ALIEN INVASIVE PLANT MANAGEMENT PLAN FOR ONDERSTEPOORT 1 SOLAR PHOTOVOLTAIC DEVELOPMENT, RUSTENBURG, NORTH WEST PROVINCE

Prepared for:

Onderstepoort Solar 1 (Pty) Ltd

Prepared by:

Biodiversity Africa

30 Chudleigh Road
Plumstead, 7800
Cape Town, Western Cape



March 2025

Details of Company

Name	Biodiversity Africa
Email	Tarryn@biodiversityafrica.com
Tel	071 332 3994 or 078 340 6295
Address	30 Chudleigh Road Plumstead, 7800 Cape Town

Contributors

Tarryn Martin (Botanical Specialist) (*Pri. Sci. Nat.* 008745)
Role: Site Assessment and Author

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).

Table of Contents

List of Figures

List of Tables

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
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
EA	Environmental Authorisation
ECO	Environmental Control Of
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 AND PURPOSE OF THIS REPORT

Onderstepoort Solar 1 (Pty) Ltd, proposes the development of a 220 MW solar photovoltaic (PV) Facility and associated infrastructure, located approximately 31 km northwest of Rustenberg in the North West Province (Figure 1.1). The Onderstepoort Solar 1 facility, covering nearly 400 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 an Alien Invasive Plant Management Plan as part of the final Environmental Management Plan (EMPr). The objective of this plan is to include mitigation measures to prevent the infestation of Alien Invasive Plant Species (AIPS) in the project area and ensure that continuous monitoring and removal of AIPS is undertaken.

This report presents the site-specific Alien Invasive Plant Management Plan for the Onderstepoort Solar 1 facility (hereafter referred to as 'the project') and has been compiled in accordance with the National Environmental Management: Biodiversity Act 2004 (Act No. 10 of 2004): Alien and Invasive Species Regulations (2014 and subsequent 2020 amendments). The layout of the report is based on the Guidelines for Monitoring, Control and Eradication Plans (DEA, 2015).

The purpose of the Alien Invasive Plant Management Plan is to:

1. Provide the legislative context for the control and removal of AIPS.
2. Assess the current status of the project area and AIPS present.
3. Provide control guidelines and methods for removal of AIPS.
4. Provide a monitoring plan for implementation during the construction and operation phase of the project to ensure invasive plant species do not become established and/or spread within the Project Area of Influence (PAOI).
5. Establish a clear set of roles and responsibilities required for implementation of the Alien Invasive Plant Management Plan.
6. Provide safety guidelines for training and awareness.

The overall objective of the Alien Invasive Plant Management Plan is to prevent the establishment and spread of AIPS, protect the biodiversity of the project area and surrounds, and ensure compliance with the relevant legislation and conditions of the EA.

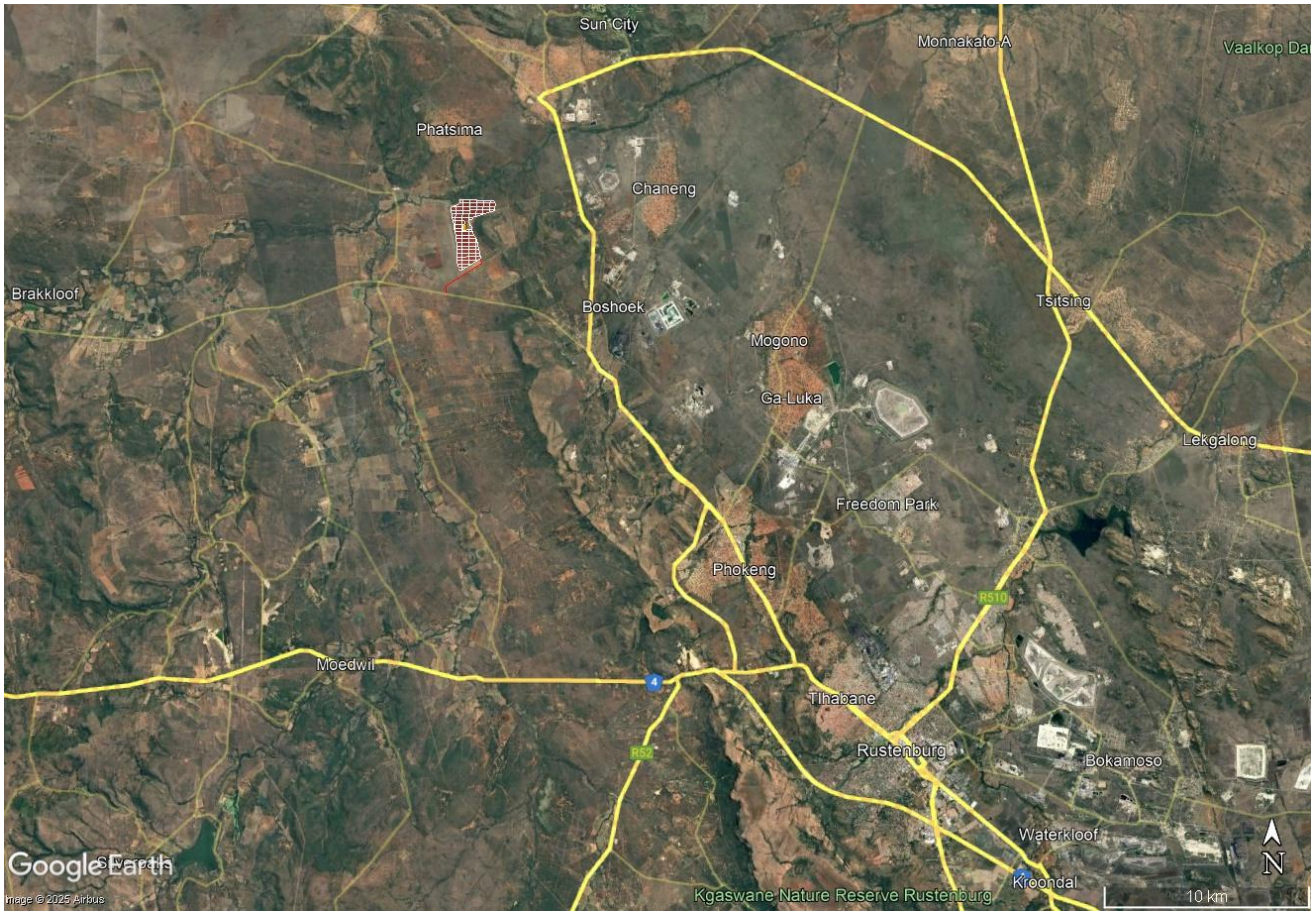


Figure 1.1: Locality map illustrating the project area (indicated in red & white) in relation to Rustenburg.

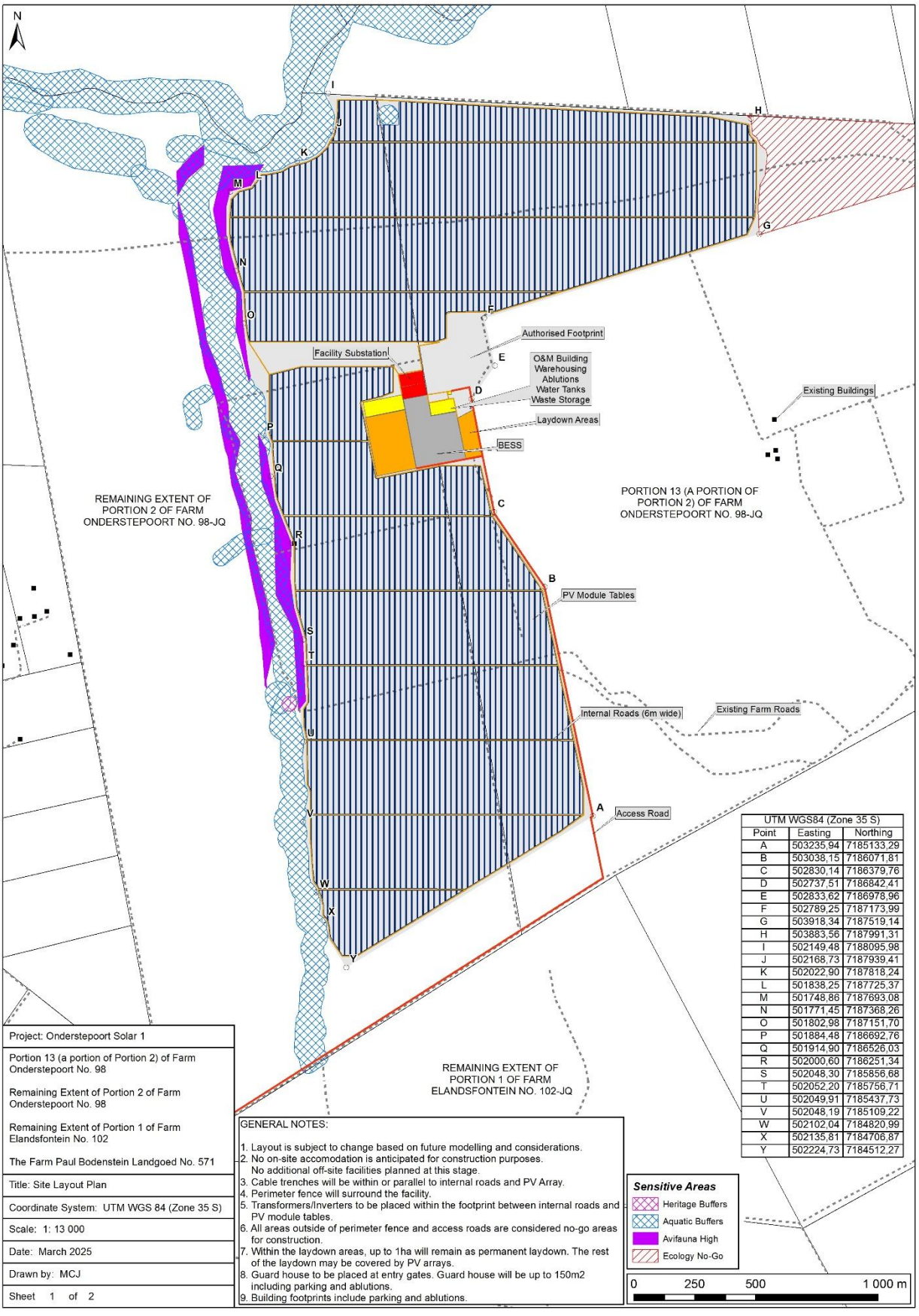


Figure 1.2: Layout map of the proposed project

1.2. WHAT ARE ALIEN INVASIVE PLANT SPECIES?

Alien Invasive Plant (AIP) species are defined as non-native or exotic plant species that occur outside of their natural geographic range. These species are introduced by humans, either accidentally or intentionally, often establishing and spreading and causing damage to ecosystems, natural habitats, and species. It should be noted that not all introduced alien species are invasive and not all invasive species are necessarily alien (see Table 1.1). The National Environmental Management: Biodiversity Act (NEM:BA) (Act No. 10 of 2004) defines Alien Invasive Plant (AIP) species as *any species whose establishment and spread outside of its natural distribution range:*

(a) Threatens ecosystems, habitats or other species or has a demonstrable potential to threaten ecosystems, habitats, or other species; and
(b) May result in economic or environmental harm or harm to human health.

AIPS are characterised by their rapid reproduction and spread in new environments due to their (i) highly competitive growth rates that allow them to outcompete local indigenous species, (ii) their resistance to local diseases, and (iii) their lack of natural enemies in new environments. AIPs are globally considered as one of the greatest threats to the environment, biodiversity, ecosystem integrity and the economy. As such, it is important to manage and control their establishment and spread.

Table 1.1: Definitions explaining the difference between Alien Invasive Plant Species, Exotic or Introduced Species, and Weeds.

Term	*Definition*
Alien Invasive Plant (AIP) species	***An AIP species*** is a non-native, or exotic, species that occurs outside of its natural distribution range and may cause damage to the ecosystem, environment and/or the economy and often results in the displacement of indigenous species.
Exotic or introduced species	***Exotic species,*** which are also known as introduced, *alien or non-indigenous species*, are species of plants that occur outside of their native distribution range but are not necessarily invasive. These species have been intentionally or accidentally moved by humans to areas outside of their native ranges. For example, ornamental species such as roses are exotic but not invasive.
Weed	A ***weed species*** is considered an undesirable species in a particular place and can be either indigenous or exotic, invasive, or not.

1.3. WHY DO ALIEN INVASIVE SPECIES NEED TO BE CONTROLLED AND HOW DO THEY ESTABLISH?

AIPS need to be controlled for the following reasons:

- ***They present a fire risk.*** AIPS often provide a large fuel load that will easily ignite, increasing the frequency and intensity of fires which damage the soil structure and seedbank of the burnt areas. The resultant loss of vegetation cover could cause erosion and the loss of top soil during heavy rainfall events.
- ***They threaten water security***. Studies in South Africa have shown that AIPS notably reduce the country's water resources which has significant ecological, economic, and social

implications. For example, it is estimated that one large *Eucalyptus* tree uses between 100-1000 litres of water per day. This is of particular concern in water scarce areas.
- ***They threaten biodiversity***. AIPS threaten to displace indigenous vegetation and could result in local extinctions if not controlled.

AIPS and weeds typically establish and spread in phases within a particular area (Williams, 1997 in Hoare, 2021). These phases include:

- **Migration Phase**: An AIPS is first introduced into a particular area.
- **Escape Phase**: Once introduced, an AIPS can spread and become fully naturalised within the introductory location.
- **Establishment Phase**: AIPS begin to reproduce within the introductory location and population numbers increase.
- **Expansion Phase**: AIPS spread to other areas outside of the initial introductory location.
- **Explosion Phase**: AIPS rapidly spread, reproduce and colonise surrounding areas and habitats.
- **Entrenchment Phase**: Entails the spread and final establishment of the AIPS in the last remaining habitat within its full range of an area.

Considering the phases of establishment and spread of an AIPS, it is far more cost effective and efficient to implement measures to prevent the establishment of AIPS than it would be to control and remove AIPS once established.

1.4. LEGISLATIVE CONTEXT

In South Africa, there are two main laws governing the control, eradication, purchasing and trading of Alien Invasive Plant (AIP) species, namely the Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983) and the National Environmental Management: Biodiversity Act (NEM:BA) (Act No. 10 0f 2004). All landowners have a responsibility and legal liability to control AIPs on their land.

1.4.1. THE CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT NO. 43 OF 1983)

The Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983) was promulgated in 1984 and amended in 1985 and again in 2001. The Act intends to provide for control over the utilization of the natural agricultural resources of the Republic, to promote the conservation of the soil, the water sources, and the vegetation, and the combating of weeds and invader plants. CARA includes a list of 198 species which are classified as weeds or invader plants according to three categories:

- **Category 1**: Invader plants must be removed & destroyed immediately. No trade in these plants.
- **Category 2**: Invader plants may be grown under controlled conditions in permitted zones. No trade in these plants.
- **Category 3**: Invader plants may no longer be propagated or sold. Existing plants do not need to be removed.

For the Onderstepoort 1 SEF, all Category 1 and Category 2 species must be removed.

1.4.2. THE NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (NEM:BA) (ACT NO. 10 0F 2004)

The Alien and Invasive Species Lists (2020) published under the National Environmental Management: Biodiversity Act (NEM:BA) (Act No. 10 of 2004) includes a list of 383 plant species which are assigned to one of four categories:

- **Category 1a:** Invasive Species that must be combatted or eradicated. A person in control of land with a Category 1a Listed Invasive Species must:
    - Immediately take steps to combat or eradicate listed invasive species.
    - Allow authorised officials to inspect the property to monitor, assist with or implement the combatting or eradication of the listed invasive species.
    - If an Invasive Species Management Programme has been developed, a person must combat or eradicate the listed invasive species in accordance with such a programme.
- **Category 1b:** Invasive Species must be controlled.
    - If an Invasive Species Management Programme has been developed, a person must control the listed invasive species in accordance with such a programme.
    - A property owner must allow an authorised official to inspect a property to monitor, assist with or implement the control of listed invasive species or compliance with the Invasive Species Management Programme.
    - The Minister may require any person to develop a Category 1b Control Plan for one or more Category 1b species, which plan must be submitted to the Minister for approval, and such Control Plan must include the following:
        (a) species identification;
        (b) extent of invasion;
        (c) control measures to be used;
        (d) an action plan or schedule including time-frames for the clearing of each species;
        (e) whether or not any species can be utilised as biomass; and
        (f) any other information which the Minister may require
- **Category 2:** Invasive Species require a permit to carry out a restricted activity within a specified area.
    - No person may carry out a restricted activity in respect of Category 2 Invasive Species without a permit.
    - A person in Control of a Category 2 Listed Invasive Species, or a person in possession of a permit, must ensure that the specimens of the species do not spread outside of the land or the area specified in the permit.
    - Any species listed as Category 2 that occurs outside of an area specified in a permit must be considered to be a Category 1b Listed Invasive Species and must be managed as such.
    - Any person or organ of state must ensure that Category 2 Listed Invasive Species do not spread outside of the land over which they have control or the specified area on such land where any restricted activity is authorised in respect of any Listed Invasive Plant Species.
- **Category 3:** Category 3 listed invasive species are subject to certain exemptions in terms of section 70 (1)(a) of the NEMBA Act, which applies to the listing of alien invasive species.

- Any plant species identified as Category 3 Listed Invasive Species that occurs in riparian areas must be considered to be a Category 1b Listed Invasive Species and must be managed as such.

It should be noted that the NEM:BA regulations which became law on the 1st of October 2014 supersede the CARA regulations. However, CARA has not been repealed yet by an updated Act and therefore, both pieces of legislation are in force. Notwithstanding, in the event of conflict between NEM:BA and any other national legislation, section 8(1)(a) specifically states that NEM:BA prevails where it concerns the management of biodiversity (CapeNature, 2022). All Category 1a, 1b and 2 species must be removed from the project area as well as category 3 species that occur within riparian areas.

2. CURRENT STATUS OF THE PROJECT AREA

2.1. ECOLOGICAL CONTEXT AND IMPORTANCE OF THE SITE

The Terrestrial Biodiversity Specialist Assessment for the Onderstepoort Solar 1 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 36.5%) has been heavily modified due to agricultural practices, including historic 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.

Eight AIPs were recorded in the project area, four of these are listed under the Alien and Invasive Species List 2020, Government Gazette No. GN1003 as Category 1b and three are listed under Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983). Furthermore, the Ecological Walkthrough conducted by Biodiversity Africa in February 2025 did not identify any additional AIPs (Biodiversity Africa, 2025).

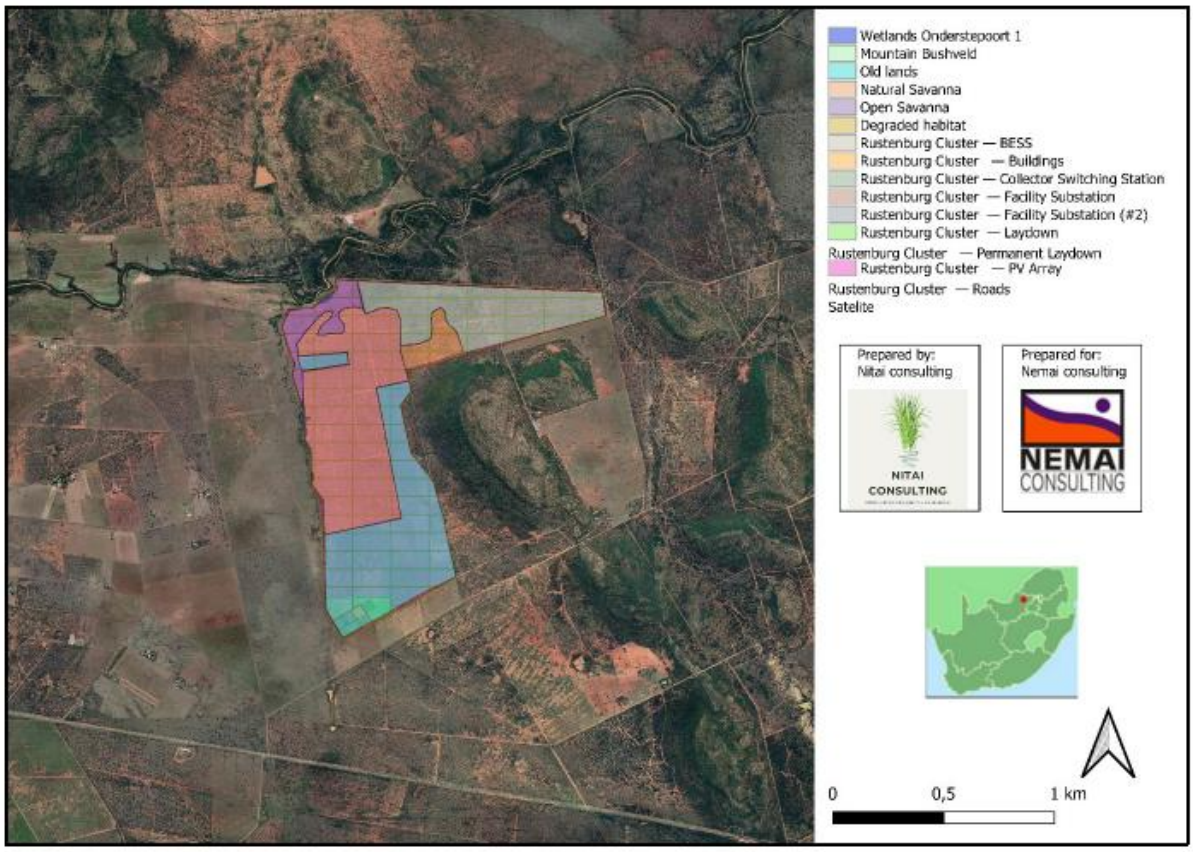


Figure 2.1: Fine scale vegetation map showing the habitats recorded in the project area.

2.2. KEY AREAS SUSCEPTIBLE TO INVASION BY AIPS WITHIN THE PROJECT AREA

The key areas that are susceptible to invasion by AIPS within the project area include:

- **Drainage lines and rivers**. These areas provide favourable habitat in which AIPS thrive and spread. Seeds could easily be transported by water to other parts of the project area.
- **Degraded areas** are more susceptible to invasion by AIPS due to reduced competition by indigenous plant species, altered environmental conditions (soil pH, moisture, nutrient levels, seed bank) which favour the growth of AIPS, reduced ecosystem resilience to AIPS due to altered ecological processes and diminished biodiversity, and increased opportunities for colonisation and establishment of AIPS.
- **Roadsides** act as pathways for the spread of AIPS. Seeds can easily be transported by vehicles and machinery to other parts of the project area or surrounding areas.
- **Transformed/Disturbed areas** (such as construction site camp, temporary laydown areas, etc). If left exposed and not rehabilitated, these areas are particularly susceptible to the establishment and spread of fast-growing weeds and AIPS.
- **Natural Areas (especially CBAs and ESAs).** Even undisturbed natural areas can be susceptible to invasion by AIPS, especially natural areas that are located adjacent to disturbed/construction areas.

Overall, any area that has been disturbed during the construction or operational phase, or that provides favourable conditions for the establishment and spread of invasive plants, is susceptible to infestation of AIPS.

2.3. FACTORS THAT COULD CONTRIBUTE TO THE ESTABLISHMENT AND SPREAD OF AIPS WITHIN THE PROJECT AREA

- The use of machinery and vehicles from outside of the project area could result in the introduction and spread of AIPS within the project area, especially if these vehicles and machinery are not cleaned and maintained.
- Soil disturbance and the removal of vegetation during the construction phase creates open habitats which provides opportunities for the establishment and spread of AIPS.
- The presence of AIPS on neighbouring properties (see Section 2.4 below).

2.4. AIPS PRESENT OR LIKELY TO OCCUR WITHIN THE PROJECT AREA OF INFLUENCE

Four AIPS and an additional four non-invasive exotic plants were recorded in the project area during the ecological assessment (Table 2.1)

Table 2.1: List of exotic plant species recorded on site.

Family	Species	Common Name	NEM:BA	CARA	Management Action
AMARANTHACEAE	*Alternanthera pungens*	Paper Thorn	-	-	Must be controlled and removed.
AMARANTHACEAE	*Guilleminea densa*	Small matweed	-	-	Must be controlled and removed.
AMARANTHACEAE	*Gomphrena celosioides*	Batchelor's button	-	-	Must be controlled and removed.
ASTERACEAE	*Campuloclinium macrocephalum*	Pom Pom Weed	Category 1b	Category 1	Must be managed in rehabilitated sites
ASTERACEAE	*Zinnia peruviana*	Wildejakobre gop/ Zinnia	-	-	Must be controlled and removed.
SOLANACEAE	*Solanum elaeagnifolium*	Silverleaf Nightshade	Category 1b	Category 1	Must be controlled and removed.
SOLANACEAE	*Solanum mauritianum*	Bugweed	Category 1b	Category 1	Must be controlled and removed.
VERBENACEAE	*Verbena bonariensis*	Purpletop Vervain	Category 1b	-	Must be controlled and removed.

3. GUIDELINES AND METHODS FOR CONTROL OF AIPS

3.1. CONTROL GUIDELINES

This section outlines the recommended approach for the project area to reduce the likelihood of establishment of AIPS and to manage any outbreaks to prevent long-term issues. Since dense infestations are costly to eliminate and demand more intricate control measures compared to low-density invasions, it is important that any AIPs that become established are swiftly identified and eradicated.

3.1.1. PREVENTION, EARLY DETECTION AND ERADICATION

A programme to prevent the establishment and spread of AIPS must be implemented during the relevant phases of the project (Refer to Chapter 4 & 5). This strategy must include, inter alia, the following:

- Regular monitoring and visual inspection of the site by the appointed contractor and Site Environmental Control Officer (ECO) for any signs of AIPS seedlings and weeds.
- If any AIPS are recorded within the project area or surrounds, immediate efforts to remove individuals either by mechanical control (e.g. hand pulling) or chemical control (e.g. herbicide) should be undertaken (Refer to section 3.2 for overarching control methods and section 3.6 for species specific control methods).
- Rehabilitation of disturbed areas that do not form part of the operational development footprint (e.g. construction site camp, temporary laydown areas, concrete batching areas).
- Cleaning and maintaining machinery and vehicles that enter the project area to prevent the introduction of AIPS and weeds.

3.1.2. CONTAINMENT AND CONTROL

If any AIPS become established within the project area, this report must be updated in line with the NEM:BA (Act No. 10 of 2004) and the Guidelines for Monitoring, Control and Eradication Plans (DEA, 2015). Updates to this plan must include:

- A detailed list and description of any listed invasive species occurring within the project area.
- A description of the project area that are infested with such listed invasive species.
- An assessment of the density and extent of such infestation.
- A status report on the efficacy of previous control and eradication measures.
- The current measures to monitor, control and eradicate such invasive species.
- Measurable indicators of progress and success, and indications of when the control plan is to be completed.

3.2. CONTROL METHODS

Different AIPS require different clearing methods. Three general types of methods are used to control AIPS including mechanical control, chemical control, and biological control. During construction, mechanical control should be prioritised along with careful application of herbicide (chemical control) if required. The three (3) main control methods are outlined in Section 3.2.1 to 3.2.3 below. Species-specific control methods recommended by the Working for Water Program (2007) for two species that occur within the project area are detailed in Table 3.1. The remaining species are not listed by Working for Water and as such recommendations for these species are based on available literature (Table 3.2).

The control of AIPs often requires an integrated approach which incorporates at least two of the three control methods and should take into account the different size classes for various AIPS.

3.2.1. MECHANICAL CONTROL

This is the physical removal or destruction of plants and includes techniques such as hand-pulling, felling, uprooting, ringbarking, cutting/slashing, strip-barking or mowing. The type of mechanical control used will depend on the species, the level of infestation and the steepness of the slopes and accessibility where the species occur. Mechanical control is typically only feasible if individuals are still small (i.e. seedlings) and do not coppice once cut, and if the infestation is sparse and restricted to a small area. Mechanical control is labour intensive and could result in soil disturbance and erosion and therefore requires careful management and monitoring.

Manual and mechanical control methods include:

- **Hand pulling:** The removal of the entire plant and roots by hand. This method is recommended for seedlings/juvenile plants, herbs and small shrubs where the plants are small enough to be pulled out successfully with the root system intact. This method is recommended for sparsely infested areas when the soil is damp or soft.
- **Ring Barking:** The removal of the tree's bark and cambium, in a horizontal 30 cm band (about 50 cm from the ground). This method is used to kill large trees. If herbicide is used, it must be applied immediately after ring barking on the cut area.
- **Cut Stumping:** The cutting of trees as low to the ground as possible with a saw, chainsaw or cane knife. If herbicide is used, it must be applied to the cut surface immediately.
- **Slashing:** The control of annuals by slashing seed stalks and/or branches with a cane knife, machete, slasher, or brush cutter before seeds mature. This is generally a low-cost method of reducing the presence of viable seeds that will germinate in the new season.
- **Strip barking:** The stripping of bark from waist height to the base of the trunk using an axe or cane knife. If herbicide is used, it must be applied immediately to the stripped surface area.
- **Frilling:** The cutting of an angled groove into the bark and cambium around the entire tree trunk. Herbicide is then applied into the groove which kills the tree as it seeps into the

cambium. This method is effective for small trees as it is quicker and more cost effective than ring barking or strip barking.

3.2.2. CHEMICAL CONTROL

This method uses herbicides (plant poison) to kill targeted plant species. There are two (2) broad types of herbicides, including selective and non-selective. Selective herbicides target specific plant groups (e.g. broad leaf plants) while non-selective herbicides kill all plants they come into contact with and are therefore unsuitable for areas with indigenous vegetation. It is important that the appropriate herbicide is selected for the species and purpose required as these poisons can often do more harm than good, especially when working near wetlands and water courses. Instructions should be carefully followed and contractors using herbicides are required to have a permit according to Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947).

Some chemical application techniques include:

- **Foliar Spraying:** The spraying of leaves, on plants below 1 m, to the point of run-off using a knapsack sprayer. This method is more cost effective than stump treatment as fewer people are required to treat large areas. However, it does require large amounts of clean water in which the herbicides are mixed. All team members using this method must be trained and certified before using this technique.
- **Handheld spraying:** The application of herbicide after cut stumping, ring barking, frilling and strip-barking using a handheld sprayer with an adjustable nozzle to achieve the correct spray width. This method is cheap, and the application of herbicide is accurate. As with the foliar spray, all team members must receive training on how to use this sprayer effectively.
- **Injection:** The application of herbicide directly into the plant by drilling or punching downward slanting holes into the tree around the circumference of the stem/trunk and then injecting the chemical into these holes.

3.2.3. BIOLOGICAL CONTROL

This is the use of a species' natural enemies (biological control agents) to remove a plant's competitive advantage and thereby reduce population vigour. This method is usually only effective in controlling populations rather than eradicating AIPS in the long term.

3.3. General Guidelines for the Removal of AIPS

- Control and eradication of listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
- Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that will result in the least possible harm to biodiversity and damage to the environment.
- The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material, and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

3.4. Disposal of Plant Material

Plant debris (including branches and trunks) generated during mechanical removal must not be burnt. In areas where topsoil is exposed, it is recommended that cut material free of seeds is either stacked or chipped to reduce the possibility of erosion, increase soil moisture, and once biodegraded, increase the nutrient content of the soil. This is especially important along steeper slopes which are prone to increased runoff. If stacked, plant material should not exceed 2-3 m in height. To reduce the risk of uncontrolled fire, stacks must be kept well apart (> 5 m) and light branches should be stacked separately from heavy timber (75 mm or more). If feasible, remove heavy branches to reduce the potential fuel load. Another option would be to sell cut material as firewood to offset costs associated with the removal of the AIPS.

Any seed-bearing branches or debris must be disposed of at a registered garden refuse disposal facility.

It is not anticipated that the AIPs present will generate a large amount of biomass for disposal as most species that need to be removed are not large woody trees but rather shrubs and herbs.

3.5. Restoration of Indigenous Vegetation

Any disturbed areas which do not form part of the development footprint must be revegetated and rehabilitated. Uncontrolled access to rehabilitated areas should be restricted and impacts such as grazing, burning, erosion, etc, should be avoided until the site is fully revegetated and restored to a near natural condition.

3.6. Specific Management Measures for Clearing within or Adjacent to Drainage Lines, Rivers and Streams

It is important to ensure that AIPS debris and herbicide run off does not enter nearby watercourses. As such, the following specific management measures should be implemented when clearing in riparian areas is required:

- Do not stack plant debris along the riverbank, below the highwater mark, or within the flood plain.
- Do not decant or mix herbicide along the riverbank, below the highwater mark, or the flood plain.
- When applying herbicide, only apply the minimum amount and as directed. Do not allow the creation of runoff. Use course droplet nozzles when applying herbicide to avoid overspray and runoff.
- Do not rinse equipment or dispose of excess herbicide mixture within or near watercourses as this can cause water contamination.
- Store herbicides within a workshop or contained area, away from the riverbank and flood plain.
- Do not apply herbicides during wet and rainy or windy conditions. Where possible, apply herbicides in the dry months.
- Spill kits and absorbent material must be available in the case of accidental spillages.

3.7. TARGETS AND TIMELINES FOR THE REMOVAL AND CONTROL OF AIPS

Clear objectives with measurable indicators need to be determined prior to the implementation of the Alien Invasive Management Plan as this will provide a measure for the success of the plan (refer to Chapter 5). Objectives and indicators should be reviewed and modified where necessary to account for the potential introduction and spread of AIPs.

Table 3.1: Specific methods of removal and control of AIPs as per the Working for Water Guidelines (2007).

TREATMENT DETAIL				APPLICATION DETAIL				PLANNING DETAIL		
Species	Size class	Treatment	Herbicide	Dosage	a.i. Litres	Mix Litres	% Mix a.i.	Density	Estimated Product Litres / Ha (or kg)	if Mix volume Litres / Ha
Bugweed (*Solanum mauritianum)*	Seedling <1m	Hand pull NB: keep roots off the ground	None							
	Seedling 0.5 to 1m and Coppice	Foliar spray	clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL Confront 360 SL (L7314)	600ml / 10 Litres water and 0.5% Wetter & Dye	0.6	10	6	Closed / Dense	18.00	300
			fluroxypyr 200 g/L EC Starane 200 EC (L4918), Tomahawk 200 EC (L6652), Voloxypyr 200 EC (7776)	12.5 ml / 10 Litres water and 0.5%Wetter & Dye	0.0125	10	0.125	Closed / Dense	0.38	300
			fluroxypyr / picloram 80 / 80 g/L ME Plenum 160 ME (L7702)	25ml / 10 Litres water and 0.5% Wetter & Dye	0.025	10	0.25	Closed / Dense	0.75	300
			glyphosate (ammonium) 680 g/kg WG Roundup Max 680 WG (L6790)	80gr / 10 Litres water and 0.1% Dye	0.08	10	0.8	Closed / Dense	2.40	300
			glyphosate (isopropylamine) 240 g/L SL Tumbleweed 240 SL (L4781)	75ml / 10 Litres water and 0.1% Dye	0.075	10	0.75	Closed / Dense	2.25	300

		glyphosate (isopropylamine) 360 g/L SL Glyph 360 SL (L4767), Mamba 360 SL (L4817), Roundup 360 SL (L407), Springbok 360 SL (L6719)	**150ml / 10 Litres water and 0.1% Dye**	**0.15**	**10**	**1.5**	**Closed / Dense**	**4.50**	**300**
		glyphosate (isopropylamine) 450 g/L SL RoundUp Turbo 450 SL (L7166)	**40ml / 10 Litres water and 0.1% Dye**	**0.04**	**10**	**0.4**	**Closed / Dense**	**1.20**	**300**
		glyphosate (isopropylamine) 480 g/L SL Mamba Max 480 SL (L7714)	**40ml / 10 Litres water and 0.1% Dye**	**0.04**	**10**	**0.4**	**Closed / Dense**	**1.20**	**300**
		glyphosate (potassium) 500 g/L SL Touchdown Forte Hitech 500 SL adjuvant incl.(L7305)	**100ml / 10 Litres water and 0.1% Dye**	**0.1**	**10**	**1**	**Closed / Dense**	**3.00**	**300**
		glyphosate (sodium) 500 g/kg WG Kilo 500 WSG (L7431)	**50gr / 10 Litres water and 0.5% Wetter & Dye**	**0.05**	**10**	**0.5**	**Closed / Dense**	**1.50**	**300**
		imazapyr 100 g/L SL Chopper 100 SL (L3444), Hatchet 100 SL (L7409)	**63ml / 10 Litres Water and 0.1% Dye**	**0.063**	**10**	**0.63**	**Closed / Dense**	**1.89**	**300**
		triclopyr (butoxy ethyl ester) 240 g/L EC Ranger 240 EC adjuvant incl. (L6179)	**100ml / 10 Litres water and 0.1% Dye**	**0.1**	**10**	**1**	**Closed / Dense**	**3.00**	**300**

			triclopyr (butoxy ethyl ester) 480 g/L EC Garlon 4 EC (L3249) & 480 EC (L4916), Triclon EC (L6661), Viroaxe EC (L6663)	50ml / 10 Litres water and 0.5% Wetter & Dye	0.05	10	0.5	Closed / Dense	1.50	300
	Mature	Cut stump NB: for trial, not registered	glyphosate (ammonium) 680 g/kg WG Roundup Max 680 WG (L6790)	265gr / 10 Litres water and 0.1% Dye	0.265	10	2.65	Closed / Dense	5.30	200
		Cut stump/frill	glyphosate (isopropylamine) 480 g/L SL Mamba Max 480 SL (L7714)	110ml / 10 Litres water and 0.1% Dye	0.11	10	1.1	Closed / Dense	2.20	200
			imazapyr 100 g/L SL Chopper 100 SL (L3444), Hatchet 100 SL (L7409)	200ml / 10 Litres Water and 0.1% Dye	0.2	10	2	Closed / Dense	4.00	200
			picloram (potassium salt) 240 g/L SL Access 240 SL (L4920), Browser 240 SL (L7357)	100ml / 10 Litres Water and 0.5% Wetter & Dye	0.1	10	1	Closed / Dense	2.00	200
			triclopyr (-amine salt) 360 g/L SL Lumberjack 360 SL (L7295), Timbrel 360 SL (L4917)	300ml / 10 Litres Water and 0.5% Wetter & Dye	0.3	10	3	Closed / Dense	6.00	200
Pom-pom weed (*Campuloclinium macrocephalum)*	Actively growing plants	Foliar spray	metsulfuron-methyl 600g/kg WG Brush-Off 600 WG (L4535)	2.5grams / 10 Litres water and 0.5% Wetter & Dye	0.0025	10	0.025	Closed / Dense	0.08	300

			picloram (potassium salt) 240 g/L SL Access 240 SL (L4920)	**35ml / 10 Litres Water and 0.5% Wetter & Dye**	**0.035**	**10**	**0.35**	**Closed / Dense**	**1.05**	**300**

Table 3.2: Methods for removal and control of species not listed by the Working for Water Guidelines

Species	Control Measures
Alternanthera pungens	Mechanical: Hand removal, digging or cutting. Fragmentation o the taproot must be avoided. Herbicides can also be used.
Guilleminea densa	Mechanical: Hand removal, digging, mowing, removing the rhizomes (Bromilow, 2010)
Gomphrena celosioides	Mechanical: Hand removal, digging, mowing (WSSA, Accessed: March 2025)
Solanum elaeagnifolium	Mechanical: Burning, mowing and cutting, digging or hand pulling (ARC, 2002) Biological Control: Leaf Beetles
Verbena bonariensis	Mechanical: Burning, mowing and cutting, digging or hand pulling (DiTomaso *et al.,* 2013)
Zinnia peruviana	Mechanical: Hand removal, digging, mowing (WSSA, Accessed: March 2025)

4. MANAGEMENT ACTIVITIES

This section summarises the specific management actions required during the construction and operational phase of the project to minimise vegetation loss and soil disturbance and prevent the introduction and spread of AIPS.

4.1. CONSTRUCTION PHASE

- Limit vegetation clearance to the approved, surveyed and demarcated development footprint.
- Any equipment brought onto site must be cleaned and maintained to ensure no transfer or introduction of AIP seeds. The EMPr states that the washing of vehicles must be done in a constructed wash bay with a sump. In addition to trapping hydrocarbons, seeds from AIPs will also be trapped.
- Ensure that any imported material (e.g. building sand) is sourced from an accredited provider and free of weeds.
- Avoid importing foreign organic matter onto site. Rather, topsoil from cleared areas should be utilised where required.
- Prevent construction activities from encroaching into water resources (including drainage lines, wetlands, and rivers) except for instances where a Water Use Authorisation has been obtained.
- Treat watercourses outside the approved footprint as no-go areas and demarcate areas as such. No vehicles, machinery, personnel, construction material, fuel, oil, bitumen, or waste must be allowed into these areas without the express permission, and supervision, of the ECO, except for rehabilitation work required in these areas.
- Undertake regular visual inspections of the project area to identify the establishment of any AIPS.
- Should any AIPS be recorded on site, immediate actions must be taken to remove and control the spread of these species.
- Ensure that any staff responsible for the management and monitoring of AIPS are appropriately trained.
- Obtain relevant permits should the use of herbicides be required.
- Rehabilitate disturbed areas as soon as possible after construction with local indigenous plants to enhance the conservation of existing natural vegetation on site and reduce opportunities for the establishment of AIPS.

4.2. OPERATIONAL PHASE

- Undertake regular monitoring and inspections of the project area to identify the establishment of any AIPS.
- Ensure that all impacted areas that do not form part of the development footprint are rehabilitated using indigenous plant species.
- Ensure that rehabilitation efforts have been successful and completed as per Rehabilitation Management Plan.

5. MONITORING

5.1. MONITORING REQUIREMENTS

Monitoring is required to ensure that the recommended management actions are effective in preventing the establishment and spread of AIPS. The following general recommendations should be implemented:

- Fixed point photographs of the project area from vantage points that capture large portions of the project area should be taken at regular intervals, especially prior to vegetation clearance, during vegetation clearance, and post rehabilitation. This will provide a graphic representation of the baseline conditions of the project area.
- If any AIPS seedlings are identified, remedial action must be taken to remove these.
- Basic records of daily operations, such as the areas that have been cleared and when, should be maintained during construction.

Specific monitoring actions required during the construction and operational phase are outlined in Table 5.1 below.

Table 5.1: Monitoring Actions, indicators, and timeframes for the implementation of the Alien Invasive Plant Management Plan.

Monitoring Action	Indicator	Timeframe	Responsible
Construction Phase			
Compile a list with accompanying photographs of all AIPs that occur or could occur within the project area. Table 2.1 provides a list of the species that could occur within the project area following disturbance. The table will need to be updated if new AIPs establish.	Completed List of AIP with accompanying photographs. This should be maintained and updated where necessary.	Preconstruction and every 4 months thereafter or as per ECO requirements.	Contractor (implement) and ECO (audit)
Undertake regular visual inspections of the project area to identify the establishment of any AIPs.	No establishment and spread of AIPS.	Every 4 months or as per ECO requirements.	Contractor (implement) and ECO (audit)
Document and review management actions implemented to prevent establishment and spread of AIPs.	Clear, documented record of management activities and review of success.	Every 4 months or as per ECO requirements.	Contractor (implement) and ECO (audit)
Operational Phase			
Undertake visual inspection of the project area to ensure	Successful establishment of indigenous plant	Every 4 months for the first 2 years and biannually thereafter.	Contractor (implement) and ECO (audit)

successful rehabilitation of impacted areas that do not form part of the operational development footprint.	species in previously impacted areas. No bare soil and areas devoid of vegetation (except for parts of the development footprint authorised as such).		
Undertake regular visual inspections of the project area to identify the establishment of any AIPs. Focus must be placed on areas susceptible to the establishment of AIP (refer to section 2.2)	No establishment and spread of AIPS.		Contractor (implement) and ECO (audit)
Document alien monitoring, control and eradication measures implemented and success achieved.	Clear, documented record of management activities and review of success.	Annually.	Contractor (implement) and ECO (audit)

5.2. 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.

5.3. REPORTING

Management measures implemented and success achieved should be clearly documented. Compliance with the Alein Invasive Plant Management Plan must be documented by the ECO and all reports should be available on request.

The Alien Invasive Plant Management Plan should be seen as a working document and must be updated as and when required or if any AIP are identified within the project area.

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.

5.4. ROLES AND RESPONSIBILITIES

The holder of the EA, the Contractors and the ECO are responsible for ensuring the AIP Management and Monitoring Plan is implemented. The roles and responsibilities for each of them are outlined in Table 5.2 below.

Table 5.2: Roles and responsibilities associated with implementing the AIPS Management Plan.

Role	Responsibility
Holder of EA	The holder of Environmental Authorisation (EA) bears the overarching responsibility for ensuring compliance with the conditions outlined within the EA.
Contractor	The Contractor appointed to implement the Alien Invasive Plant Management Plan assumes responsibility for the monitoring, control, and eradication of any AIPs that establish and/or spread during the construction and operational 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. • Reporting on the effectiveness of the monitoring, control and eradication (if any) completed to date. • Monitoring the site for new infestations. • Analysing the data. • Making recommendations on remedial action when required. • Writing progress and annual reports. • Educating staff and contractors on the required method of removal for each species. • Monitoring the use of herbicide. It is recommended that the Contractor appoint an Environmental Site Officer (ESO) with a background in environmental management to fulfil these duties.
ECO	The ECO is responsible for auditing and verifying the implementation of the management plan during the relevant phases of the project. This must include a physical inspection of the project area for the presence of AIP.

Once construction has been completed, the O&M Contractor and/or HSE Officer/Manager must undertake visual inspection of the project area every 4 months for the first 2 years and biannually thereafter for the life of the project to ensure that AIPS do not establish in impacted areas associated with the development. Should removal of AIPs be required during the operational phase, the holder of the EA must appoint a suitably qualified Contractor for the removal of the AIPS.

6. TRAINING AND AWARENESS

All personnel and contractors, including third parties, who are appointed to remove AIPs will be conversant with all legislation and best practice standards applicable to their contractual obligations. They will need to be appropriately trained on how to remove the Alien Invasive Plant (AIP) species and use herbicides correctly. All personnel appointed to remove AIPs must have therefore undergone a training and awareness programme that addresses these issues. It is recommended that the contractor that is employed provides evidence of the training he has undertaken with his staff by providing a signed register that indicates an induction was held with his staff. Details of what was covered in the induction talk must be appended to the register and the Contractor must keep this on record.

Information must be transferred in an appropriate manner and training courses must take language and education levels into consideration. In particular, the training of potentially illiterate staff will require the development of appropriate training material and approach.

It is recommended that all personnel involved in the removal of AIPS must be required to participate in an induction programme.

The range of topics that should be covered in the awareness training will, *inter alia*, include:

- Environmental Policy
- Occupational Health and Safety (OHS)
- Community Health and Safety
- Organizational Structure and Responsibilities
- Aspects of routine day-to-day operational activities, which can have environmental, social, safety or health impacts.
- Environmental and safety hazards which could arise from non-routine situations and corrective actions.
- The importance of environmental and safety incident reporting and completion of appropriate reports.
- Emergency Preparedness and Response.
- Channels of communication for discussing and reporting issues.
- Documentation systems so that appropriate records of training and awareness programs are maintained.

Training and awareness components to be considered will include:

- Identification of AIPS.
- Methods of removal for each species.
- Herbicide Safety.
- Personal Protective Equipment (PPE).
- Health and Safety when using equipment for removal of species.

7. REFERENCE MATERIALS AND FURTHER READING

7.1. ACTS

- National Environmental Management: Biodiversity Act, Act 10 of 2004. Department of Environment Affairs, Pretoria.
- National Environmental Management: Biodiversity Act, Act 10 of 2004: Alien and Invasive Species Regulations (2014 and subsequent 2020 amendments). Department of Environment Affairs, Pretoria.
- National List of Invasive Terrestrial and Freshwater Plant Species (2016)
- The Conservation of Agricultural Resources Act (CARA), Act 43 of 1983. Department of Agriculture, Pretoria.
- The Occupational Health and Safety Act, Act 85 of 1993. Department of Labour, Pretoria.
- Guidelines for Monitoring, Control and Eradication Plans as required by Section 76 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(NEM:BA) for Species List as Invasive in terms of Section 70 of this Act. Department of Environmental Affairs, Pretoria.

7.2. WEBSITES AND MATERIAL

- Invasive Alien Plant Control Management Plan: https://www.dffe.gov.za/projectsprogrammes/wfw/alienplantcontrol_managementplan
- Invasive Species of South Africa: http://www.invasives.org.za/
- Cape Nature Alien Vegetation Management: https://www.capenature.co.za/alien-vegetation-management
- Management of Invasive Alien Plants: https://www.dws.gov.za/wfw/Control/
- Invasive Alien Plant Alert: https://www.sanbi.org/resources/infobases/invasive-alien-plant-alert/
- Invasive Alien Plants in South Africa: https://wwfafrica.awsassets.panda.org/downloads/invasive_alien_plants_in_south_africa.pdf
- Agricultural Research Council – Legal Obligations Regarding Invasive Alien Plants in South Africa: https://www.arc.agric.za/arc-ppri/weeds/Pages/Legal-Obligations-Regarding-Invasive-Alien-Plants-in-South-Africa.aspx

8. REFERENCES

ARC – Plant Protection Research Institute. 2002. Biological Control of Solanum Weeds (Family Solanaceae: Potato Family). Pretoria.

BROMILOW, C., 2010. Problem Plants and Alien Weeds of South Africa. Briza Publications, Pretoria

DiTomaso, J.M., G.B. Kyser et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California. 544 pp.

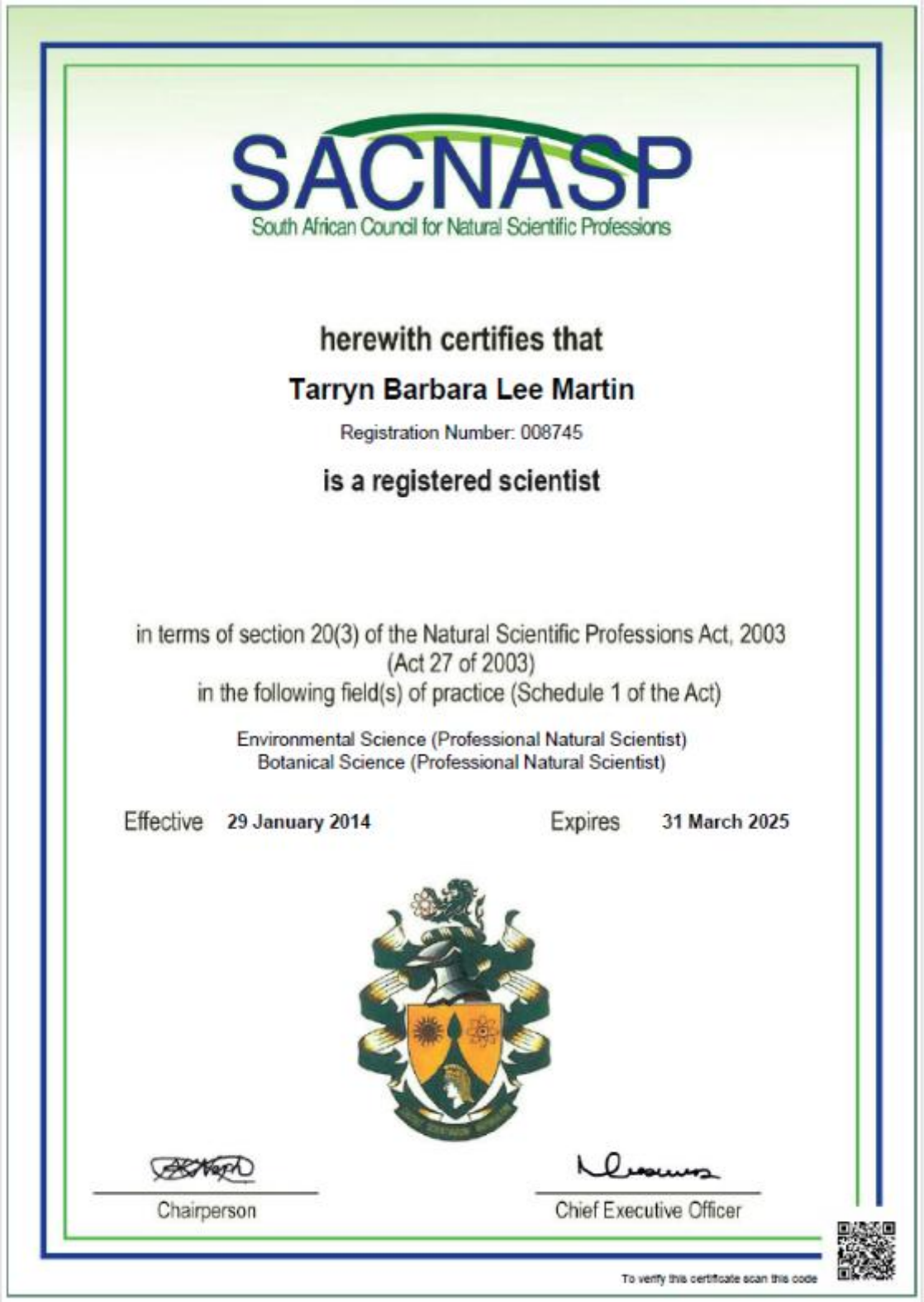
Department of Environmental Affairs (DEA) (2015). Guidelines for monitoring, control and eradication plans as required by Section 76 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) for species listed as invasive in terms of Section 70 of this Act.

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.

Nitai Consulting (Pty) Ltd, 2023. Terrestrial Biodiversity Specialist Assessment for the Proposed Solar development for Onderstepoort 1, 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.

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 2025**

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