION

VICE CHANCELLOR

DEAN OF THE FACULTY OF SCIENCE

REGISTRAR

GRAHAMSTOWN
10 APRIL 2010



TARRYN MARTIN

Curriculum Vitae

APPENDIX 2: CV

CONTACT DETAILS

Name	**Tarryn Martin**
Name of Company	**Biodiversity Africa**
Designation	Director
Profession	Botanical and Terrestrial Biodiversity Specialist
E-mail	tarryn@biodiversityafrica.com
Office number	+27 (0)71 332 3994
Education	2010: Master of Science with distinction (Botany) 2004: Bachelor of Science (Hons) in African Terrestrial Vertebrate Biodiversity 2003: Bachelor of Science
Nationality	**South African**
Professional Body	**SACNASP**: South African Council for Natural Scientific Profession: Professional Natural Scientist (400018/14) **SAAB**: Member of the South African Association of Botanists **IAIASa**: Member of the International Association for Impact Assessments South Africa Member of Golden Key International Honour Society

Key areas of expertise

- Biodiversity Surveys and Impact Assessments that meet Performance Standard 6 of the IFC and the Protocols under NEMA
- Environmental Impact Assessments
- Critical Habitat Assessments
- Biodiversity Management and Monitoring Plans
- Alien Invasive Management Plans
- Rehabilitation Plans
- Project Management of large Environmental Impact Assessments in Mozambique

PROFILE

Tarryn has over twelve years of experience working as a botanist, eleven of which are in the environmental sector. She has worked as a botanical specialist and project manager on projects within South Africa, Mozambique, Lesotho, Zambia, Tanzania, Cameroon and Malawi.

She has extensive experience writing botanical impact assessments, critical habitat assessments, biodiversity management plans, biodiversity monitoring plans and rehabilitation and restoration plans to South African and International Standards such as those of the International Finance Corporation (IFC). Her experience includes working on large renewable energy projects in South Africa as well as large mining projects in Mozambique, including multiple graphite mines and a heavy mineral mine, all of which were to international lenders standards.

Tarryn holds a BSc (Botany and Zoology), a BSc (Hons) in African Vertebrate Biodiversity and an MSc with distinction in Botany from Rhodes University. Tarryn's Master's thesis examined the impact of fire on the recovery of C_3 and C_4 Panicoid and non-Panicoid grasses within the context of climate change for which she won the Junior Captain Scott-Medal (Plant Science) for producing the top MSc of 2010 from the South African Academy of Science and Art as well as an Award for Outstanding Academic Achievement in Range and Forage Science from the Grassland Society of Southern Africa. Tarryn is a professional member of the South African Council for Natural Scientific Professionals (since 2014).

EMPLOYMENT EXPERIENCE

Director and Botanical Specialist, Biodiversity Africa

July 2021 - present

- Botanical and ecological assessments for local and international EIAs in Southern Africa
- Identifying and mapping vegetation communities and sensitive areas
- Designing and implementing biodiversity management and monitoring plans
- Designing rehabilitation plans
- Designing alien management plans
- Ecological walkthroughs micro siting project infrastructure for renewable energy developments
- Critical Habitat Assessments and Ecosystem Services Reports that meet PS6 of the IFC
- Managing budgets

Principal Environmental Consultant, Branch Manager and Botanical Specialist, Coastal and Environmental Services

May 2012-June 2021

- Managing large ESIAs to lenders standards in South Africa and Mozambique

- Botanical and ecological assessments for local and international EIAs in Southern Africa often to IFC Standards
- Identifying and mapping vegetation communities and sensitive areas
- Designing and implementing biodiversity management and monitoring plans
- Designing rehabilitation and biodiversity offset plans
- Designing alien management plans
- Critical Habitat Assessments
- Large ESIA studies
- Managing budgets
- Cape Town branch manager
- Coordinating specialists and site visits

Accounts Manager, Green Route DMC

October 2011- January 2012

- Project and staff co-ordination
- Managing large budgets for incentive and conference groups travelling to southern Africa
- Creating tailor-made programs for clients
- Negotiating rates with vendors and assisting with the ground management of inbound groups to ensure client satisfaction.

Camp Administrator and Project Co-ordinator, Windsor Mountain International Summer Camp, USA

April 2011 - September 2012

- Co-ordinated staff and camper travel arrangements, main camp events and assisted with marketing the camp to prospective families.

Freelance Project Manager, Green Route DMC

November 2010 - April 2011

- Project and staff co-ordination
- Managing large budgets for incentive and conference groups travelling to southern Africa
- Creating tailor-made programs for clients
- Negotiating rates with vendors and assisting with the ground management of inbound groups to ensure client satisfaction.

Camp Counselor, Windsor Mountain Summer Camp, USA

June 2010 - October 2010

NERC Research Assistant, Botany Department, Rhodes University, Grahamstown in collaboration with Sheffield University, Sheffield, England

April 2009 - May 2010

- Set up and maintained experiments within a common garden plot experiment
- collected, collated and entered data
- Assisted with the analysis of the data and writing of journal articles

Head Demonstrator, Botany Department, Rhodes University

March 2007 - October 2008

Operations Assistant, Green Route DMC

September 2005 - February 2007

- Project and staff co-ordination
- Managing large budgets for incentive and conference groups travelling to southern Africa
- Creating tailor-made programs for clients
- Negotiating rates with vendors and assisting with the ground management of inbound groups to ensure client satisfaction

PUBLICATIONS

- Ripley, B.; Visser, V.; Christin, PA.; Archibald, S.; Martin, T and Osborne, C. Fire ecology of C_3 and C_4 grasses depends on evolutionary history and frequency of burning but not photosynthetic type. *Ecology.* 96 (10): 2679-2691. 2015
- Taylor, S.; Ripley, B.S.; Martin, T.; De Wet, L-A.; Woodward, F.I.; Osborne, C.P. Physiological advantages of C_4 grasses in the field: a comparative experiment demonstrating the importance of drought. *Global Change Biology*. 20 (6): 1992-2003. 2014
- Ripley, B; Donald, G; Osborne, C; Abraham, T and Martin, T. Experimental investigation of fire ecology in the C3 and C4 subspecies of *Alloteropsis semialata. Journal of Ecology.* 98 (5): 1196 - 1203. 2010
- South African Association of Botanists (SAAB) conference, Grahamstown. Title: Responses of C3 and C4 Panicoid and non-Panicoid grasses to fire. January 2010
- South African Association of Botanists (SAAB) conference, Drakensberg. Title: Photosynthetic and Evolutionary determinants of the response of selected C3 and C4 (NADP-ME) grasses to fire. January 2008

COURSES

- EIA Short Course 2012, Rhodes University and CES, Grahamstown
- Fynbos identification course, Kirstenbosch, 2015.
- Photography Short Course, Cape Town School of Photography, 2015.
- Using Organized Reasoning to Improve Environmental Impact Assessment, 2018, International IAIA conference, Durban

CONSULTING EXPERIENCE

(projects that meet IFC PS are in bold)

International Projects

- **2022: Critical Habitat Assessment for FG Gold Baomahun Gold Project, Sierra Leone. This report was to IFC Standards.**
- **2022: Botanical Impact Assessment for the proposed Nataka Heavy Minerals Mine and TSF, Nampula Province, Mozambique. This report was to IFC Standards.**
- 2021: Botanical screening assessment for the proposed Nataka Heavy Minerals Mine, Nampula Province, Mozambique
- 2021: Botanical specialist for the Pilivilli Heavy Minerals Mine Monitoring Program in Nampula Province, Mozambique
- 2020 – 2021: Project manager for the 2Africa subsea cable ESIA in Mozambique.
- 2020 – 2021: Project manager for the Category B EIA for the Wihinana Graphite Mine, Cabo delgado, Mozambique
- 2020 – 2021: Project manager for the category B exploration ESIA for Sofala Heavy Minerals Mine, Inhambane, Mozambique

- **2020: Critical Habitat Assessment for a graphite mine in Cabo Delgado, Mozambique. This assessment was to IFC standards.**
- 2020: Analysed the botanical dataset for Lurio Green Resources and provided comment on the findings and gaps.
- **2020: Biodiversity Management Plan and Monitoring Plan for mine at Pilivilli in Nampula Province, Mozambique. This assessment was to IFC standards.**
- **2019: Botanical Assessment for a cocoa plantation, Tanzania. This assessment was to IFC standards.**
- **2019: Critical Habitat Assessment, Biodiversity Management Plan and Ecosystem Services Assessment for JCM Solar Farm in Cameroon. This assessment was to IFC standards.**
- **2019: Undertook the Kenmare Road and Infrastructure Botanical Baseline Survey and Impact Assessment for an infrastructure corridor that will link the existing mine at Moma to the new proposed mine at Pillivilli in Nampula Province, Mozambique. This assessment was to IFC standards.**
- 2012 – 2019: Kenmare Terrestrial Monitoring Program Project Manager and Specialist Survey, Nampula Province, Mozambique.
- **2018: Conducted a field survey and wrote a botanical report to IFC standards for the proposed Balama Graphite Mine Environmental and Social Impact Assessment (ESIA) in Cabo Delgado Province, Mozambique.**
- **2018: Co-authored the critical habitat assessment chapter for the proposed Kenmare Pilivilli Heavy Minerals Mine.**
- 2018: Authored the Conservation Efforts chapter for the Kenmare Pilivilli Heavy Minerals Mine.
- **2017-2018: Co-authored and analysed data for the Kenmare Bioregional Survey of *Icuria dunensis* (species trigger for critical habitat) in Nampula Province, Mozambique. This was for a mining project that needed to be IFC compliant.**
- **2017: Conducted a field survey and wrote a botanical report to IFC standards for the proposed Ancuabe Graphite Mine Environmental and Social Impact Assessment (ESIA) in Cabo Delgado Province, Mozambique.**
- 2017-2018: Managed the Suni Resources Montepuez Graphite Mine Environmental Impact Assessment. This included the management of ten specialists, the co-ordination of their field surveys, regular client liaison and the writing of the Environmental Impact Assessment Report which summarised the specialists findings, assessed the impacts of the proposed mine on the environment and provided mitigation measures to reduce the impact.
  I was also the lead botanist for this baseline survey and impact assessment and undertook the required field work and analysed the data and wrote the report.

- **2017: Undertook the botanical baseline survey and impact assessment for the proposed Kenmare Pilivili Heavy Mineral Mine in Nampula Province, Mozambique. This was to IFC Standards.**
- 2017: Ecological Survey for the Megaruma Mining Limitada Ruby Mine Exploration License, Cabo Delgado, Mozambique.
- 2016: Undertook the botanical baseline survey and impact assessment, wrote an alien invasive management plan and co-authored the biodiversity monitoring plan for this farm. The project was located in Zambezia Province, Mozambique.
- 2015-2016: Conducted the Triton Minerals Nicanda Hills Graphite Mine Botanical Survey and Impact Assessment. Was also the project manager and specialist coordinator for this project. The project was located in Cabo Delgado Province, Mozambique.
- **2015: Was part of the team that undertook a Critical Habitat Assessment for the Nhangonzo Coastal Stream site at Inhassora in Mozambique that Sasol intend to establish drill pads at. This project needed to meet the IFC standards.**
- 2014: Lurio Green Resources Wood Chip Mill and Medium Density Fibre-board Plant, Project Manager and Ecological Specialist, Nampula Province, Mozambique. 2014-2015.
- 2013-2014: LHDA Botanical Survey, Baseline and Impact assessment, Lesotho.
- 2014: Biotherm Solar Voltaic Ecological Assessment, Zambia.

- 2013-2014: Lurio Green Resources Plantation Botanical Assessment, Vegetation and Sensitivity Mapping, Specialist Co-ordination, Nampula Province, Mozambique.
- 2013: Syrah Resources Botanical Baseline Survey and Ecological Assessment., Cabo Delgado Mozambique.
- 2013-2014: Baobab Mining Ecological Baseline Survey and Impact Assessment, Tete, Mozambique.

South African Projects

- 2024: Ecological walkthrough for the Mogobe BESS and OHL, Northern Cape Province
- 2024: Ecological Walkthrough for the Rhino Solar PV Facility, North West Province
- 2024 - Present: Ecological Impact Assessment for two SEFS in the Free State Province
- 2024: Botanical and Terrestrial Biodiversity Impact Assessment for a SEF Cluster, Limpopo Province
- 2024: Ecological Site Verification and Screening field survey and report for a SEF cluster, Mpumalanga Province
- 2024: Ecological Site Verification and Screening field survey and report for a SEF cluster, Limpopo Province
- 2024: Ecological Site Verification and Screening field survey and report for a SEF cluster, Gautend Province
- 2024: Ecological Assessment for the Somerset Housing Development, Worcestor, Western Cape
- 2024: Ecological Assessment for the Uitvlug Industrial Development, Worcestor, Western Cape
- 2023 – Present: Botanical and Terrestrial Biodiversity Assessment for a housing estate, Plettenberg Bay, Western Cape Province
- 2023 – Present: Botanical Impact Assessment for the Zephyr WEF and OHL, Mpumalanga Province
- 2023 – Present: Botanical Impact Assessment for a WEF Cluster, Mpumalanga Province
- 2023: Ecological Screening assessment for two housing estates, Jacobsbaai, Western Cape
- 2023 – Present: Botanical and Terrestrial Biodiversity Assessment for a WEF near Three Sisters, Western Cape Province
- 2023 – Present: Botanical and Terrestrial Biodiversity Assessment for a SEF near Murraysberg, Western Cape Province
- 2023: Kareerand BESS Ecological Assessment, North West Province
- 2023: Midas BESS Ecological Assessment, North West Province
- **2023: Critical Habitat Assessment and Ecosystems Services Assessment for Oya WEF, Western Cape**
- **2023: Critical Habitat Assessment and Ecosystem Services Assessment for Kareebosch WEF, Western Cape**
- 2023: Ecological desktop screening assessment for a Solar PV Facility, North West Province
- 2023: Ecological Screening and Sensitivity Verification Assessment for a WEF Facility Cluster, Northern Cape
- 2023: Ecological Impact Assessment for the Eskom Powerline from Kenhardt to Vredendal, Western and Northern Cape Provinces
- 2023: Compliance Statement for and S24G for the unauthorized clearing of vegetation to expand a dam, Bot Rivier, Western Cape
- 2023: Ecological Site Verification and Screening field survey and report for a WEF cluster, Free State
- 2023: Ecological Site Verification and Screening field survey and report for a WEF cluster, Mpumalanga

- 2023: Ecological Site Verification and Screening field survey and report for a second WEF cluster, Mpumalanga
- 2022 – Present: Ecological Impact Assessment for a Solar Facility Cluster, Free State
- 2022: Ecological Impact Assessment for the Kaladokwhe WEF Cluster, Cradock, Eastern Cape
- **2022 - Present: Botanical Impact Assessment to IFC Standards for a cluster of wind energy facilities, Northern Cape**
- 2022: Ecological Screening and Sensitivity Verification Assessment for a Solar PV Facility Cluster, Northern Cape
- 2022: Ecological Walkthrough for two WEF located between Matjiesfontein and Sutherland, Western Cape
- 2022: iLanga Solar PV Cluster Ecological Assessment, Western Cape
- 2022: Alien Invasive Plant Management Plan for a private farm, Kleinbrak, Western Cape
- 2022: Ecological Impact Assessment for a road upgrade, Elgin, Western Cape
- 2022: Ecological Impact Assessment for the Kiboko Private Land Strip, Mosselbay, Western Cape
- 2022: Ecological Screening Assessment for a WEF, Free State
- 2022: Ecological Impact Assessment for a S24G for a composting Facility, Tulbagh, Western Cape
- 2022: Compliance Statement for a dairy farm, Franschhoek, Western Cape
- 2022: Ecological Impact Assessment for a housing development, Jacobsbaai, Western Cape
- 2022: Compliance Statement for the development of a private home, Constantia, Western Cape
- 2022: Compliance Statement for and S24G for the unauthorized clearing of vegetation. Bot Rivier, Western Cape
- 2022: Botanical Impact Assessment for a housing estate, Fishhoek, Western Cape
- 2022: Botanical Impact Assessment for a raisin factory, Vredendal, Western Cape
- 2022: Botanical Impact Assessment and Translocation Plan for a SCC for a mixed use development, Kuils River, Western Cape
- 2022: Botanical Impact Assessment for the clearing of indigenous vegetation, Augrabies, Northern Cape
- 2021 – present: Botanical Assessment for a Solar PV Facility near Klerksdorp, North West Province
- 2021: Ecological Screening Assessment for a solar PV facility, North West Province
- 2021: Botanical screening assessment for cemetery sites near Ceres, Western Cape
- 2021: Botanical Impact Assessment for a S24G tented camp, Stellenbosch, Western Cape
- 2021 (in progress): Botanical Impact Assessment for a housing Estate at a wine estate in Stellenbosch, Western Cape
- 2021: Botanical Walkthrough and assessment for the Kudu-Oranjemund powerline and the Gromis substation deviation, Northern Cape, South Africa
- 2021: Botanical Assessment of four biodiversity offset sites for ECPTA, Eastern Cape, South Africa
- 2021: Botanical Assessment for a S24G process for a tented camp, Western Cape, South Africa
- 2021: Translocation Plan for a critically endangered geophyte, Western Cape, South Africa
- 2021: Ecological walkthrough for the Eskom Juno-Gromis 15km powerline deviation, Western Cape, South Africa
- **2021 : Project Manager for the Sturdee Energy Solar PV facility, Western Cape**
- 2021: Ecological Assessment for the Sturdee Energy Solar PV facility, Western Cape
- 2021: Rehabilitation plan for a housing development (Hope Village)

- 2020: Ecological Assessment for the Eskom Juno-Gromis Powerline deviation, Western Cape
- **2020: Project Manager for the Basic Assessment for SANSA development at Matjiesfontein (Western Cape). Project received authorization in 2021.**
- 2020: Ecological Assessment for construction of satellite antennae, Matjiesfontein, Western Cape
- 2019: Ecological Assessment for a wind farm EIA, Kleinzee, Northern Cape
- 2019: Ecological Assessment for two housing developments in Zeerust, North West Province
- 2019: Botanical Assessment in Retreat, Cape Town for the DRDLR land claim.
- 2019: Cape Agulhas Municipality Botanical Assessment for the expansion of industrial zone, Western Cape, South Africa, 2019.
- 2018: Ecological Assessment for the construction of a farm dam in Greyton, Western Cape.
- 2018: Conducted the Ecological Survey for a housing development in Noordhoek, Cape Town
- 2018: Conducted the field survey and developed an alien invasive management plan for the Swartland Municipality, Western Cape.
- 2017: Undertook the field survey and co-authored a coastal dune study that assesses the impacts associated with the proposed rezoning and subdivision of Farm Bookram No. 30 to develop a resort.
- 2017: Project managed and co-authored a risk assessment for the use of Marram Grass to stabilise dunes in the City of Cape Town.
- 2015-2016: iGas Saldanha to Ankerlig Biodiversity Assessment Project Manager, Saldanha.
- 2015: Innowind Ukomoleza Wind Energy Facility Alien Invasive Management Plan, Eastern Cape Province, South Africa.
- 2015: Savannah Nxuba Wind Energy Facility Powerline Ecological Assessment, ground truthing and permit applications, Eastern Cape South Africa.
- 2014: Cob Bay botanical groundtruthing assessment, Eastern Cape, South Africa.
- 2013-2016: Dassiesridge Wind Energy Facility Project Manager, Eastern Cape, South Africa.
- 2013: Harvestvale botanical groundtruthing assessment, Eastern Cape, South Africa.
- 2012: Tsitsikamma Wind Energy Facility Community Power Line Ecological Assessment, Eastern Cape, South Africa.
- 2012: Golden Valley Wind Energy Facility Power Line Ecological Assessment, Eastern Cape, South Africa.
- 2012: Middleton Wind Energy Facility Ecological Assessment and Project Management, Eastern Cape, South Africa.
- 2012: Mossel Bay Power Line Ecological Assessment, Western Cape, South Africa.
- 2012: Groundtruthing the turbine sites for the Waainek Wind Energy Facility, Eastern Cape, South Africa.
- 2012: Toliara Mineral Sands Rehabilitation and Offset Strategy Report, Madagascar.