Mulilo Struisbult Photovoltaic Energy Plant (PV2) Alien Invasive Plant Management Plan

Copperton, Northern Cape

February 2022

CLIENT

Prepared by:

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Report Name	**Mulilo Struisbult PV2 Alien Invasive Plant Management Plan**
Reference	**Mulilo Struisbult PV2 – AIP Plan**
Submitted to/Client	
Report Writer	**Michael Schrenk** 
	Michael completed his professional Civil and Environmental engineering degree at the University of the Witwatersrand in 2016. He has been working in the fields of project management, biodiversity and habitat assessment and ecological restoration for over 3 years.
Reviewer	**Andrew Husted** 
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

DECLARATION

I, Michael Schrenk, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Michael Schrenk

Environmental Consultant

The Biodiversity Company

February 2022

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1 Introduction

Struisbult PV2 (Pty) Ltd holds an Environmental Authorisation (EA) (DEA Reference: 12/12/20/2502/AM4), dated 04/12/2020, to develop the 100 MW Photovoltaic (PV) solar energy facility (PV2) on the farm Struisbult (portion 1 of farm no. 104) in the Siyathemba local municipality near Copperton in the Northern Cape province. The authorised 300 ha solar energy facility will comprise the following infrastructure:

- PV module arrays;
- Upgrading of existing internal farm roads and the construction of new roads to accommodate the construction vehicles and access to the site;
- Construction of a 132 kV transmission line to connect the proposed PV plant with Eskom's grid via the Cuprum substation;
- Electrical fence to prevent illegal trespassing and the possible theft of panels, and to keep livestock from roaming between the solar arrays and causing accidental damage; and
- Other infrastructure includes an office, connection centre and a guard cabin.

The Biodiversity Company was commissioned to develop an Alien Invasive Plant (AIP) Management Plan to meet the requirements of the issued EA. The EA stipulates that an Alien Invasive Management Plan is to be implemented during construction and operation of the facility, and the plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.

This is stipulated because AIPs tend to dominate or replace indigenous flora, thereby transforming the structure, composition and functioning of healthy ecosystems. Some invader plants may also degrade ecosystems through superior competitive capabilities which exclude native plant species. Therefore, it is important that these plants are controlled through the enforcement of an eradication and monitoring programme.

1.1 Terms of Reference

The Terms of Reference (ToR) for this assessment include the following:

- Review of existing information related to the development;
- A site visit to confirm the presence of AIPs within the project area;
- Compilation of a report detailing the results of the site visit; and
- Provision of recommendations for the control of AIPs and the implementation of monitoring measures.

1.2 Assumptions and Limitations

The following assumptions and limitations should be noted for the assessment:

- The assessment area was based on the spatial file provided by the client and any alterations to the development area presented may affect results;

- Whilst every effort is made to cover as much of the site as possible, representative sampling was completed and by its nature it is possible that some plant and animal species that are present on site were not recorded during the field investigations;
- The GPS used in the assessment had a maximum accuracy of 5 m and consequently any spatial features identified may be offset by 5 m; and
- All regional and site-specific environmental information is contained within original (submitted) documents, and this is therefore not repeated within this document. This document focuses only on the specific mandate and findings of the AIP survey.

1.3 Legislative Framework

The National Environmental Management: Biodiversity Act, Act No. 10 of 2004, (NEMBA) is the most recent legislation pertaining to Alien Invasive Plant species and in September 2020 the most current lists of Alien Invasive Species were published in terms of NEMBA (in *Government Gazette No*. 43726 of 18 September 2020). The Alien and Invasive Species Regulations serve to define and regulate the various categories of Alien and Invasive Species and were recently updated and published in terms of NEMBA in the *Government Gazette No*. 43735 of 25 September 2020.

In August 2014, the first list of Alien Invasive Species was published in terms of the NEMBA. The latest Alien and Invasive Species Regulations and Lists were extended as published in the Government Gazette No. 44182, 24th of February 2021. The legislation calls for the removal and/or control of AIP species (Category 1 species). In addition, unless authorised thereto in terms of the NWA, no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse. Below is a brief explanation of the three categories in terms of the NEMBA:

- *Category 1a*: Invasive species requiring compulsory eradication. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- *Category 1b*: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- *Category 2*: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones. Species existing outside of a regulated area shall be classified as category 1b.
- *Category 3*: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities: import, possess, grow, breed, move, sell, buy or accept as a gift - involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones as these will be classified as category 1b species.

Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

- Notify the competent authority in writing;
- Take steps to manage the listed invasive species in compliance with:
    - Section 75 of the NEMBA;
    - The relevant invasive species management programme developed in terms of regulation 4; and
    - Any directive issued in terms of section 73(3) of the NEMBA.

2 Guidelines for Controlling Alien Invasive Plants

This section provides details pertaining to the general control of AIPs and should therefore be read before Section 4 of this report.

2.1 Area Prioritisation

The following are recommended when considering priority areas:

- The initial clearing should be focused on areas where follow-ups can be guaranteed (areas with easy and frequent access);
- Areas that are only lightly infested should be cleared first, to prevent the build-up of seedbanks, followed by riparian systems which are sensitive and critical vectors. Dense infestations should be cleared last;
- The progression of targeting areas as above should follow the trial and proven efficacy of the chosen control methods (i.e., test control methods on light infestations first, and then move on to more challenging areas once a method has been proven effective);
- Consider leaving areas that require active restoration until the restoration materials are available, to avoid soil loss or re-invasion; and
- Areas should be cleared before plants have a chance to set seed.

2.2 Control Methods

2.2.1 Mechanical Control

Mechanical control involves the physical destruction or total removal of plants. Mechanical techniques include hand-pulling, felling, uprooting, ringbarking, cutting/slashing, strip-barking, or mowing. Mechanical methods are not generally feasible in dense infestations as these can be labour intensive and time-consuming. Removing all AIPs using mechanical control methods in a densely infested area can also lead to severe soil disturbance and erosion. These methods are generally more appropriate for sparse infestations and for species that do not coppice (stimulate growth) after cutting.

Hand-pulling is the removal of plants by hand, ensuring that the root system is also removed. Hand pulling is only recommended when an area is sparsely invaded, has a high sensitivity, and the plants are small enough to be pulled out successfully with the roots intact. Hand pulling

does create soil disturbance, but if the area is sparsely invaded then such disturbances are unlikely to be damaging. The immediate area from where the plant was pulled should be pressed to ensure compaction and levelling with the surrounding soil.

Manual removal using hand tools can also be used to remove AIPs. The use of hand tools is often the most effective method in areas with low infestations. Ringbarking using an axe is useful for killing large trees. The tool is used to remove the bark in a complete horizontal band 300 mm in width and approximately 500 mm from the ground. Small trees can be frilled by cutting an angled groove into the bark and cambium (secondary tissue layer), right the way around the tree trunk. This can be achieved with either a cane knife or axe, depending on how hard the bark and cambium layers of the tree are. The seed stalks/branches of annuals (plants that complete their life cycles, from germination to the production of seeds, within one growing season, and then die) can be slashed with a slasher before the seeds have matured. This is an effective method significantly reducing the presence of viable seeds that will germinate in the new season.

Manual removal using mechanised tools is also an effective means of controlling AIPs. Heavy duty motorised brush-cutters are useful for controlling low-growing thickets of AIPs. Importantly, a suitable blade must be fitted to the brush-cutter as using a standard nylon cutter for clearing vegetation can lead to machine damage in the long-term. A chainsaw is ideal for felling large trees and can also be used to cut logs and branches into shorter lengths.

2.2.2 Chemical Control

The chemical control of AIPs involves the use of herbicides to kill targeted species. It is important that the appropriate herbicide be used in the appropriate manner, as using inappropriate or incorrect herbicides is wasteful, costly, and can be unnecessarily harmful to the surrounding environment. Herbicide use is especially problematic in aquatic systems (such as near rivers and wetlands) as they can be transported downstream and may remain active in the ecosystem for a long period of time.

Herbicides are classified as either selective or non-selective:

- Selective herbicides are usually specific to a particular group of plants; and
- Non-selective herbicides can kill any plant. Therefore, non-selective herbicides are not suitable for use in areas where indigenous plants are present.

It is important that herbicide applicators complete a certified training course.

Each herbicide has a chemical compound that is used as the active ingredient to kill the plants of interest. It is therefore critical that a herbicide with the correct active ingredient is selected and the advised dilution be adhered to. Dye is often mixed with herbicides to ensure a clear visual indication of which plants have been treated and which have not. This allows workers to see where they have applied the herbicide and allows for the easy inspection of work a few days or weeks later.

Herbicides also have a residual effect; this is the time that they will remain active in the soil. The shorter the residual effect, the less likely that non-target species will be killed. The residual effect of a herbicide must be checked, especially in areas where re-vegetation will occur. Herbicides require a carrier liquid, which can be either water or diesel. Water is preferred due to the negative environmental impacts associated with diesel, its cost, and the risk of theft.

Diesel should never be used for foliar applications (generally a spray treatment over a plants leaves) and must only be used for cut-stump treatment.

Foliar spraying involves the spraying of leaves with herbicide to the point of run-off. Correct training and certification are essential. It is important to invest in high quality knapsack sprayers and ensure that replacement parts can be easily purchased. This approach requires that large quantities of clean water be available for herbicide-mixing. Handheld spraying is a technique that can be used to apply herbicide accurately after cut stumping, ringbarking, frilling and strip-barking. Handheld sprayers are cheap, but workers must receive training on how to properly maintain handheld sprayers.

Whether applying herbicide via direct cut stump treatment (generally with a paint brush) or foliar spray, it is always crucial to minimise any non-target drift. This occurs when herbicide is accidentally spilt or sprayed in areas that do not contain any target AIP species. Many indigenous plants are highly sensitive to herbicides and non-target drift can have devastating consequences for indigenous flora populations.

A novel technique that may be considered to deliver herbicide to woody stems and cut stumps is through Ecoplugs (Ecoplugs, 2022). This essentially involves the encapsulation of herbicide in a small plastic plug which gets automatically released through a valve. Due to is design this method presents practically no risk of non-target drift or operator contamination. It is claimed that Ecoplugs can be used in all-weather events and at any time of the year.

2.2.3 Biological Control

Biological control, or biocontrol, is the introduction of an invasive species' natural enemy (typically insects and/or diseases) to remove the plants' competitive advantage and reduce population vigour. The advantages of biocontrol include the fact that it is the most sustainable of all AIP control methods, it does not usually require high or long-term maintenance, and it has a relatively low cost-implication over the long term. The disadvantages involve the fact that it is generally a slow process, and low levels of infestation, with occasional outbreaks, will often remain in the project area.

2.3 Clearing Method Recommendations

The recommended clearing method guidelines based on the size class of the plant are summarised in Table 2-1.

Table 2-1 Summary of recommended control methods for various plant size classes

Size Class	Density/Environment	Control Method	Technique
Seedling (Diameter < 2.5 cm), incl. herbaceous plants	Sparse/Sensitive Environments	Hand pulling/Hoeing	Plants pulled by hand or using a tree-popper (Treepopper, 2019). Roots removed and soil disturbance to be kept to a minimum.
	Dense or open stands (< 1 m high)	Foliar spraying	Use fan nozzles in dense stands. Use selective herbicides. Avoid non-target drift.
Sapling (Diameter up to 15 cm), incl. woody plants	Sparse/Sensitive Environments	Hand pulling/Hoeing	Plants pulled by hand or using a tree-popper. Roots removed and soil disturbance to be kept to a minimum.
	Dense (< 1 m high)	Foliar spraying	Use fan nozzles in dense stands. Use selective herbicides. Avoid non-target drift.

	Dense or open stands	Basal stem (bottom/base of stem)	Apply herbicide to the bottom 250mm of the stem. Apply by means of a low pressure, coarse droplet spray from a narrow angle cone nozzle.
	Large saplings (over 2 cm diameter)	Cut stump	Cut stumps, including all side stems and suckers, as low to the ground as possible (< 10 cm). Apply herbicide to the cut area as recommended on the label.
Mature Trees	Large diameter trees	Ring barking/Frilling	Remove the bark in complete horizontal band 300 mm in width about 500 mm from the ground. Trees can be left to stand but where there is a danger of trees falling into watercourses they should be cut down and removed. Treat stumps with herbicide. Frilling will involve making cuts into the sapwood around the circumference of the tree. Apply herbicide to the inside of the frill within 3 minutes. Ecoplugs can be used in place of herbicide.
	Thinly barked trees (maximum diameter 100 mm)	Basal stem	Treat up to 50 mm diameter stems to a height of 250mm, and stems from 50mm to 100mm to a height of 500 mm. Spray the full circumference of the stem with a low-pressure coarse droplet spray from a narrow angle, solid cone nozzle. Trees must be reasonably free of mud and dust, and somewhat dry. Method is also effective to destroy saplings, regrowth and multi-stemmed trees and shrubs.
	Medium to large diameter trees	Cut stump	Cut stem, including all side stems and suckers, as low to the ground as possible (<10 cm). Apply herbicide or Ecoplugs within 3 minutes of the cut.
	Succulents	Herbicide injection	Inject herbicide directly into pre-made holes in the stem and cladodes with a syringe. Plants can also be chopped down to ground level. If the stump is sufficiently low no herbicide is required. All plant material must be removed and disposed of properly as vegetative reproduction can occur.

2.4 Site Management Recommendations

The following recommendations are important for the environmental management of the site wherein clearing is being undertaken:

- A qualified flora specialist should be on site to identify and mark all target AIP species prior to final removal, and to train site workers on identification. This will prevent the removal of any simiar looking indigenous plants;
- Avoid damage to indigenous vegetation during clearing efforts by ensuring the proper placement of equipment and herbicide, and stacking areas;
- All chemicals, whether concentrated or diluted, must be kept in a designated safe place. Preferably under locked conditions;

- All containers into which the herbicide or mixers are decanted must be clearly marked and a copy of the original label must be secured to the container;
- Applicators must wear appropriate Personal Protective Equipment (PPE), including gloves, aprons, and eye protection. After contact hands must be carefully washed with plenty of soap and water;
- Herbicides must only ever be applied according to the recommendations on the label;
- Ablution facilities should be provided where possible and all litter must be removed on a daily basis;
- No decanting of herbicide, fuel, or the cleaning of equipment should take place in areas populated by natural vegetation or aquatic systems. This should take place within a designated area and on a drip sheet to prevent spillage;
- In the case of spillage, the spill must be contained immediately and cleaned up with absorbent material such as fine dry soil. Contaminated material should be disposed of as per manufacturer's instructions. Spillages must be reported to the Environmental Control Officer (ECO);
- Prevent environmental contamination by ensuring accurate application and only using the minimum amount of herbicide needed to achieve the desired level of control. The use of coarse droplet nozzles to avoid overspray or spray drift onto adjacent vegetation is recommended. Herbicide must not be applied in windy conditions;
- Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but must be temporarily stored in a demarcated area;
- Removal of alien invasive species or vegetation and follow-up procedures must be in accordance with the Conservation of Agricultural Resource Act, 1983 (Act 43 of 1983);
- Remove plant biomass wherever possible and never stack the material in wetlands or riparian areas. Finer material can be stacked in designated areas (far from any watercourses and over densely compacted earth/artificial surfaces). Plant biomass may be burnt within designated areas and according to a strict fire safety plan, or disposed of with general garden refuse;
- Plant biomass must not remain on site as the dispersal of seed or plant parts from the cut flora may lead to a significant reintroduction of the AIPs; and
- Where possible harvest and remove wood that can be utilised for manufacturing.

2.5 Rehabilitation Recommendations

This plan must be read in conjunction with the re-vegetation and habitat rehabilitation plan to ensure that the area is rehabilitated successfully after the AIPs have been removed. This involves the fact that the rehabilitation of specific areas should take place as soon as possible after AIP removal in order to limit erosion and to allow indigenous species the opportunity to outcompete any reoccurring AIP seedlings.

3 Assessment Method

3.1 Project Area

The Mulilo Struisbult PV2 solar energy facility is adjacent to the town of Copperton, between the larger towns of Prieska to the northeast and Vanwyksvlei to the southwest, in the Northern Cape. The project area overlaps with both the Bushmanland Arid Grassland and Bushmanland Basin Shrubland vegetation communities, known for their excessively hot and dry summers and very cold, frosty winters. Soils are typically 300 mm deep consisting of red-yellow apedal freely drained soils. Although very little of these vegetation communities are formally protected, they are considered 'Least Threatened' ecosystems as only small portions of the areas have been transformed (although recent expanses in the renewable energy sector have resulted in the transformation of large portions of natural land within the Northern Cape). It is noted that invasive *Prosopis* sp. are invading large areas, particularly towards the eastern sections of the Northern Cape.

According to the 2018 NBA dataset (Awuah, 2018 and van Deventer *et al*., 2018) the project area overlaps with two wetland depressions and a natural river system to the south, which has resulted in the development of isolated riparian zone vegetation communities.

Figure 3-1 below presents the project area and its relation to the nearby watercourses. The project area has been expanded towards the southwest to incorporate the access routes and transmission lines proposed as part of the development (Aurecon, 2012).

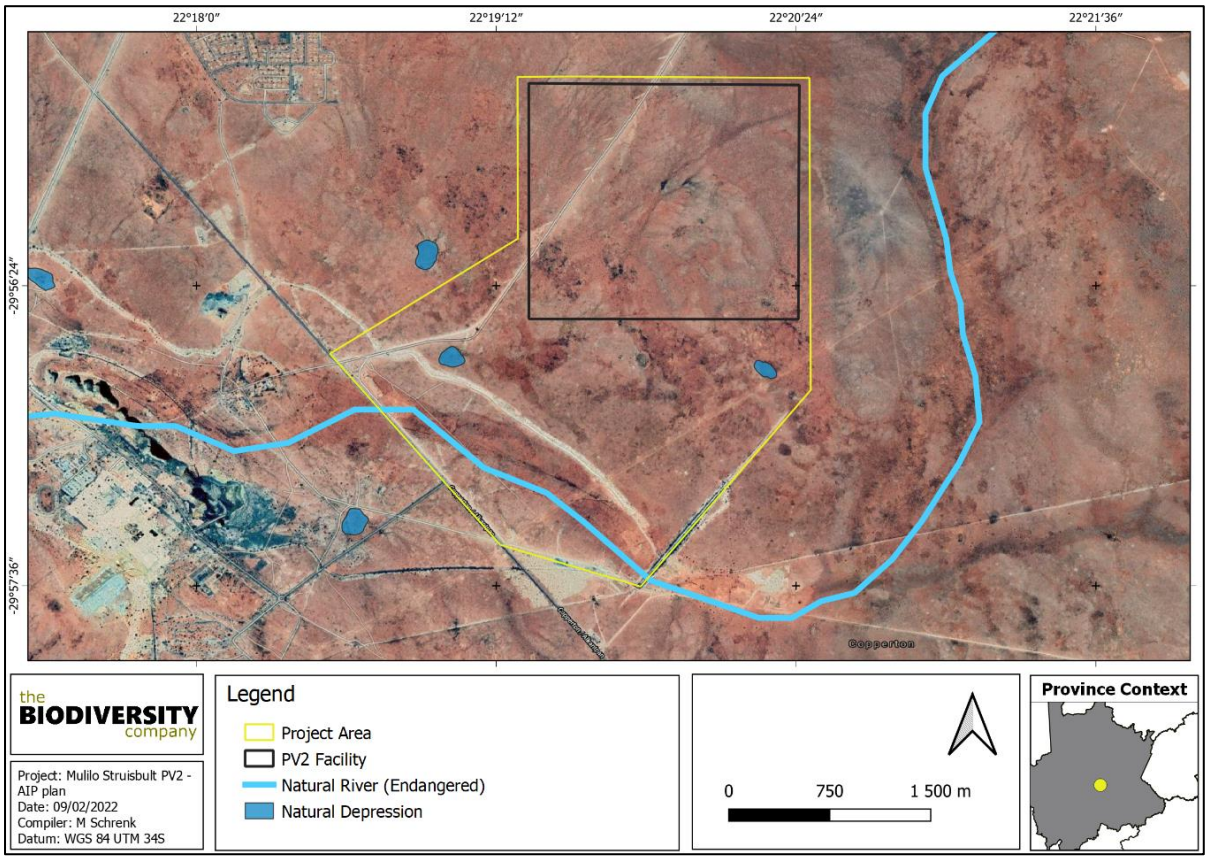

Figure 3-1 Map illustrating the location of the Mulilo Struisbult PV2 solar energy facility in relation to nearby watercourses

3.2 Habitat Vulnerabilities to Invasion

AIPs present a substantial challenge to South Africa. They have invaded over 10 million hectares (8.28%) of the country, and continue to spread rapidly (Pierce *et al*, 2002). These invasions are a considerable cost to the economy and the environment. AIPs encroach into new areas as a result of regular disturbances such as the implementation of improper fire regimes, and transformation from agriculture, road building, forestry and development. A 2016 study based on data from the IUCN Red List concluded that alien species were the most common threat associated with the extinction of mammal, amphibian and reptile species (Bellard *et al.*, 2016), and selected studies show that invasions have reduced the value of some ecosystems by over US$ 11.75 billion (van Wilgen *et al*., 2001). The control of AIPs is therefore an imperative action that is required to maintain national environmental and economic wellbeing.

Alien invasive plants threaten four main components of the landscape:

- The agriculture potential of the land;
- The biodiversity value of the land;
- Water quality; and
- Water quantity.

The susceptibility to invasion by alien species varies between habitats, and this is further influenced by the level of disturbance that has occurred within the area, as disturbance promotes the conditions suitable for the invasion of alien plants. Although the entire project area can be infested with alien plant species, the following areas are more likely to be influenced:

- Drainage lines including the river to the south;
- Areas with deeper soils, including the four nearby depression pans identified by the 2018 NBA;
- Lines along existing and new roadways; and
- Areas disturbed during construction and adjacent to the development footprint (as a result of events such as water runoff).

These risks will need to be mitigated through the AIP management and monitoring plan.

3.3 Desktop Assessment

The desktop assessment was principally undertaken using a Geographic Information System (GIS) to access datasets in order to develop digital cartographs and species lists. The data sets used comprise of the following:

- The Plants of Southern Africa (POSA) website (SANBI, 2021). The extent of the filter area applied is illustrated in Figure 3-2. Specimen records were filtered for species that were identified as alien or invasive; and
- The 2020 lists of Alien and Invasive Species (*Government Gazette No*. 43726 of 18 September 2020).

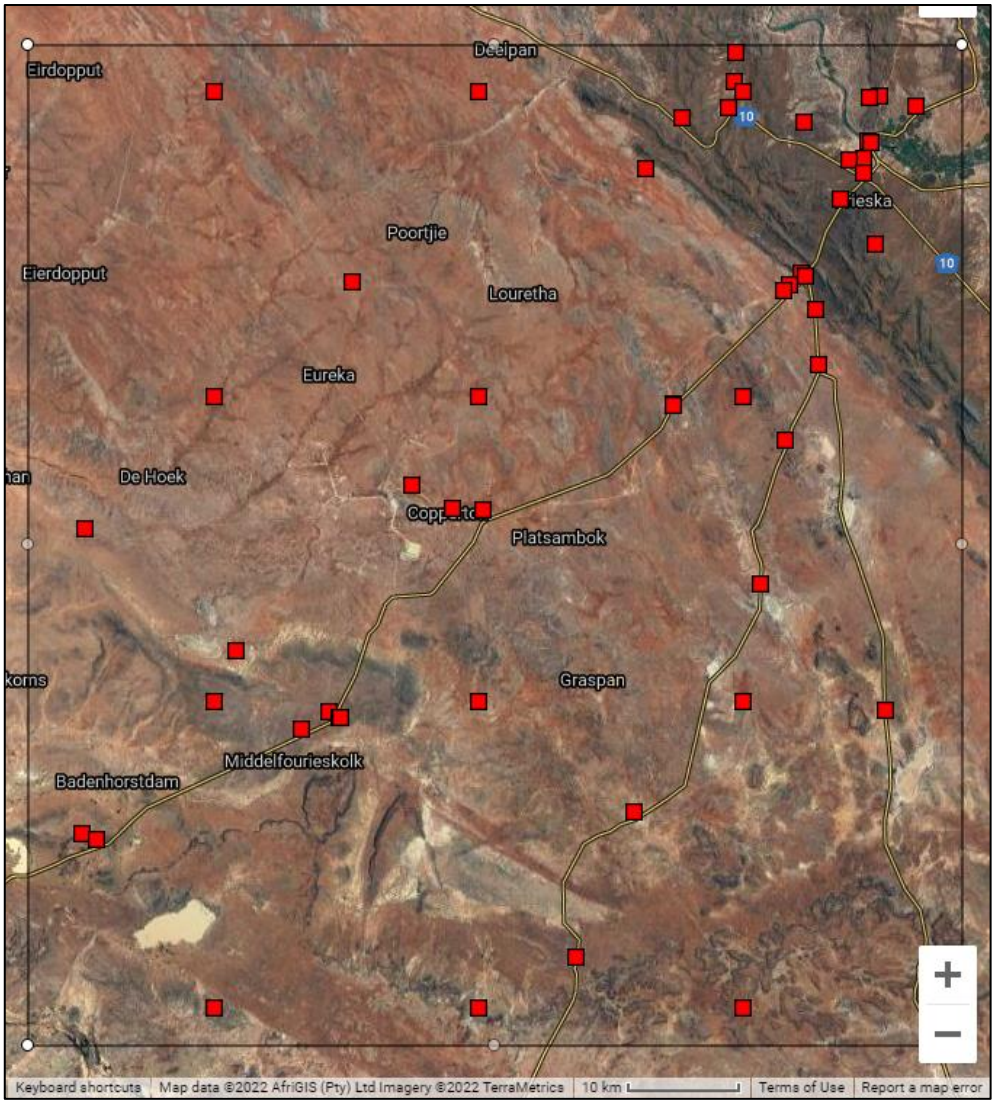

Figure 3-2 ***Map illustrating extent of area used to obtain the expected Alien Invasive Plant species list from the Plants of Southern Africa (POSA) database (red dots indicate approved observation records within the database)***

3.4 Field Assessment

A single field survey was undertaken between the 17th and 19th of January 2022 to confirm the presence and extent of AIPs within the project area. The area surveyed comprised of a planned PV2 facility, access roads, and planned transmission lines – each delineated by shape files that were supplied by the client.

Figure 3-3 below presents the extent of the project area surveyed in relation to the proposed developments.

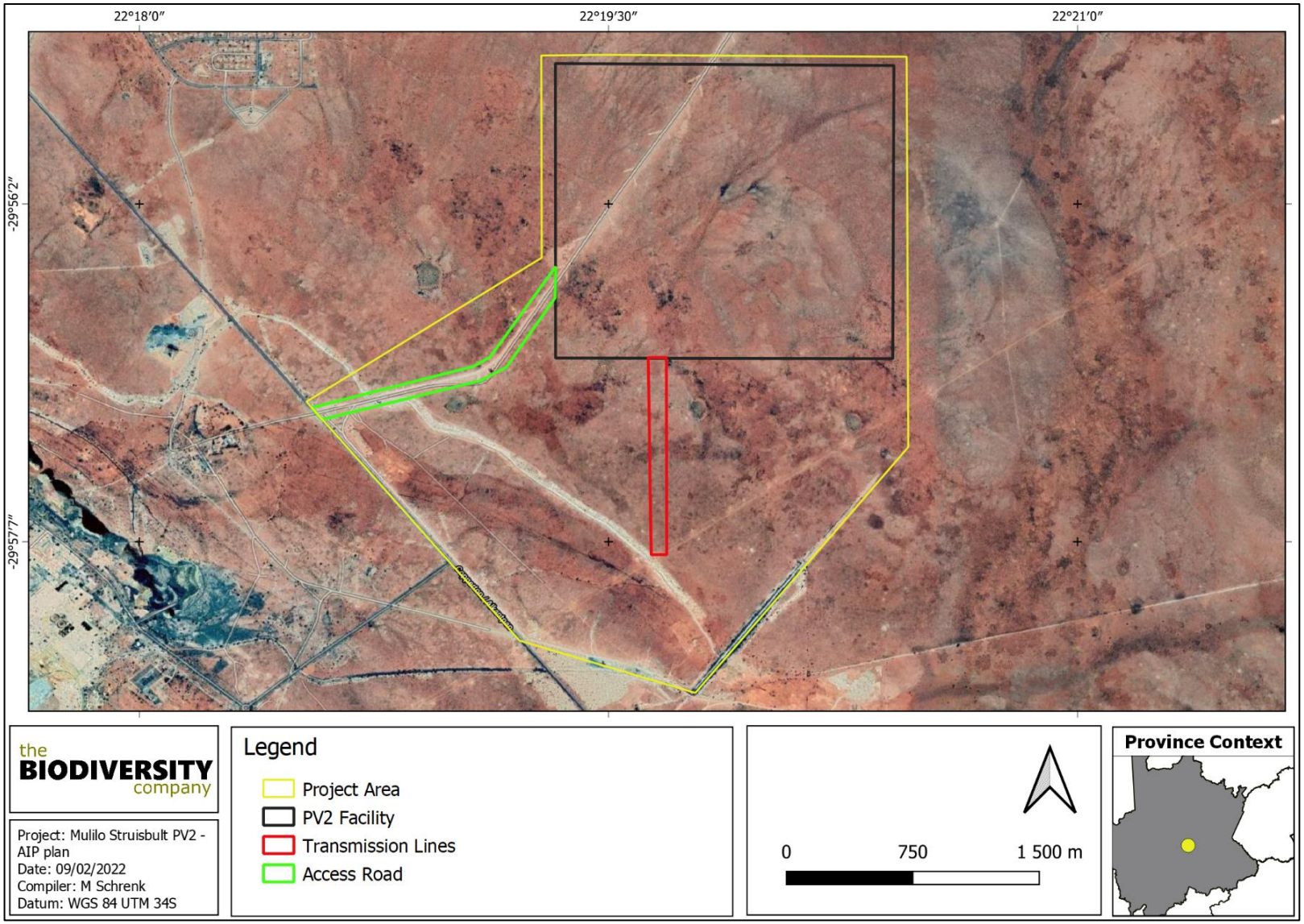

Figure 3-3 Map illustrating the project area pertaining to the Alien Invasive Plant Management Plan

4 Alien Invasive Plants of the Project Area

4.1 Desktop Assessment

The POSA database indicates that 3 species of AIPs have been recorded within the broader landscape (Table 4-1). One (1) of these expected species is listed as a category 1b AIP and two (2) are listed as category 3 AIPs. Table 4-2 outlines a summary of the description and control methods applicable for these species.

Table 4-1 Summary of expected Alien Invasive Plants (AIPs) extracted from the Plants of South Africa (POSA) database for the project area

Family	Species Name	Common Name	NEMBA Category, 2020
Fabaceae	*Prosopis glandulosa*	Honey mesquite	**3 (in Northern Cape)**
Fabaceae	*Prosopis velutina*	Velvet mesquite	**3 (in Northern Cape)**
Amaranthaceae	*Salsola kali*	Tumbleweed	**1b**

Table 4-2 Summary, description and removal methods pertaining to the NEMBA Category 1b and 3 Alien Invasive Plants that potentially occur within the broader landscape of the Mulilo Struisbult PV2 facility

***Prosopis glandulosa* - Honey mesquite**

Description: A multi-stemmed acacia-like shrub or small tree up to 10m high with paired, straight spines/thorns and reddish-brown branchlets. Dark green leaves with leaflets 10-25mm long. Yellow flower spikes from June to November. Yellowish to purplish, slender, straight, woody pods. The pods are poisonous, and the pollen is a respiratory tract irritant.

Problems Caused: Prosopis trees are extravagant users of readily available ground-water and dense stands could seriously affect the hydrology of the ecosystems they invade. Dense stands compete with and replace indigenous woody and grassland species. Dense stands produce few pods and thus replace natural pasturage without providing pods in return. Dense stands are virtually impenetrable, restricting the movement of domestic and wild animals and causing injuries

Control: Mixed mechanical and chemical control. Uproot smaller trees, cut stump and apply herbicide to larger trees. Fire control is not effective.

Photo credits: © Gregory Nicolson; © David Hoare

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***Prosopis velutina* - Velvet mesquite**

Description: Similar to *P. glandulosa*. A deciduous multi-stemmed shrub or small tree with a spreading crown and crooked branches leading to feathery, velvety dark green leaves up to 12 cm long. Leaves have 12-20 pairs of short, hairy and closely spaced leaflets. Branches have short, yellow-white thorns up to 2.5 cm and generally occur in pairs. Flowers are cream-coloured yellow with long white stamens.

Problems Caused: *P. velutina* is thought to have negative effects on water availability, but the exact effects of this species on the level of water tables has yet to be fully elucidated. *Prosopis* species also outcompete the important and indigenous *Vachellia Karroo* and *Vachellia erioloba* trees.

Control: Mixed mechanical and chemical control. Uproot smaller trees, cut stump and apply herbicide to larger trees. Fire control is not effective.

Photo credits: © Nicola van Berkel; © David Hoare; © Brian du Preez

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***Salsola kali* - Tumbleweed**

Description: Annual weed that begins life as a typical multiple branched bush, which then takes on a spherical form. Leaves are alternate; blades linear, 1-2 mm wide and fleshy. Flowers appear from Sept. to April and are inconspicuous, white, yellowish or greenish, cup shaped, in the leaf axils.

Problems Caused: The plant displaces native plants and competes for space, water, and nutrients. It is highly problematic, tough, and unpalatable, also clogging up storm water channels. It can rapidly colonise new areas, especially overgrazed, bare, and eroded soil. It is unpalatable leading to selective grazing.

Control: Young plants can be pulled or uprooted, or hoed just below ground level before seed set. In all cases, it is important to establish desirable plants, such as competitive perennial grasses, in disturbed or open areas after any form of control to reduce re-invasion.

Photo credits: © Nolan Exe; © Cheng-Tao Lin

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4.2 Field Assessment

One (1) AIP species was identified within the project area (Table 4-3). The species, *Prosopis glandulosa,* is a category 3 AIP in the Northern Cape. This species is therefore treated as a category 1b in riparian areas and as such the river/drainage line and wetland sections should be considered priority areas for control.

The listed species was recorded widely throughout the project area, with more dense infestations occurring along the access route and around the riparian areas towards the west-southwest within the project area (Figure 4-1). Individual trees were recorded throughout the central and northern portions.

Table 4-3 Summary of the Alien Invasive Plants recorded within the assessment area

Species Name (and NEMBA Category)	Photograph	Description	Control Methods
Prosopis glandulosa (Honey mesquite) Category 3 in the Northern Cape; Category 1b in the Eastern Cape, Free State, North-West and Western Cape. Category 1b in all riparian areas.		Multi-stemmed acacia-like shrub or small tree up to 10m high with paired, straight spines and reddish-brown branchlets. Dark green leaves with leaflets 10-25mm long. Yellow flower spikes from June to November. Yellowish to purplish, slender, straight, woody pods. **Similar species:** The indigenous *Vachellia karroo* tree also occurs in the region. The tree flowers in summer and the flowers are small, yellow and pompom/rounded in shape.	Cut stump close to ground (<10 cm) and wipe the exposed stump surface to remove saw dust prior to application. Immediately apply registered herbicide to the entire cut surface using a paint brush. Kaput 100 Gel is a proven effective herbicide in the treatment of *Prosopis* sp. Refer to product label sheet for all details and special instructions. Pull or dig out entire root system if mechanised equipment is available (chain and tractor or bulldozer).

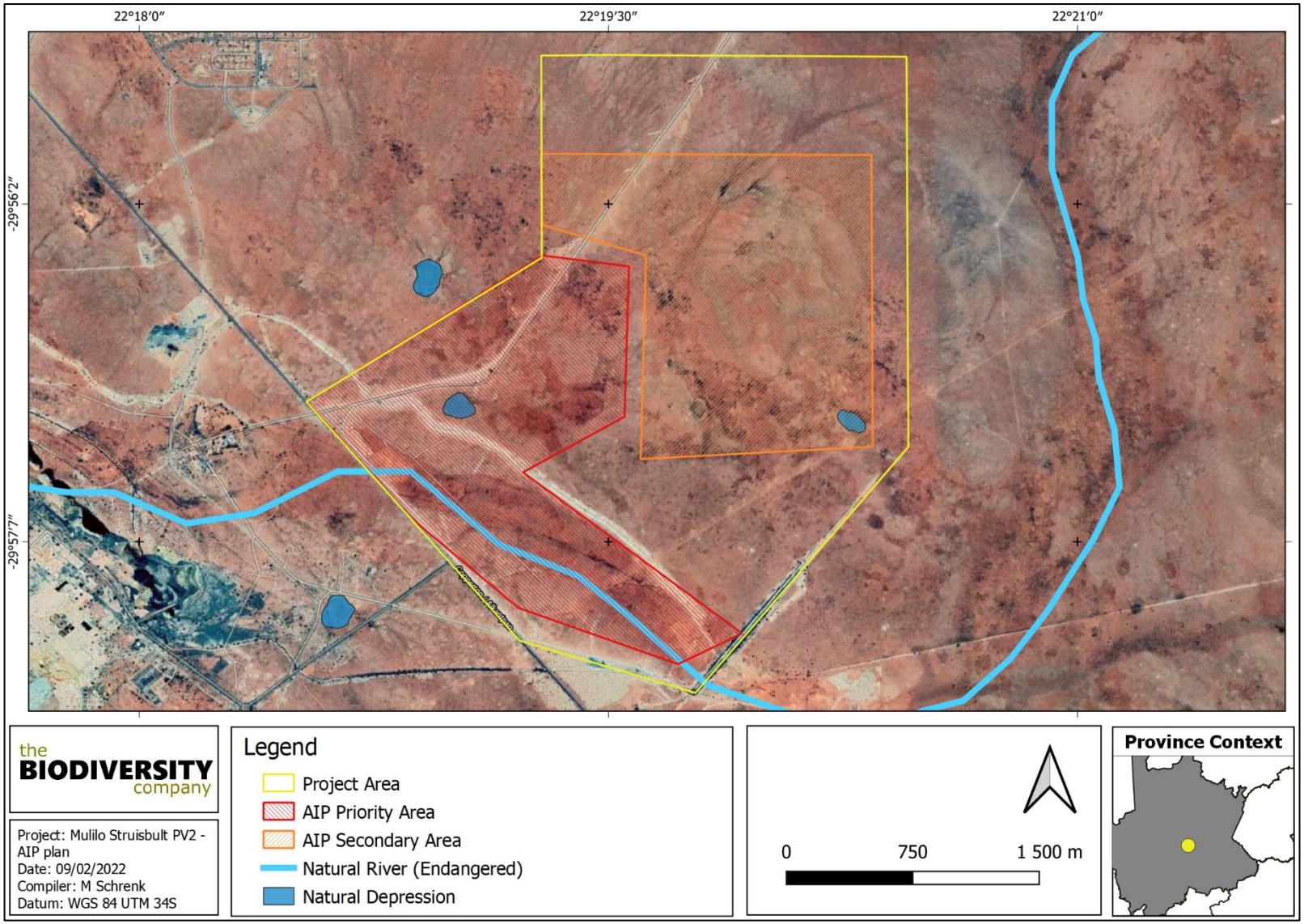

Figure 4-1 Map illustrating the locations of AIP species and the corresponding areas of priority

4.3 Areas of Potential Invasion and Priority

AIP Clearing Plans typically require a map showing the density/distribution of the dominant alien species in the area, and this is provided for in Figure 4-1 above. The areas of potential invasion include those within and adjacent to the construction footprint where there will be disturbance, including the PV arrays, roads, transmission line, laydown areas, site office, permanent office, connection centre and guard cabin.

These areas all have a high likelihood of possessing and spreading invasive species, especially during the summer growing season and during the operational phase. Therefore, the routine monitoring of these areas is essential to effectively control the spread of AIPs:

- All clearing that is undertaken within each area should be documented. Mapping and the dating of cleared areas is useful in identifying 'hotspots' and locations where follow-ups are essential;
- The species observed and an estimate of the cover should be recorded and updated so as to ascertain the effectiveness of the control methods implemented. The time taken, methods used, and the quantity applied of each herbicide used per site or effort should be recorded; and
- It is vital that this data be stored on a digital spreadsheet. Photographs can be taken at quarterly intervals.

During the operational phase the disturbed areas and the drainage lines must be monitored every three (3) months within the first two years of operation, in order to control reoccurrence and therefore minimise the long-term cover of AIPs. Subsequently, i.e., after the first two years, these areas can be monitored every (6) months.

4.4 Prevention of Future Invasion

It is critical to put measures in place that will help prevent the introduction or reintroduction of NEMBA listed AIPs onto the property, and to prevent the spreading of AIPs from the current property to neighbouring properties. Recommendations are provided below in this regard.

4.4.1 Preventative actions

- No listed Alien Invasive Plant species may be carried onto the project area or planted;
- Minimise any unnecessary ground disturbances;
- Areas that border with neighbouring land must be prioritized for control so as to prevent the existing invasive plants from spreading beyond the boundaries of the property; and
- No listed invasive animal species may be introduced on to the property.

4.4.2 Early Detection and Rapid Response and Eradication actions

- Regularly survey the property to detect any new or emerging listed AIP species;
- Immediately report new AIP species to the Department of Environmental Affairs (DEA) or the provincial Department of Environment and Nature Conservation (DENC), and ask for assistance with the control of the species;

- Do not allow emerging or new invasive species to produce seeds, act immediately by removing them (hand-pull or dig out young plants);
- Update the species list by including new AIP species and indicate where on the property they were located; and
- Increase surveillance in the affected areas after the species were controlled to allow for the rapid removal of re-sprouting plants or seedlings.

4.4.3 Monitoring

The following monitoring framework should be adopted to ensure that AIPs are continually and effectively monitored, and progress is adequately recorded (Table 4-4). Monitoring of the area throughout the process is crucial in order to prevent the AIPs from growing and spreading further out of control.

Table 4-4 Proposed monitoring framework

Action/Event	Frequency	Method	Response/Adaptation
Assess the effectiveness of the control methods	3-6 months after every event	Survey the cleared areas and evaluate regrowth. Before and after pictures are very effective. Determine if any non-target effects of herbicide are present (destruction of indigenous flora).	If the survey reveals that the control methods are effective, e.g., low levels of re-sprouting evident, continue following the herbicide mixtures and control methods. If non-target plants are dying off where herbicides were applied, ensure appropriate training for herbicide applicators, demonstrate the off-target effects to herbicide applicators to ensure they are using the correct methods and herbicides. (If the results show that the control methods are not effective, adapt by e.g., cutting lower above ground or changing herbicides or timing of herbicide application.)
Review decreases in the level of infestation	Annually	Survey the cleared areas and record species, densities, and sizes. Before and after pictures are very effective.	If the infestation levels are not decreasing, reconsider clearing intervals and look at alternative clearing methods. If infestation levels are decreasing - continue clearing, methods are effective.
Compile and update the list of AIPs present	Annually	A list of the alien invasive species present must be updated annually. Their distribution must be mapped to allow for predictive planning on areas to prioritise.	The management of the species must be reviewed and adapted should the number of species increase. An expert must be consulted in this case.
Herbicide usage	During every event	Keep track of cost and ensure no wastage. Record herbicide usage quantity.	Track usage over time, this will reveal a certain trend in the quantities used for different infestation levels. Less herbicide should be used when the infestation levels are lower. Record herbicide costs.
Recovery of bare patches with indigenous vegetation	Annually	Survey the cleared areas and determine the indigenous species abundance and density. Before and after pictures must be taken from the same geotagged location.	Follow the site rehabilitation plan. If recovery is taking place, the programme is effective. Should the area not be recovering then the clearing methods and clearing intervals must be reassessed. Should this continue, an expert must be consulted.
Document & record all alien control measures implemented	Every 6 months	Records of clearing activities must be compiled.	Accurate record keeping enables and empowers an expert to come in and review what has been done and what can be changed should the plan not be effective.

5 Conclusion

A total of one (1) listed NEMBA AIP species was recorded during a field survey of the project area, with an additional two (2) recorded from a desktop study of the region. Two (2) of the species are listed as category 3 AIPs and one (1) is listed as a category 1b species, according to the latest lists of Alien and Invasive Species published in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (*Government Gazette* No 43726 of 18 September 2020).

All relevant AIPs were identified and described, and the appropriate clearing strategy was assigned. It is recommended that a registered pest control operator be present on site during the use of any herbicides. The management and control of AIPs is not a single occurrence, but rather an ongoing process, mostly because of the seedbank that will be present which contains a large amount of variable AIP seeds - which will emerge when the conditions are suitable. It is thus important to follow the proposed monitoring framework as presented above.

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