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DRAFT

PRE-CONSTRUCTION, CONSTRUCTION AND POST-CONSTRUCTION/ REHABILITATION PHASE

ENVIRONMENTAL MANAGEMENT PROGRAMME

FOR THE

THE PROPOSED CONSTRUCTION OF THE N7 VISSERSHOK WEIGHBRIDGE ON FARM 153 VISSERSHOK OUTSPAN, MORNING STAR 25/141 AND MORNING STAR RE/141 (C1038: UPGRADING OF TR11/1), CITY OF CAPE TOWN MUNICIPALITY, WESTERN CAPE PROVINCE.

APPLICANT:	WESTERN CAPE GOVERNMENT: DEPARTMENT OF INFRASTRUCTURE
ENVIRONMENTAL ASSESSMENT PRACTITIONER:	SHARPLES ENVIRONMENTAL SERVICES CC AUTHOR: BETSY DITCHAM (EAPASA #1480) CONTRIBUTING AUTHOR: JESSICA GOSSMAN (EAPASA #6154)
DEA & DP PROJECT REFERENCE:	16/3/3/1/A1/41/3042/25
SES REFERENCE NUMBER:	26/DEMPr/08/25
DATE:	08/25

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APPENDIX 4 OF THE EIA REGULATIONS 2014 (AS AMENDED 2017).

This Environmental Management Programme has been drafted in accordance with Appendix 4 of the Environmental Impact Assessment Regulations 2014 (as amended 2017). The table below shows how the requirements of Appendix 4 have been included within this Environmental Management Programme.

(1) An EMPr must comply with section 24N of the Act and include— (a)details of– (i)the EAP who prepared the EMPr; and (ii)the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Appendix A
(b)a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 5
(c)a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Appendix B
(d)a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including— (i)planning and design; (ii)pre-construction activities; (iii)construction activities; (iv)rehabilitation of the environment after construction and where applicable post closure; and (v)where relevant, operation activities;	Section 7 - 10
(f)a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to — (i)avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii)comply with any prescribed environmental management standards or practices; (iii)comply with any applicable provisions of the Act regarding closure, where applicable; and (iv)comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	

(g)the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	
(h)the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	
(i)an indication of the persons who will be responsible for the implementation of the impact management actions;	
(j)the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	
(k)the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 12 -13 Appendix E
(l)a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	
(m)an environmental awareness plan describing the manner in which— (i)the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii)risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 15 Appendix E and N
(n)any specific information that may be required by the competent authority.	

1. DOCUMENT DETAILS

Project Ref. No:	CT26
Conditions of Use:	This report is the property of the sponsor, *Sharples Environmental Services cc* (*SES*), who may make allowance to publish it, in whole provided that: a. Approval for copy is obtained from *SES*. b. *SES* is acknowledged in the publication. c. *SES* is indemnified against and claim for damages that may result from publication of specifications, recommendations or statements that is not administered or controlled by *SES*. d. That approval is obtained from *SES* if this report is to be used for the purposes of sale, publicity or advertisement. *SES* accepts no responsibility for failure to follow the recommended program.

2. ABOUT THIS EMPR

This document is intended to serve as a guideline to be used by the *Proponent* during the pre-construction, construction, post-construction rehabilitation and operational (maintenance) phases of the proposed development. This document provides measures that must be implemented to ensure that any environmental degradation that may be associated with the development is avoided, or where such impacts cannot be avoided entirely, are minimised and mitigated appropriately.

This EMPr has been prepared in accordance with the requirements of an Environmental Management Programme (EMPr) as specified in the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (Government Notice Regulation (GNR) 326 of 2017) and Section 24N of the National Environmental Management Act, 1998 (Act No. 107 of 1998), and with reference to the "Guidelines for Environmental Management Programmes" published by the Department of Environmental Affairs and Development Planning (DEA&DP, 2005).

In line with the mitigation hierarchy (see Figure *1*), the overarching goal of this EMPr is to anticipate and provide measures that must be implemented to ensure that any environmental impact that may be associated with the development is avoided, or where such impacts cannot be avoided entirely, are minimised and mitigated appropriately. The mitigation hierarchy was considered during the Basic Assessment Report (BAR) planning process, to appropriately manage environmental impacts.

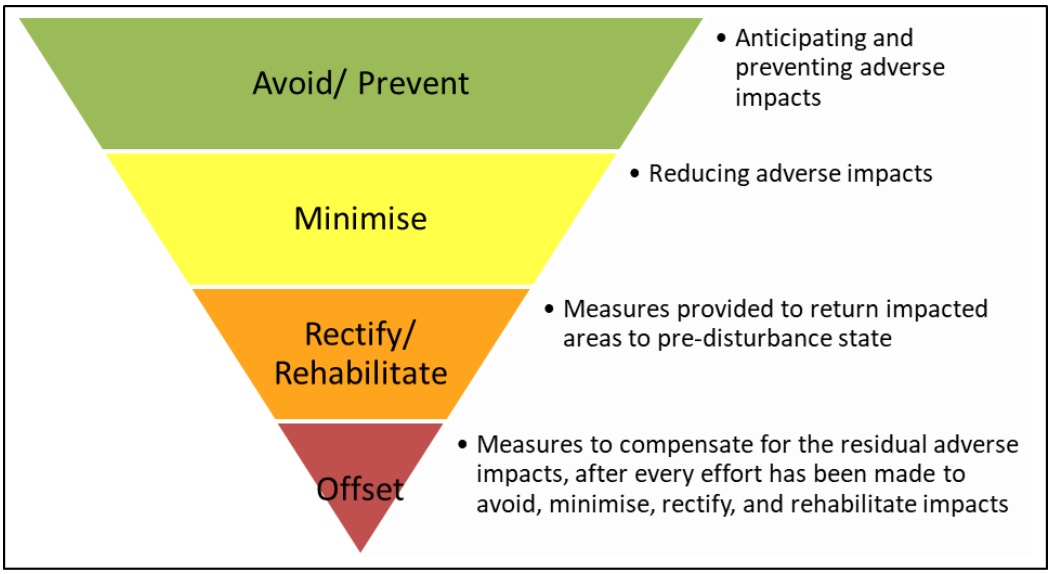


Figure 1. Mitigation hierarchy

It is important to note that not only is the EMPr designed to manage the physical establishment of the development *per se*, but also as a tool which can be used to manage the environmental impacts of the development.

The rehabilitation, mitigation, management and monitoring measures prescribed in this EMPr must be seen as binding to the *Proponent*, and any person acting on its behalf, including but not limited to agents, contractors, employees, associates, guests or any person rendering a service to the development site.

2.1. Important caveat to the report

In the past, some developments have had a devastating impact on the environment even though they have had Environmental Management Programmes in place, while other developments have had a low impact even though no management plans have been compiled.

The Implementing Agent and the attitude of the construction team play an integral role in determining the impact that the development will have on the environment. The Environmental Control Officer (ECO) needs to ensure that all role-players are aware of the constraints that the EMPr places on the development and construction team and are prepared to be actively involved in implementing these constraints. The end result relies on co-operation, mutual respect and understanding of all parties involved.

3. HOW TO USE THIS DOCUMENT

It is essential that this EMPr be carefully studied, understood, implemented and adhered to as far as reasonably possible, throughout all phases of the proposed development. The *Proponent* must retain a copy of this EMPr, and an additional copy must be kept on site at all times during the pre-construction, construction and post-construction rehabilitation phases of the development.

This EMPr must be included in all contracts compiled for contractors and subcontractors employed by the *Proponent*, as this EMPr identifies and specifies the procedures to be followed by engineers and other contractors to ensure that the adverse impacts of construction and maintenance activities are either avoided or reduced. Appointed contractors must make adequate financial provision to implement the environmental management measures specified in this document.

This EMPr must be seen as a working document, which may be amended as and when needed, to accommodate changing circumstances on site or in the surrounding environment, or to accommodate requests/ conditions issued by the Competent Authority, the Department of Environmental Affairs & Development Planning (DEADP). Amendments to this EMPr must first be approved by the Competent Authority, in writing, before being implemented.

4. DETAILS OF THE EAP & TECHNICAL/SPECIALIST INPUT

This EMPr and the associated environmental assessment was undertaken by Sharples Environmental Services cc. Sharples Environmental Services (SES) was established in 1998 and has been actively engaged in the fields of environmental planning, assessment and management. SES advises on private, corporate and public enterprises on a variety of differing land use applications ranging from large-scale residential estates and resorts to golf courses, municipal service infrastructure installations and the planning of major arterials. Our consultants have over 40+ years of combined experience and we operate in the Southern, Eastern and Western Cape regions.

A brief description of the Environmental Assessment Practitioners (EAP) has been included below, as per Table 1, and a detailed Curriculum Vitae has been included in Appendix A.

Table 1: EAP Details.

Role:	Name:	E-Mail Address:	Qualifications:	Registration/ Memberships	YEARS OF EXPERIENCE
Author	B Ditcham	betsy@sescc.net	• B.Sc. Honours (Wildlife Management) (UP) B.Sc (Zoology and Ecology (UCT)	• IAIA (SA) EAPASA (Reg Nr. : 1480)	16+ yrs
Co-author	J Gossman	jessica@sescc.net	• B. Degree Environmental Management • B.Sc. Honours Geography	• IAIA (SA) • EAPASA (Reg Nr. : 6154)	1+ yrs

5. DESCRIPTION OF THE ACTIVITY

THE PROPOSED CONSTRUCTION OF THE N7 VISSERSHOK WEIGHBRIDGE ON FARM 153 VISSERSHOK OUTSPAN (C1038: UPGRADING OF TR11/1), CITY OF CAPE TOWN MUNICIPALITY, WESTERN CAPE

Sharples Environmental Services cc (SES) has been appointed by Hatch South Africa (Pty) Ltd on behalf of the Western Cape Government: Department of Infrastructure to undertake the environmental assessment in accordance with the National Environmental Management Act, 1998 (Act 107 of 1998), as amended, and the Environmental Impact Assessment (EIA) Regulations of 2014, as amended (GNR 326 of 2017), for the proposed relocation and construction of the N7 Vissershok Weighbridge (C1038: upgrading of TR11/1).

At present, there is an operational weighbridge along the N7 northbound (**Error! Reference source not found.**). The proposed relocated weighbridge will be predominantly located on a portion of Farm Vissershok Outspan 153, City of Cape Town (CoCT) Municipality, Western Cape. Sections of the proposed weighbridge site, such as service roads, are located on Farm Morningstar 25/141 and a portion of Morningstar RE/141. Two other layout locations have been assessed for the proposed weighbridge. During the site sensitivity verification, an area of "High Conservation Value" Cape Flats Sand Fynbos was noted by the Botanical Specialist in the central portion of the site. Given the conservation importance of this vegetation type, three additional layouts have been assessed in conjunction with the originally proposed layouts. Engineering and environmental considerations have been proposed, with multiple design layouts that have been considered. However, Alternative 5 (layout 5) has been selected as the final design for implementation (**Figure 3**)).

Figure 2. Existing Vissershok Weighbridge.

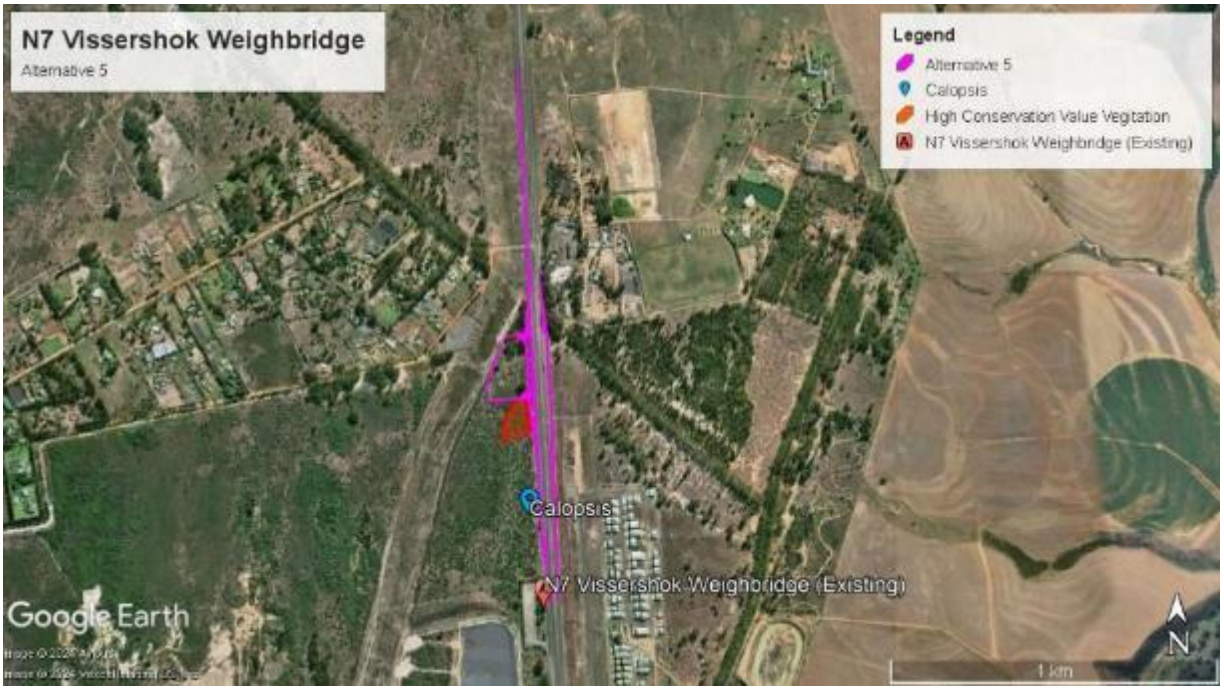


Figure 3. Proposed preferred and final layout 5.

The intention is to establish the new Vissershok Weighbridge approximately 600 m north of the existing site, followed by the demolition of the existing weighbridge and rehabilitation of that site. This proposal aligns with a larger ongoing road works programme.to accommodate the N7 Van Schoorsdrift diamond interchange, to the south of the existing site, which was approved on 13 April 2022, DEADP Ref.: 14/3/1/1/1A1/16/0564/21. The new proposed project will help improve road safety along the route.
The proposed Vissershok weighbridge will include the main weighbridge structure, offices, parking areas, fencing and relevant service connections (water, sewer and electricity infrastructure) and connecting service roads. It will also include a weigh-in-motion station along the southbound corridor of the N7.

ENGINEERING INPUT (PLANNED INFRASTRUCTURE)

Administration Block
It is envisaged that provision would be made for an administration block similar to the existing one at the existing facility. An assessment will be carried out of the current facility in the detail design stage to ascertain whether any further improvements to the layout of the office block should be included in the new facility, such as the use of solar power.

Weighbridge Holding Area
Currently there is a gravelled holding area, which has a demarcated concrete block paved area, for the transfer and or re-packing of goods for vehicles that exceed the axle weight limitations. At this stage it is not envisaged to plan for anything larger or smaller.

Weighbridge
It is proposed that a totally new weighbridge with the latest technology and electronics be installed. It is further proposed that provision be made for a 3,2m wide scale similar to the existing scale.

Weigh-in Motion Facilities
It is proposed that weigh-in-motion facilities be installed in both the southbound and northbound directions.

Weighbridge Facility Access Road Layout
The proposed layout of the roadworks for the weighbridge facility is presented in Annexure B1. The weigh-in-motion facility, in the south bound direction, has been shifted further north (compared to the previous scheme) to avoid having to provide an auxiliary lane between the weigh-in-motion facility and the N7-southbound on ramp and off ramp of the Van Schoorsdrift Interchange.

The detailed design by the engineers (Hatch) has been included within Appendix B of this EMPr.

The demolition of the existing weighbridge is illustrated in the engineering drawing below. All demolition materials will be reused whenever possible or disposed of at a licensed landfill site.

Figure 4. The Demolition plan for the existing weighbridge facility after the new weighbridge is established.

APPLICABLE LISTED ACTIVITIES

List the applicable activities in terms of the NEMA EIA Regulations

Activity No(s):	Provide the relevant **Basic Assessment Activities** as set out in **Listing Notice 1**	Describe the portion of the proposed development to which the applicable listed activity relates.
24	*The development of a road—* *(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* ***(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;*** *but excluding a road—* *(a) which [are] is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) [roads] where the entire road falls within an urban area; or* *(c) which is 1 kilometre or shorter.*	The proposed weighbridge infrastructure includes a weigh-in-motion facility to be installed in both the southbound and northbound directions. There are two service roads from the main N7 national road, one entering from a southern direction and one exiting in a northern direction. These structures, along with other components of the weighbridge (and associated roadworks) are expected to influence the road reserve width and it is anticipated that the road reserve will require a minor widening of 10m to 15m, however, this is an expansion on the currently established road and no new roads are expected to be developed. **Therefore, this listing notice will not apply to the proposed development and has been confirmed by the Competent Authority within the NOI comments.**
27	*The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for –* *(i) The undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	It is anticipated that the location of the weighbridge will result in clearance of approximately 1 ha of indigenous vegetation. **Therefore, this activity will be applicable and has been added to the BAR.**
56	*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre—* *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres;* *excluding where widening or lengthening occur inside urban areas.*	The proposed weighbridge (and associated road on ramp and off ramp from the N7 national road) could constitute a widening and/or lengthening of the road. The outbound on-ramp from Cape Town will be about 633 meters long and 9 to 10 meters wide, with a 1:50 taper zone for safe heavy vehicle entry. The outbound off-ramp will be approximately 825 meters long and 9 to 10 meters wide. The inbound weigh-in-motion section will be around 1,026 meters long and 13 meters wide.

		it is deemed that this Activity <u>will be</u> applicable and has been added to the BAR.
Activity No(s):	Provide the relevant **Basic Assessment Activities** as set out in **Listing Notice 3**	Describe the portion of the proposed development to which the applicable listed activity relates.
4	*The construction of a road wider than 4 meters with a reserve less than 13.5 meters.* *<u>(d) IN Western Cape:</u>* *I. In an estuary;* *ii. All areas outside urban areas;* *iii) In urban areas:* *(aa) Areas zoned for use as public open space within urban areas;* *And* *(bb) Areas designed for conservation use in Spatial Development Frameworks adopted by the competent authority, or zoned for a conservation purpose.*	A portion of the proposed weighbridge road infrastructure will be located east of the N7, just north of the Morningstar airfield. This development will encroach approximately 10 meters into the designated Protected Area known as the Van Schoorsdrift Conservation. The project requires this encroachment to facilitate the widening and lengthening of the road, allowing for better traffic accommodation in conjunction with the new weighbridge. **Therefore, this activity <u>will not</u> apply to the proposed development and has been confirmed by the Competent Authority within the NOI comments.**
12	*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *<u>i. Western Cape</u>* *i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;* *ii. Within critical biodiversity areas identified in bioregional plans;* *iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas;* *iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning; or* *v. On land designated for protection or conservation purposes in an Environmental Management Framework adopted in the prescribed manner, or a Spatial Development Framework adopted by the MEC or Minister.*	It is expected that more than 300 m^2 of land will be cleared on a mostly undisturbed area which contains some indigenous vegetation within the Western Cape. The surrounding land has been largely developed, with a large landfill site to the south-west, an airfield to the east, smallholdings to the north-west and the N7 national directly east of the proposed site. According to the DFFE Screening Tool, the site ecosystem status has been indicated to be Critically Endangered by the SANBI Red List of Ecosystem Remnants and the site sensitivity has been indicated to be Very High (Critically Endangered - Cape Flats Sand Fynbos). That will see to an area of over 300 square meters of indigenous vegetation being cleared to accommodate the proposed development, as the proposed development is 4.7 ha in extent. **This activity <u>will be</u> applicable and has been added to the BAR.**
18	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *i. <u>Western Cape</u>* *i. Areas zoned for use as public open space or equivalent zoning;* ***ii. All areas outside urban areas:*** ***(aa) Areas containing indigenous vegetation;*** *(bb) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined; or*	The proposed weighbridge (and associated road on ramp and off ramp from the N7 national road) could constitute a widening and/or lengthening of the road in an area with indigenous vegetation within the Western Cape. Environmental Authorisation is currently in place for the existing N7 national road; however the proposed weighbridge and associated infrastructure is considered an expansion on the existing road and the on ramp and off ramp which will link the weighbridge to the main road will constitute an addition (lengthening and widening) of the road, The outbound on-ramp from Cape Town will be about 633 meters long and 9 to 10 meters wide, with a 1:50 taper zone for safe heavy vehicle entry.

	iii. Inside urban areas: *(aa) Areas zoned for conservation use; or* *(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority.*	The outbound off-ramp will be approximately 825 meters long and 9 to 10 meters wide. The inbound weigh-in-motion section will be around 1,026 meters long and 13 meters wide therefore; **It is deemed that this Activity <u>will be</u> applicable and has been added to the BAR.**
Activity No(s):	Provide the relevant **Scoping and EIR Activities** as set out in **Listing Notice 2**	Describe the portion of the proposed development to which the applicable listed activity relates.
Not applicable.		
Note: • Only those activities listed which will be applied for shall be considered for authorisation. The onus is on the Applicant to ensure that all applicable listed activities are included in the application. Environmental Authorisation must be obtained prior to commencement with each applicable listed activity. If a specific listed activity is not included in an Environmental Authorisation, a new application for Environmental Authorisation will have to be submitted. • The Minister responsible for mineral resources is the Competent Authority to deal with all applications where the listed or specified activity is directly related to- (a) prospecting or exploration of a mineral or petroleum resource; or (b) extraction and primary processing of a mineral or petroleum resource.		

<u>The DFFE Screening Tool Summary:</u>

The following summary of the development footprint environmental sensitivities is identified by the Screening Tool Report (Table 2).

The National Sector Classification Category selected to produce the Screening Tool Report for the preferred and final layout 5, dated 8 of May 2025:

Infrastructure/Transport Services/Roads/Public

Only the highest sensitivity is indicated. The environmental sensitivities for th proposed development footprint as identified by the screening tool report, are only indicative and have been verified on site by a suitably qualified person.

Table 2: Summary of sensitivities as identified by the screening tool report

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme		X		
Animal Species Theme		X		
Aquatic Biodiversity Theme				X
Archaeological and Cultural Heritage Theme				X
Civil Aviation (Solar PV) Theme		X		
Defense Theme			X	
Paleontology Theme				X
Plant Species Theme		X		
Terrestrial Biodiversity Theme	X			

6. RECEIVING ENVIRONMENT

The following specialist assessments were undertaken:

- Agricultural Compliance Statement - Johann Lanz
- Archaeological and cultural heritage (incl. palaeontology) specialist assessment/compliance statement - Jayson Orton

- Terrestrial Faunal and Avi-Faunal Biodiversity specialist assessment - Jacobus H. Visser
- Botanical & Terrestrial Biodiversity specialists assessment - Nick Helme

Specialist Company	Specialist Details	Sensitivity of receptors	Summary of findings	Summary of impact management measures that pertains to the design/operation of the proposed development.
HERITAGE AND PALAEONTOLOGICAL OBSERVATIONS				
ASHA Consulting (Pty) Ltd	Jayson Orton (Heritage Consultant)	Negligible	**Archaeological and Cultural Heritage Theme** From a cultural heritage and landscape perspective, based on the nature of the proposed project and the nature of the receiving environment of the proposed development. **No heritage resources of significance were identified within the site.**	No mitigation measures proposed.
TERRESTRIAL BIODIVERSITY AND PLANT SPECIES ASSESSMENT				
Nick Helme Botanical Surveys	Nick Helme	Low to Medium	**Plant Species Theme** According to the SA Vegetation Map the original natural vegetation in the study area is all Cape Flats Sand Fynbos (Mucina & Rutherford 2018). Based on my ground-truthing I agree with this, and no copy of the vegetation map is provided as it adds little value. Cape Flats Sand Fynbos is now gazetted as Critically Endangered on a national basis (Government of South Africa 2022), with less than 18% of its total original extent remaining intact, less than 1% conserved, and an unreachable national conservation target of 30% (Rouget et al 2004). The unit supports a very high number of threatened and endemic plant species, and occurs on deep, nutrient poor, sandstone derived, acid soils on in the area between Melkbos and Cape Point, and the vegetation type needs fire for optimal ecological functioning (Helme et al 2016). The vegetation on site does not appear to have been burnt for at least twenty years. This means that the vegetation on site is now senescent (some species dying of old age; diversity dropping), as this type of Fynbos should burn once every 10-14 years for optimal ecological functioning (Helme et al 2016). Most of the study area has been relatively heavily disturbed in the past, most recently by dense stands of alien invasive trees, such as *Leptospermum laevigatum* (Australian myrtle), *Acacia saligna* (Port Jackson) and *Acacia cyclops* (rooikrans). Most of this alien vegetation was cleared and chipped about ten years ago, but has returned at a lower density since then, and now covers about 10-20% of the study area and would be easy to eradicate. Rehabilitation potential is however only moderate in many areas, as the soil chemistry has been altered by the long period of alien plant invasion (changed soil from acid to neutral pH). The long-term absence of fire	• The authorised hard surface footprints should be surveyed and pegged out on site prior to any site development, and the outer fenceline of the new development (both east and west of the N7) should also be erected prior to any site development. • No areas of natural or partly natural vegetation should be disturbed outside the pegged out and authorised development footprints. No vehicular activity or dumping of material may take place outside the authorised development footprints. • All woody alien invasive vegetation should be removed from within the fenced off project area, prior to the development of any authorised development footprints. This material should be removed from site and taken to an approved organic dump. Removal of the alien vegetation must be undertaken by a trained and licensed alien vegetation removal team, and must be undertaken using methodology outlined in the Best Practise Guidelines (see Martens et al 2021). • Formal conservation of the identified High sensitivity areas adjacent to the proposed development (west of the N7) is recommended and should be investigated. These areas should ideally be declared Protected Areas within one year of any authorisation of the current project and could potentially be managed by the City of Cape Town Biodiversity Management Branch, with ongoing management funding to be provided by the applicant.

Specialist Company	Specialist Details	Sensitivity of receptors	Summary of findings	Summary of impact management measures that pertains to the design/operation of the proposed development.
			has also meant that the indigenous seedbank has not had optimal conditions to germinate for a long time (>20yrs). The more disturbed and lower diversity areas are deemed to be of Medium botanical sensitivity at a regional scale. Indigenous plant cover here is about 50%, with about 30-40% being open space. Indigenous plant species recorded in these areas include *Aspalathus ternata, A. hispida, Putterlickia pyracantha, Thamnochortus punctatus, T. obtusus, Dimorphotheca pluvialis, Athanasia trifurcata, Searsia laevigata, S. lucida, Seriphium plumosum, Phylica cephalantha, Metalasia densa, Asparagus capensis, Erica mammosa, Aristida diffusa, Dicerothamnus rhinocerotis, Staberoha cernua, Phylica stipularis, Ehrharta villosa, Restio sieberi, Ficinia secunda, F. indica, Ursinia anthemoides, Chrysocoma ciliata, Agathosma imbricata, Senecio pterophorus, Helichrysum cymosum, Tetragina fruticosa, Anthospermum spathulatum, Eriocephalus racemosus and Passerina corymbosa.* No succulents or bulbs were observed, which is probably largely an indication of the previously disturbed nature of the site. The High sensitivity area includes all or most of the above species, plus *Senecio erosus, Diosma oppositifolia and Willdenowia teres*. The key distinguishing feature here is the much higher indigenous plant cover (about 80% versus about 15%), and the consequently much higher rehabilitation potential. The road reserve east of the N7 is of Low sensitivity, as it is degraded, regularly mown and of low diversity, being dominated by *Ehrharta villosa, Cynodon dactylon, Tetragonia fruticosa* and assorted weedy annuals. East of the road reserve fence it becomes slightly more diverse and consequently of higher sensitivity, as it has not been regularly mown, although it was until recently very densely invaded by alien invasive Port Jackson (now felled). Additional indigenous species still present in this area include *Aspalathus hispida, Thamnochortus punctatus, Dimorphotheca pluvialis, Searsia laevigata, Metalasia densa, Asparagus capensis, Aristida diffusa, Dicerothamnus rhinocerotis, Ficinia indica, Ursinia anthemoides, Chrysocoma ciliata, Willdenowia incurvata, Senecio pterophorus and Passerina corymbosa.* Two plant Species of Conservation Concern (SoCC) were recorded during the survey, and a few others may occur in these relatively	• Rehabilitation of the current weighbridge area was mentioned, but I don't believe that it will add any ecological value, and the significant amount of money it would require should rather be spent on rehabilitation of other nearby areas that are not as heavily degraded and have a realistic chance of rehabilitation success (such as around the Morningstar airfield (currently a formally Protected Area), or west of the current study area). The heavily degraded nature of the current weighbridge site means that rehabilitation will be expensive, difficult and time consuming, as Sand Fynbos is not easy to rehabilitate once the soil structure and chemistry has been altered. I would rather advocate that the rehabilitation budget be spent on ongoing removal of all woody alien invasive vegetation (using methodology as outlined in Martens et al 2021) in the adjacent High sensitivity areas (as per Figure 4), and in the area between the N7 and the Eskom servitude (some 300m west of the N7), which has a much higher chance of rehabilitation success, and is not as heavily degraded.

Specialist Company	Specialist Details	Sensitivity of receptors	Summary of findings	Summary of impact management measures that pertains to the design/operation of the proposed development.
			degraded and senescent areas. None of them were actually recorded within the study area. A couple of very old plants of *Aspalathus ternata* (Near Threatened) were found adjacent to and just north of the existing weighbridge, but their presence here is of low regional significance, as the population is very small, and this species is widespread and still relatively common (Vredendal to Cape Town). *Restio impolitus* is a rare and severely threatened graminoid found on the coastal sand plain, from Redelinghuys to Cape Town, and is Redlisted as Vulnerable. A single plant was found, just outside the southern part of the study area, but I have also observed it about 700m to the northwest, so there seems to be a small local subpopulation here. A single plant of *Otholobium uncinatum* (Near Threatened) has been recorded very close to the *Restio impolitus* (see inaturalist.org) but was not seen during the current site survey. The plotted location of the plant on iNaturalist can thus not be verified, but it is clearly more common east of the N7, on the Morningstar airfield property, where there are loamy soils, typically more to its liking, and I thus believe that the locality here may be an error. Heterorachis aculeata (Vulnerable) also occurs just north and east of the airfield, but is not present in the study area. Botanical sensitivity map in the vicinity of the proposed development area. All areas within the Layout 5 study area (including the yellow shaded areas) that are not shaded red are of Low or Medium sensitivity. The additional high-sensitivity areas outside the actual study area have been included for context. Additionally, an Alien Invasive Species Management Plan must be in place prior to the commencement of the proposed works, if approved.	
AGRICULTURAL COMPLIANCE STATEMENT				
Johann Lanz	Johann Lanz	Medium	**Agricultural Theme** An agricultural impact is a change to the future agricultural production potential of land. The significance of the agricultural impact is directly proportional to the extent of the change in production potential. The loss of 3 hectares of grazing land, of which there is no particular scarcity in the country, represents minimal loss of	No mitigation measures proposed.

Specialist Company	Specialist Details	Sensitivity of receptors	Summary of findings	Summary of impact management measures that pertains to the design/operation of the proposed development.
			agricultural production potential in terms of national food security and for the affected farm.	
ANIMAL SPECIES COMPLIANCE STATEMENT				
Blue Skies Research	Dr Jacobus H. Visser	Low	**Animal Species Theme** The most prominent current impact on the site constitutes significant infestations of alien and invasive Port Jackson and Bluegum trees which relates to a degraded habitat structure and altered ecosystem dynamics. Furthermore, the site is bordered by the N7 Road to the east and the Zonnekus and Reygersdal Roads to the north from (which services the Morning Star AH Sub Place) from where there is significant and constant noise and vibration from vehicle traffic. Furthermore, the Koeberg Flight Park is also located to the west of the site, where there is further additional noise and vibration from air traffic. Collectively, these encompass the current impacts on the site. No Species of conservation concern was identified. However, Six mammal species were recovered within the study area), all of which are currently classified as "Least concern" by the IUCN. The site exhibits high abundances of burrowing species such as the Cape Golden Mole *(Chrysochloris asiatica),* Cape Dune Mole-rat (*Bathyergus suillus*) and Cape Gerbil *(Gerbilliscus afra*) given the deep sandy soils which characterise the study area. In addition to these species, common rodents such as the African Mole-rat (*Cryptomys hottentotus)* and Four-striped Grass Mouse (*Rhabdomys pumilio*) were also noted on the site, with individuals of the Common Duiker (*Sylvicapra grimmia*) also utilizing the site as a foraging area. Importantly, no mammalian predators or evidence of such species were recovered on the site. Only two reptile species were recovered within the study area both of which are currently classified as "Least concern" by the IUCN. Both represent common reptile species in the study area landscape, including the Angulate Tortoise *(Chersina angulata*) and Cape Skink (*Trachylepis capensis*). In total, 14 bird species were recorded within the study area, all of which are currently classified as "Least concern" by the IUCN. All of the avifauna on the site constitute common species, and avifaunal diversity appears generally depauperate. Most notable is the complete lack of raptor species in the study area, most likely given the lack of terrestrial prey items	• An experienced, independent Environmental Control Officer (ECO) must be appointed to oversee the construction activities and compliance with the EMPr. • During construction, no wild animals may under any circumstance be handled, removed, or be interfered with by construction workers. No wild animals may under any circumstance be hunted, snared, captured, injured, or killed. This includes animals perceived to be vermin, • Alien plant eradication and control must be undertaken throughout the construction and the operational phase. • None of the habitats on the site currently harbour any populations of faunal SCC, and furthermore exist in a degraded state. As such, the entire site is retrieved as having a "Very low" SEI where minimisation mitigation is acceptable and allowing for development activities of medium to high impact without restoration activities being required. • The Restio habitat which is located outside of and to the west of the project footprint, however, exists in a natural and intact state, and this habitat is retrieved as having a "High" SEI where avoidance mitigation is advocated

7. GENERAL ENVIRONMENTAL MANAGEMENT

The following general management measures are intended to protect environmental resources from pollution and degradation during all phases of the project life cycle. These measures must be implemented as and where applicable, reasonable and practicable during the pre-construction, construction and post-construction rehabilitation and operational (maintenance) phases of the proposed development.

Code of Conduct
The purpose of the Code of Conduct (CoC) is to minimise the impact of the activities associated with the construction phase on the environment. The rules and regulations prescribed in this CoC are intended to ensure that the impacts on the environment are not prejudiced by the construction activities. Failure to adhere to or any breach of this CoC will result in a fine being levied against the offending or defaulting party / individual.

Labourers during the construction phase must conserve the natural environment, endorsing the principles of sustainable use and minimum impact. They must also be sensitive to the impact of their operation on the environment within which they work and minimise any adverse impacts.

This EMPr forms an integral part of the activities during the construction phase and as such, is legally enforceable. In addition to the restrictions and controls provided for in this EMPr, the environmental controls comprise of the following:

- **Engineers**
  - Unless otherwise stated by the holder, only a registered engineer must be appointed for the construction phase of the development.
  - The engineer must provide work or services of a quality and scope, and to a level, which are commensurate with accepted standards and practices.
  - The engineer must be impartial in decision-making, provision of advice and judgement.

- **Contractors and sub-contractors**
  - Unless otherwise determined, only appropriately registered contractors must be appointed.
  - It shall be the responsibility of the holder / engineer to ensure that the contractors abide by and comply with the rules and regulations of the Code of Conduct.
  - Contractors shall at all times be responsible for their sub-contractors and employees whilst they are on the development property.

Rules and Regulations
It is of vital importance that engineers, and contractors understand and acknowledge that they are working on a site that has undergone an environmental assessment and if authorised will require compliance with all relevant permits/licenses and this EMPr. The role players should agree to conform to all environmental controls specified in this EMPr, and any additional environmental permits/licenses, as well as any additional input by the ECO.

In addition to the EMPr, the environmental controls comprise of the following:

- **Plan Controls**

- A copy of the approved and signed project plans must be available on site during the construction phase of the development.
- Variations of the building plans must be approved by the engineer / holder prior to being implemented.

- **Site Tidiness**
  - The contractor must keep the appearance of the site neat and tidy at all times. Building rubble must be removed from site at regular intervals, and litter must be removed from the site on a daily basis (if not in appropriate receptacles). Refuse drums must be available on site which waste can be placed in. The drums must be emptied on a regular basis and the waste taken to a licenced local waste disposal facility.
- **Safety**
  - The contractor must comply with the Health and Safety Act (Act No. 85 of 1993), as amended (OSHA), together with such regulations promulgated thereunder.

7.1. Site Access and Traffic Management

All construction vehicles need to adhere to traffic laws and regulations, drivers must be sensitised to the fact that they are working in an area with a potentially high volume of foot and vehicle traffic. The speed of construction vehicles and other heavy vehicles must be strictly controlled to avoid dangerous conditions for other road users. As far as possible, care must be taken to ensure that the local traffic flow pattern is not significantly disrupted, and vehicle operators therefore need to be educated in terms of "best-practice" operation in order to minimise unnecessary traffic congestion or dangers. These practices include, but are not limited to, not unnecessarily obstructing the access point or traffic lanes used to access the site; considering the load carrying capacity of road surfaces and adhering to all other prescriptive regulations regarding the use of public roads by construction vehicles.

Adequate signage that is both informative and cautionary to passing traffic must be erected to warn other road users (motorists and pedestrians) about the presence of construction vehicles, particularly at the point where construction vehicles enter/ exit the site warning them of the construction. Signage would need to be clearly visible and include, amongst others, the following:

- Identifying working area as a construction site;
- Cautioning against relevant construction activities;
- Prohibiting access to construction site;
- Clearly specifying possible detour routes and / or delay periods;
- Possible indications of time frames attached to the construction activities, and;
- Listings of which contractors are working on the site.

Other mitigation measures include:

- Construction vehicles must adhere to the load carrying capacity of road surfaces and adhere to all other prescriptive regulations regarding the use of public roads by construction vehicles.
- ECO to do awareness training with the contractor and labourers and to highlight the traffic related risks before construction commences.
- Where possible, construction traffic that may obstruct traffic flow on the surrounding roads must be scheduled for outside of peak traffic times.
- Ensure appropriate behaviour of operators of construction vehicles.
- If needed, appropriate traffic management measures and/ or points men (traffic marshals) must be utilised to assist vehicles entering/ exiting the site, particularly where vehicles must cross the path of oncoming traffic.

7.2. Site Demarcation

The working areas should be clearly demarcated on site during the pre-construction or construction phases of the development, as appropriate.

7.2.1. Construction Working Area

Prior to the commencement of any land-clearing or construction activities, the outer boundary of the development area must be surveyed and pegged. This demarcation boundary is to ensure that land clearing and construction activities are restricted to only that area strictly required for the proposed development, and to prevent unnecessary disturbance of soil surfaces and vegetation outside of the development footprint.

The outer boundary of the working area should be enclosed with, at least, shade netting, droppers & wire, or similar measures – as is feasible and practical. Access point should be temporarily gated. The fencing should be retained and maintained for the duration of the construction period or up until the conclusion of the rehabilitation phase. If changes to changes are required, such changes can only be applied once the approval of the appointed ECO and Site Engineer has been acquired. Areas to be cleared must be demarcated before any clearing and grubbing commences.

7.2.2. No-Go Areas

Areas beyond the approved working corridor and access corridors must be considered "no-go" areas, to avoid disturbance from expanding beyond the approved footprint. Due to the specialist assessing the site, there were no SCCs. However, before construction can commence, a general sweep of the area is required to make sure no indigenous SCC Fauna and flora are located within the project site (by an appropriately registered specialist/ECO). The construction footprint must be considered temporary no-go areas, until this activity is completed to the satisfaction of the individual responsible therefor.

No-go areas outside the approved development area must be off-limits to all construction workers, vehicles and machinery during all phases of the development. No vegetation may be cleared from within the no-go areas (unless in accordance with an approved alien invasive management plan and under the supervision of the ECO), and no dumping of any material (waste, topsoil, subsoil etc.) may occur in these areas. Construction workers must be informed of the no-go areas, and if necessary appropriate signage can be used to enforce the demarcation. Any interaction with No-Go Areas should be consulted between the Contractor and ECO prior to any actions.

7.2.3. Demarcation of the Site Camp

The area chosen for the site camp and associated facilities must be the minimum area reasonably required to accommodate the site camp facilities, and which will involve the least disturbance to the environment. It is recommended that easily accessible, transformed areas must be used for the site camp. Site selection must be done in consultation with the ECO.

7.3. Site Camp and Associated Facilities

The set up and organisation of the site camp is paramount to ensuring compliance. An environmental file is to be created by the contractor and be situated within the site camp throughout the construction phase and with the applicant thereafter. The environmental file is to include the following;

- A copy of the Environmental Authorisation.

- A copy of the General Authorisation or any other relative permits.
- A copy of the approved EMPr.
- Updated waste slips.
- Disposal slips or cleaning slips (ablution cleaning).
- All EMR's (Environmental Monitoring Reports) and ECO instructions.
- Copies of Environmental induction register/s.
- The Protocol for Chance Palaeontological Findings.
- A Complaints Register.
- Updated method statements.
- Any and all emergency procedure/s applicable to site activities.
- An Incident Register.

The following general management measures pertaining to the set-up, operation and closure of a site camp must be applied where appropriate, reasonable and practicable:

7.3.1. Fencing & Security

The site camp area must be secured to prevent any unauthorised individuals from entering the site camp and possibly getting injured or posing a safety and/or security risk. Adequate signage must be displayed, designating the site office / camp as a restricted area to non-personnel. If required, the site camp and associated areas may be fenced off along the demarcated boundaries of these areas, preferably with 2m high fence and shade netting or similar. A site register is recommended to record any daily visitors and activities, for record keeping purposes.

7.3.2. Fire Fighting Equipment

No less than 2 fire extinguishers must be present in the site camp. The extinguishers must be in a working condition and within their service period. A fire extinguisher must always be present wherever any "hot works" (e.g. welding, grinding etc.) are taking place.
Should the contractor choose to, he/she may designate a smoking area within the site camp, of which the contractor is solely responsible for the management of this activity on site, and any incidents that may occur. It must contain the following features:

- Appropriate signage.
- A barrel/bucket filled to 50% capacity with sand, for disposal of used cigarettes.
- An appropriately weighted lid, that cannot be easily displaced by volatile weather conditions.
- The bin and designated area must be positioned in such a manner that it is not directly affected by heavy winds.
- This bin must be emptied as is necessary and must not be allowed to reach 75% capacity.

In the case of accidental fires, the contractor must (if required/significant) alert the Local Authority's Fire Department as soon as a fire starts prior to the fire becoming uncontrollable.

7.3.3. Waste Storage Area

Sufficient bins for the temporary storage of construction related waste must be provided inside the site camp and/or at the working area and must be located in such a way that they will present as little visual impact to surrounding residents and road users as possible. Sufficient signage and awareness must be created to ensure that these bins are properly used.

7.3.4. Hazardous Substances Storage Area

Fuels, chemicals, lubricants and other hazardous substances must be stored in a demarcated, secured, bunded and clearly sign-posted area within the site camp. Sufficient signage and awareness must be

created to ensure that these bins are properly used. It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. Ensure that when substances are transferred, this is done on an impermeable and/or bunded surface to contain any spillage. Spillage, should it occur, must be disposed of appropriately.

Any accidental release of a hazardous substance during the construction and operational phase of the proposed development, must be reported to the relevant authorities, including the Department of Environmental Affairs and Development Planning's Directorate: Pollution and Chemicals Management, in terms of Section 30(3) of the NEMA.

7.3.5. Potable Water

An adequate supply of potable water must be provided to construction workers at the site camp. It is the Contractors duty to ensure that the labour has adequate access to potable water throughout construction phase. To conserve water, it is recommended that buckets of water are used to clean tools and machinery, rather than running water.

7.3.6. Ablution Facilities

Chemical toilets must be kept at the site camp, on a level surface and secured from blowing over and located in such a way that the toilets will not cause any form of pollution. As per the SANS 10400 (SANS 10400 – Part P; Section 4.11 – Table 5) requirement, one ablution facility for every 8 male workers and 2 ablution facilities for every 8 female workers will be provided.

The ablution facilities must not be linked to the river system/drainage lines in any way. Toilets must be serviced regularly and kept in an orderly state. The contractor must ensure that no spillage occurs when the toilets are cleaned, serviced or moved. The toilet facilities should be emptied on a weekly basis, by an appropriately registered service provider. Proof of this weekly servicing must be obtained and filed in the Environmental File on site. Performing ablutions outside of the provided toilet facilities is strictly prohibited and the ECO would need to regularly inspect the state of the chemical toilets to ensure compliance.

7.3.7. Eating Area & Rest Area

A dedicated area within which construction workers can rest and eat during breaks must be provided within the site camp. Seating, shaded areas and waste bins must be provided.

7.3.8. Vehicle & Equipment Maintenance Yard

All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area (impermeable surface or underlain by a drip tray) to prevent ingress of hydrocarbons into the soil. Where possible, construction vehicles and equipment that require repair must be removed from site and taken to a workshop for servicing. If emergency repairs and/or basic maintenance of construction vehicles or equipment are necessary on site, such repair work must be undertaken within the designated maintenance yard area. Repairs must be conducted on an impermeable surface, and/or a tarpaulin and/or drip trays must be laid down prior to emergency repairs taking place, in order to prevent any fuel, oil, lubricant or other spillages from contaminating the surrounding environment. All spills should they occur, should be immediately cleaned up and treated accordingly.

7.3.9. House-Keeping

The site camp and related site camp facilities must be kept neat and orderly at all times, in order to prevent potential safety risks and to reduce the visual impact of the site during construction.

7.4. Protection of Fauna

Construction workers are to be sensitised to the fact that they may encounter fauna during the construction period. This must be included in the environmental awareness training completed with all site personnel before any construction commences. Environmental Awareness Training must educate labour on conduct in terms of faunal management throughout the construction phase, including but not limited to:

- No person/s may harm, kill, capture or keep any fauna.
- Appropriate access control must be put in place to reduce the risk of animal species gaining access to the development area.
- Where possible, avoid interactions, particularly with fauna that can inflict harm, if such fauna is identified on site contact local SPCA other animal protection and removal services.
- No domestic animals are permitted on the sites.
- Maintain good housekeeping, so that fauna cannot hide amongst waste and material.

If any fauna is encountered by construction workers, the ECO is to be notified. If the ECO is not on site, the site manager is to be informed. Rescued fauna must be released into a nearby area of similar habitat away from any construction. Contact details for animal rescue services and/or snake wrangler, from the local area, should be available on site, in case of an emergency.

Use shade cloth over existing fence line (boundary of working area), to stop animals from wandering onto site should this be required.

7.5. Indigenous Vegetation Clearing and Protection.

Where indigenous vegetation must be cleared for the development, the following measures must be implemented:

- An Independent Environmental Control Officer will oversee compliance with all the prescribed environmental requirements and mitigation measures listed here and will be on site regularly.
- Only the areas required to accommodate the construction and access to the construction site must be cleared/trimmed of vegetation, as long as the vegetation has not been identified as an SCC.
- Vegetation outside of the construction footprint and within any no-go areas must not be cleared, unless permitted in accordance with the alien invasive management plan, and under the supervision of the ECO.
- Land clearing and earthmoving activities should not be undertaken during strong winds or heavy rainfall events, where possible.
- Trees and shrubs that are directly affected by the operations may be felled or cleared but only by the expressed written permission of the ECO, and under the applicable permits obtained in terms of the Nature Conservation Ordinance (19 of 1974, amended 2000) and/or the National Forests Act (Act 84 of 1998, amended 2009), should this be required.
- Stripped vegetation should be temporarily stored during operations and to be used later to stabilise slopes/soils. This excludes alien invasive species.
- Ensure any open spaces/bare areas are kept clear of alien plant species through the adoption of an Alien Invasive Management plan.
- No unpermitted/uncontrolled fires are permitted on site.
- Rehabilitation of vegetation of the site must be done as described in the Rehabilitation Plans.

- To limit adverse impacts to the surrounding environment, the contractor and labourers must take great care if cement is to be mixed on site. Cement is to be mixed on thick plastic sheets or in large buckets that are bunded. Any spillage must be cleaned up immediately. Cement water is also to be contained in the above manner and allowed to dry out and then removed from site. Cement water, which is highly alkaline, poses a definite threat to the soil and seed banks, should the water disperse into surrounding areas.

7.6. Alien Invasive Species Control

Several exotic invasive and other weed species were noted on the site, ranging from a few scattered individuals to dense infestations. The existing infestations and any further spread of these tree species pose a significant negative risk to the environment by causing direct habitat destruction, increasing the risk and intensity of wildfires, and reducing surface and sub-surface water. Alien Invasive Plants require removal according to the Conservation of Agricultural Resources Act 43 of 1983 (CARA) and the National Environmental Management: Biodiversity Act (10 of 2004; NEMBA): Alien and Invasive Species Lists (GN R598 and GN R599 of 2014).

Removal of species should take place throughout the construction, operational, and maintenance phases. The specialist Nick Helme has included an alien management plan that will be appended to this EMPr.

7.7. Topsoil and Subsoil Management

In accordance with theRehabilitation Programme, topsoil must be removed from any area where physical disturbance of the surface will occur, including within the footprint of the development site (working area) and possibly within the site camp, ablution area, vehicle maintenance yard, refuelling area and temporary waste storage area. Topsoil removal and stockpiling must be undertaken only after consultation with the ECO. The following soil management measures must be implemented:

- Topsoil & subsoil that has been excavated must be stockpiled separately, along & adjacent to the excavation pits and must be covered with a suitable cover crop or tarpaulin.
- Excavated topsoil and subsoil must be stockpiled for the duration of the active construction period and utilised for the final landscaping and rehabilitation of disturbed areas on site.
- Excavated subsoil must be stockpiled separately from topsoil.
- The topsoil & subsoil storage area must be located on a level area outside of any surface drainage channels outside the riparian zone, and at a location where it can be protected from disturbance and river flow/floods during construction and where it will not interfere with construction activities.
- Topsoil and subsoil stockpiles must be adequately protected from being blown away or eroded by storm water. If necessary, shade cloth or other suitable measures must be used to stabilise and protect the stockpile from wind/water erosion. Topsoil stockpiles must not be covered with tarpaulin, as this may smother and decrease the virility of topsoil. Stockpiles may not exceed 2 m in height.
- Handling of topsoil must be minimised as much as possible, and the location of the topsoil berm must be chosen carefully to avoid needing to relocate the topsoil berm at a later date.
- Ideally, topsoil is to be handled twice only, once to strip and stockpile, and once to replace, level, shape and scarify.
- Topsoil shall be kept separate from overburden and shall not be used for building or maintenance of roads.

- Topsoil stockpiles must not exceed 1.5 m in height and must not be compacted.
- If soil stockpiles will be stored for an extended period of time, the stockpiles must be kept clear of weeds and alien vegetation growth by regular weeding, (or application of herbicides if agreed with the ECO).
- Soil material that will not be re-utilised on site may be removed from site and taken to an appropriate site for re-use or disposal.
- Note that the topsoil must be the final layer applied to a rehabilitated/ re-landscaped site, after subsoil/ spoil material has been placed and shaped on the site.

7.8. Integrated Waste Management Approach

It is recommended that an integrated waste management system is adopted on site. The system must be based on waste minimisation and must incorporate reduction, recycling, re-use and disposal where appropriate. Separate waste bins/skips that are weather and animal proof must be provided for recyclable waste, general waste and hazardous waste. Recovered builder's rubble & green waste may be stockpiled on the ground within the site camp, or in separate skips until removal. These bins/skips must be emptied, and the waste taken to a registered recycling facility. The receipts from the facility must be kept on file and must be available on request.

The non-recyclable and non-reusable waste (e.g. builder's rubble, etc.) generated on site must be disposed of at a landfill site licensed in terms of the applicable legislation. The receipts from the facility must be kept on file and must be available on request.

Chemical toilets present a risk to the surrounding environment and must be managed accordingly. Chemical toilets must be kept within the site camp (not be linked to the storm water drainage system), on a level surface and secured from blowing over. Chemical toilets must be regularly emptied, by a registered cleaning company and the waste disposed of at an appropriate wastewater disposal/ treatment site. Care must be taken to prevent spillages when moving or servicing chemical toilets.

Hazardous substances such as diesel, oil and detergents will be present on site throughout the construction phase of the proposed development. Hazardous substances pose a greater risk to the surrounding environment than general substances and therefore need to be managed accordingly. A designated storage area within the site camp that is clearly demarcated must be set aside for the storage of hazardous substances and is to be treated as a no-go zone to unauthorised personnel. Appropriate signage, Material Safety Data Sheets (MSDSs), recently serviced fire extinguishers and spill kits should accompany the hazardous substances. Appropriate storage of hazardous substances is important while drip trays should always be utilised when decanting of hazardous substances and when refilling chemical/ fuel storage tanks. If any spills do occur, the solid must be excavated and disposed of as hazardous waste.

Cement and concrete batching will be permitted on site, but may only take place on designated impermeable, bunded surfaces, as agreed with the ECO. Used cement bags should be disposed of as hazardous waste on site.

7.9. Erosion Control and Stormwater Management

Stormwater must be managed in accordance with the Municipal Stormwater Management By-law and based on Sustainable Drainage Systems (SUDS). The SUDS systems attempt to maintain or mimic the natural flow systems as well as prevent the wash-off of urban pollutants to receiving waters. Further to this, the EA holder or appointed contractor must ensure that:

- Where necessary, Stormwater Management Plans must be developed for the site and should include the following:
    - The management of stormwater during construction.
    - The installation of stormwater and erosion control infrastructure.
    - The management of infrastructure after completion of construction.
- Sheet runoff from access roads and the walkways is slowed down by the strategic placement of berms.
- Diversion channels should be constructed ahead of the open cuts, and above emplacement areas and stockpiles to intercept clean runoff and divert it around disturbed areas into the natural drainage system downstream of the site.
- As much indigenous vegetation should be maintained and encouraged to minimise erosion;
- All soil compacted because of construction activities as well as ongoing operational activities falling outside of project footprint areas should be ripped and profiled; and
- To ensure that site is not subjected to excessive erosion and capable of drainage runoff with minimum risk of scour, their slopes should be profiled at a maximum 1:3 gradient.
- Rehabilitation is necessary to control erosion and sedimentation of all eroded areas (where works took place).
- It is importation that the rehabilitation of site is planned and completed in such a way that the runoff water will not cause erosion.
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

The scale and nature of the erosion and stormwater control measures implemented on site must be appropriate to the conditions on site, and sufficient to achieve the desired outcomes (soil preservation, prevention of flooding, stormwater control) to the satisfaction of the ECO and consulting engineer.

The prevention of soil erosion can be initiated by designating specific areas for stockpiling of raw materials with consultation of the ECO. No stockpiling is to occur on or near slopes and all stockpiling areas must be approved by the ECO before stockpiling occurs.

It may be necessary to implement small-scale erosion protection measures at the construction site, to prevent soil erosion. Such measures may include the use of shade netting, geo-fabric, brush-packing or similar barriers in areas susceptible to erosion and along exposed slopes.

Cleared areas and any other area susceptible to erosion should be provided with a suitable cover and stabilised as soon as possible via the implementation of appropriate erosion control measures.

7.10. Excavations and Earthworks

Any major earthworks with bulldozers and heavy machinery must be under constant supervision and operators are to be aware of all the environmental obligations, as there is always the potential to inflict damage to the sensitive areas. Any unnecessary or excessively heavy machinery movement must be kept to a minimum i.e. only what is absolutely necessary. Areas to be excavated must be clearly demarcated. Areas, which have already been excavated and entail fairly significant earthworks, must be similarly demarcated to avoid the spreading of construction activities into more sensitive areas.

All excavated material must be stored on a flat surface away from any drainage line, sloped areas or area susceptible to erosion. The location must be decided in consultation with the ECO. Stored material

must be protected from wind and water erosion, and this may entail covering the material with suitable shade cloth material or similar (if and when necessary). The shade cloth may need to be weighed down in such a manner that any stream flow is directed away from the stockpile, reducing the risk of erosion.

Whenever any excavation is undertaken, the following procedures shall be adhered to:

- Topsoil shall be handled as described in this EMPr.
- Excavations shall take place only within the approved demarcated site.
- Excavations must follow the contour lines where possible.
- Excavations shall be temporarily fenced shade cloth or barrier fencing to obstruct visual impacts and to prevent the harm to animals or unauthorised persons that may fall into excavations.
- The construction site will not be left in any way to deteriorate into an unacceptable state.
- Once excavations have been filled with overburden and coarse natural materials and profiled with acceptable contours (including erosion control measures), the previous stored topsoil shall be returned to its original depth over the area.

7.11. Visual Impact.

The proposed development has the potential to cause a visual impact during the construction and operational periods. To minimise the potential visual impact, all working areas, storage facilities, stockpiles, waste bins, elevated tanks and the site camp should be located in such a way that they will present as little visual impact to surrounding residents and road users as possible. Waste must be managed according to this EMPr. Good housekeeping practices on site must be maintained to ensure the site is kept neat and tidy. The site camp may require visual screening via shade cloth or other suitable material. The use of reflective materials and excessive lighting should be avoided, and construction vehicles must enter and leave the site during working hours (07:30-17:30).

7.12. Noise Management.

Additional noise is expected during the construction period due to construction activities. It is important that a noise complaints register should be opened and that all excavations and earth-moving activities must be restricted to normal construction working hours (7:30 – 17:30) as far as possible. Work on site must be well-planned and should proceed efficiently so as to limit the duration of the disturbance. This is to be done by ensuring that all equipment is in good working condition and fitted with mufflers/exhaust silencers in necessary. Noise levels must comply with the relevant health & safety regulations and SANS codes and should be monitored by the Health & Safety Officer as necessary and appropriate, and all affected parties must be informed of the excessive noise factors. In addition to the beforementioned measures the following must be implemented:

- No constructions activities are permitted between 17:00 and 7:00 unless previously agreed upon between the Contacting team and the Municipality.
- Construction workers are to remain within the designated site boundary at all time.
- Eating areas are to be located away from any residential units/homesteads within proximity to the current working areas.

7.13. Dust Management.

Although the generation of dust is synonymous with construction sites, care needs to be taken to prevent excessive dust from impacting the surrounding environment and community. Majority of the dust causing activities will take place during the construction period. Exposed surfaces, such as stockpiles and cleared areas should be provided with a suitable cover as soon as possible or wetted down. Construction vehicles should maintain low speeds of 20-40km/h and must ensure that tarpaulins

are used to cover any loads transported. Dust levels specified in the National Dust Control Regulations (GN 827 of November 2013) may not be exceeded. i.e. dust fall in residential areas may not exceed 600mg/m²/day, and dust fall rates in non-residential areas may not exceed 1200 600mg/m²/day, measured using reference method ASTM D1739.

A Complaints Register must be available at the site office for inspection by the ECO, in case of complaints, such as those related to dust. This should form a part of your Environmental File.

7.14. Heritage Resources

In the unlikely event that any heritage resources, including evidence of graves, human remains, archaeological material and paleontological material, are uncovered during construction activities, these must be immediately reported to Heritage Western Cape. Burials must not be disturbed or removed until inspected by a professional archaeologist. The following mitigation measures were proposed by the heritage and palaeontological specialists appointed for the proposed development:

- Corner off the identified area, no construction work may commence in that area. The Fossils will be required to be extracted by a registered heritage expert.
- A Chance of Find protocol must be implemented on site throughout the construction phase of the proposed project, within Appendix E of this EMPr

7.15. Site Closure and Rehabilitation

Upon completion of the construction phase, and after each maintenance event, all disturbed areas, including the working area (disturbance corridor), temporary access road, and all areas utilised for the site camp and associated site camp facilities, if applicable, may require rehabilitation as follows:

- On completion of the construction operations, the site camp area must be cleared of all site camp facilities, ablution facilities, fencing, signage, waste and surplus material.
- All areas within the working area and site camp that have become devoid of vegetation or where soils have been compacted due to construction activities must be scarified or ripped to improve filtration and reduce run-off.
- All demarcation fencing, including all droppers, wires, netting and barrier tape must be removed from site and taken to an appropriate site for re-use or disposal.
- Surfaces are to be checked for waste products from activities such as concreting or asphalting and cleared in a manner approved by the ECO. Any soil contaminated with hydrocarbons (oil, fuel, etc) or other hazardous substance must be collected and disposed of as hazardous waste to a licenced disposal facility.
- All construction waste is to be removed from the site and disposed of at an appropriate facility. Burying or burning of waste or rubble on site is strictly prohibited.
- Topsoil that was removed and stockpiled before construction, must be replaced by spreading it evenly over the areas from which it was removed. This topsoil (and the seedbank it contains) will facilitate the re-vegetation of the site.
- If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, the Environmental Control Officer may require that the soil be analysed and any deleterious effects on the soil arising from the activity, be corrected and the area be seeded with a vegetation seed mix to his or her satisfaction. This *must* be done in consultation with the ECO.
- Disturbed areas, especially areas where excavations have taken place, must be shaped as appropriate (original topography must be restored where possible), and covered with a layer of stockpiled topsoil as soon as possible.

- Any topsoil, subsoil or other excavated material that cannot be utilised during site rehabilitation must be removed from the site and disposed of at an appropriate disposal site.
- The disturbed, newly rehabilitated surfaces (particularly steeper slopes and areas recently covered with topsoil) must be protected from wind & water erosion using mulch, brush packing or other appropriate erosion protection measures. Brush-packing/ mulching is done by covering the exposed surface with organic plant material such as branches, plant cuttings and leafy material. Ideally the vegetation removed from site at the start of the construction must be utilised. Brush-packing/ mulching plays a valuable role in erosion control, while also promoting re-vegetation of the site by retaining moisture in the soil, introducing seeds and/or trapping wind-blown seeds and providing organic material (compost) to promote new plant growth.
- Final landscaping and rehabilitation of the site must be done to the satisfaction of the ECO and must adhere to all conditions/ requirements of the Environmental Authorisation.

8. ENVIRONMENTAL IMPACT MANAGEMENT: PLANNING AND DESIGN PHASE

No direct environmental impacts are associated with the planning and design phase. However, poor planning or inappropriate design decisions in this phase may result in environmental impacts arising during subsequent phases of the project.

Planning and design activities must therefore take into account the environmental constraints and opportunities identified during the Environmental Impact Assessment process, in order to avoid or minimise the potential future impacts of the development. Proper planning is also essential to ensure that adequate provision is made to implement the environmental requirements of this EMPr, and to ensure that the development is compliant with additional conditions which may be included in the Environmental Authorisation.

The environmental management objectives (goals) during this phase are to:

- Appoint an Independent Environmental Control Officer.
- Detailed Design, Site Layout Plan
- Legislative compliance

These environmental management objectives, as well as the management actions that must be implemented in order to achieve the desired objective and avoid/minimise potential impacts are discussed in more detail below.

8.1. Objective 1: Appointment of an Environmental Control Officer and Environmental Auditor

***Impact Management Objective:* To appoint a suitably qualified and experienced environmental control officer, environmental auditor.**		
Potential impact to avoid	• Failure to appoint an ECO and Environmental Auditor will result in non-compliance with the requirements of the EMPr.	
Impact Management Outcome	The requirements of the EMPr are implemented and monitored during all phases of the development, which will promote sound environmental management on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
Environmental Auditor & Control Officer • A suitably qualified and experienced Environmental Auditor must be appointed before any activities commence on site. • A suitably qualified and experienced Environmental Control Officer (ECO) must be appointed before any activities commence on site. • The appointed ECO must adhere to the requirements stated in Section 11 of this EMPr. • The appointed ECO must be advised of the construction start date, at least two weeks in advance, prior to the commencement of any construction activities on site, so that the ECO can perform a pre-commencement inspection, ensure any pre-construction conditions of the environmental authorisation are completed, and plan for environmental awareness training of construction workers (see Section 14 for Environmental Awareness Plan and Appendix H for Environmental Awareness Training Booklet).	Western Cape Government's Department of Infrastructure	During design phase
Performance Indicator	• A qualified ECO and Environmental Auditor is appointed prior to the commencement of any construction activities (including pre-construction set-up activities) on site.	

8.2. Objective 2: Detailed Design, Site Layout Plan

Impact Management Objective: ***Compliance with legislative requirements***			
Potential impact to avoid	Substantial deviation from the conceptual layout plan may result in: • Non-compliance with the Environmental Authorisation during construction. • Triggering of additional listed activities not authorised in the Environmental Authorisation. • An increase in the severity of the impacts identified and assessed in the BAR or may result in new impacts not previously assessed and not provided for in the EMPr, resulting in environmental degradation. • Visual disturbance. • Climate change considerations need to be addressed at this stage, and where possible, adaption/mitigation measures found to be feasible must be integrated into the final design/planning during construction, and financial provision must be made where necessary.		
Impact Management Outcome	Development is compliant with the recommendations of the BAR and the EMPr.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
General: • The final detailed design & layout must adhere to the conceptual layout assessed in the BAR process. • The final detailed design & layout must adhere to any conditions of the Environmental Authorisation (EA). • If the final detailed design differs significantly from that assessed during the BAR, the revised layout must be assessed by an ECO and escalated to the Environmental Auditor, who should liaise with the CA regarding an amendment, prior to proceeding. • Climate Change Considerations including adaption, must be integrated into the final design, and mitigation must be integrated into the construction scope of works, where necessary, all financial provisions must be made.		Western Cape Government's Department of Infrastructure The Engineering contractor	During design phase
Performance Indicator	Detailed designs and site layout plans are approved, that adheres to the conditions of the EA and EMPr, prior to the commencement of construction.		

8.3. Objective 3: Legislative compliance

***Impact Management Objective:* Legislative compliance**			
Potential impact to avoid	Commencement of activities without all relevant permits/permissions/licences/approvals including registered servitudes, permits to remove specific vegetation, etc. as well as commencing without implementation of specialist recommendations, including compliance with EMPr pre-construction activities, can result in penalties, time delays and excessive costs. All stemming from poor planning.		
Impact Management Outcome	All permits, permissions, licences, approvals, and specialist input are acquired, and the proposed development is compliant with the respective conditions.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
General • Ensure programme of works is planned accordingly and includes recommended measures where necessary. • Ensure financial allowances are made for the recommended measures, such as rehabilitation, etc. • Ensure all relevant permits/licenses/approvals are in place and are valid prior to commencing with works. These include: o Environmental Authorisation o Servitudes registrations o District Municipality approval for DRE road crossings o Permission from Municipal Roads and Stormwater Department for the temporary closure of municipal roads		Western Cape Government's Department of Infrastructure	During design phase

○ Permission from private landowners for the closure of private access roads during road crossingsA licence from Forestry Western Cape in terms of the National Forests Act (Act 84 of 1998, amended 2009) should any trees in natural forests be required to be cut, disturbed or uprooted. • Ensure that the Contractor has accepted the approved EMPr and Environmental Authorisation (and any other relevant permits/licenses, etc), as a part of their Tender Document, to ensure that they are fully aware of their responsibilities in terms of the implementation of these documents. • Ensure that the Contractor provides method statements for activities intended to be undertaken, and these are checked and approved by the ECO as well as the Engineer. • Inform ECO of planned works ahead, so as to ensure inductions are undertaken timeously. • Involve ECO in selection of site camp location. <u>Programme of Works:</u> Ensure that the construction programme is pre-planned, and all affected landowners are notified of the estimated date, extent and conclusion of works on their property or affecting their access. The removal of trees should only be done in cooler months of the year, when there is less heat- and water stress on the trees. <u>Unplanned/Planned Shutdown:</u> • Should site need to be closed, ensure the following is undertaken: - All waste is removed from site. - All stockpiled soils, etc. is removed from site or is bunded efficiently and covered with tarp, to minimise dispersion. - Ensure all excavations are backfilled, and recommended rehabilitation is commenced at the very least.		

- Ensure heavy machinery is stored safely. - Contact the ECO to undertake an inspection and advise on any appropriate measures that need to be undertaken. • It is important to note that the Environmental Authorisation and approved EMPr is a legal and binding document, therefore regardless of reason for shutdown compliance with these conditions must be met, or the Competent Authority must be informed of the reason and estimated duration of shutdown.		
Performance Indicator	The project does not incur delays, excessive costs and penalties due to unobtained permits and non-compliance with required permits, permissions, licences, and approvals.	

9. ENVIRONMENTAL IMPACT MANAGEMENT: PRE-CONSTRUCTION PHASE

Proper set-up during the pre-construction phase can set the foundation for good environmental management during the active construction phase to follow and can avoid potential impacts from arising at a later date.

The Impact Management Objectives for this phase of the project relate to:

- Pre-Construction ECO and Environmental Site Officer (ESO) Inspection and Due Diligence
- Implement Site Walk-Down, Sweep, and Identify & demarcate No-Go and working areas
- Establish Environmentally Sensitive Site Camp & Site Facilities Establishment of site camp and associated site facilities.

9.1. Objective 1: Pre-Construction ECO and Environmental Site Officer (ESO) Inspection and Due Diligence

It is essential that the appointed ECO and ESO be advised of the intended construction start date before construction activities commence on site, in order for the ECO to conduct an initial site inspection to assess the pre-commencement condition of the site. The ECO can also advise on the appropriate siting and demarcation of the site facilities, and the identification and demarcation of the no-go areas. The ECO may also conduct the first round of environmental awareness training at this stage, if any construction workers/sub-contractors are present on site.

Impact Management Objective: ***Environmental Control Officer and Environmental Site Officer to conduct an inspection prior to the commencement of construction activities on site.***	
Potential impact to avoid	• Failure to appoint ECO or to notify ECO of commencement prior to commencement may result in non-compliance with the EA. • If a pre-commencement ECO inspection is not performed, the Construction Contractor may be held liable for environmental degradation that took place prior to the Contractor commencing work on site.
Impact Management Outcome	• Good environmental management is promoted and enforced by the ECO during the full pre-construction and construction phases. • Site facilities are appropriately located on site. • Construction workers receive environmental awareness training before commencing work on site.
IMPACT MANAGEMENT ACTIONS	

Mitigation measure	Responsible party	Time period
• The appointed ECO must be advised of the construction start date, before any activities commence on site so that the ECO can perform a pre-commencement inspection and plan for environmental awareness training (see Section 14 and Appendix H), of construction workers. • The ECO must ensure all relevant items are in place in terms of Section 7 and 8 of this EMPr, where necessary, and all relevant pre-construction requirements have been complied with in terms of the EA. • Ensure the project timeframe has taken the relevant requirements of the EA and EMPr, into account. • The ECO is to take photographs of the site prior to the establishment of ALL facilities (including the site camp), for record purposes. • The ECO is to ensure that the Environmental File is in place on site, with all the relevant content, and emergency numbers for the relevant authorities are available. • The ECO is to consult with the Contractor regarding relevant dates for environmental inductions (with regard to new labour). • If it is recommended that an ESO is appointed.	Contractor	Start of construction phase
Performance Indicator	A pre-commencement site inspection is conducted by the appointed ECO before construction activities commence on site.	

9.2. Objective 2: Implement A site walk-down, sweep and identify & demarcate No-Go and working areas

Impact Management Objective: ***Implement a site walk-down, sweep of the area and identify & demarcate No-Go and working areas.***	
Potential impact to avoid	• Clearance before the site walk-down and sweep is established and implemented resulting in irrecoverable loss of faunal and avi-faunal species. • Insensitive location of working areas and site facilities may result in environmental impacts during the construction phase. • Failure to accurately demarcate working areas may result in works exceeding the approved assessed footprint, resulting in non-compliance and potential penalties and delays

Impact Management Outcome	Future construction activities will be restricted to within the designated areas & all areas indicated as no-go areas, will be protected from disturbance, i.e., beyond the development footprint or areas not assessed in terms of the site walk-down and sweep, as of yet.

IMPACT MANAGEMENT ACTIONS

Mitigation measure	Responsible party	Time period
<u>General</u> • Involve ECO in selection of site camp location. • Environmental Awareness and Training (EAT) – Ensure all labour are informed and plant operators are aware of risks, issues, dos and don'ts and no-go areas. • Ensure permits/licenses applicable, are obtained prior to commencement of construction works on site. <u>Site walk-down and sweep:</u> • A sweep needs to be implemented in order to ensure minimal impact on faunal and avi-faunal species, conducted by the ECO and the Contractor's ESO. • Written confirmation from the ECO must be issued to the Contractor and construction team (ie. engineers and applicant), notifying them that the completed site walk-down and sweep for the intended phase has been fulfilled. Therefore, the Contractor may proceed with demarcation and construction activities. • No clearance may occur until the site walk-down and sweep is implemented, and removal activities have concluded, for the relevant construction phase. Areas which have not been assessed during the site walk-down (as confirmed by the ECO) must be considered temporary no-go areas until this activity is completed. <u>Terrestrial Faunal and Avi-Faunal Specialist Recommendation:</u>	ECO and Contractor (General) , ESO	Pre-construction phase (prior to arrival of construction equipment, machinery, or workers on site)

• Every effort must be made to save and relocate any mammal, reptile, amphibian, bird, or invertebrate that cannot flee of its own accord, encountered during site preparation. These animals should be relocated to the undeveloped area to the west of the site, but under no circumstances any further away.
 	
<u>Working Corridor</u>
 	
• Ensure the ECO is present and consulted for demarcation.
  o Specialist/ECO must undertake an application to Forestry Western Cape for the removal of identified tree species (if necessary).
• Demarcate/fence off the working area with temporary fencing (e.g. poles and shade cloth) to:
  o contain potential overflow into the surrounding sites;
  o obstruct visual impacts;
• Prevent harm to fauna that may fall into open excavations. The temporary fencing must be retained and maintained on a daily basis for the duration of the construction period.
• Contain disturbance to the demarcated construction area.
• Areas outside the working area must be considered no-go areas.
 	
<u>Landowners;</u>
• Notify landowners of the construction programme to ensure that they are aware that construction activity may bring about delays/obstructions as well as ensuring that they are aware of any risks.
• Ensure clear signage is erected on the access road.
• Ensure that landowners are notified before private access roads are crossed, and this is done in a timely and practical manner in order to ensure access is always available.
 	
<u>Heritage and Palaeontological Sensitivity:</u>
• Report any fossils discovered during excavations. Implement Chance Finds Procedure. (as included as Appendix E).		

Botanical Specialist Recommendation: • The authorised hard surface footprints should be surveyed and pegged out on site prior to any site development, and the outer fenceline of the new development (both east and west of the N7) should also be erected prior to any site development. • No areas of natural or partly natural vegetation should be disturbed outside the pegged out and authorised development footprints. No vehicular activity or dumping of material may take place outside the authorised development footprints. • All woody alien invasive vegetation should be removed from within the fenced off project area, prior to the development of any authorised development footprints. This material should be removed from the site and taken to an approved organic dump. Removal of the alien vegetation must be undertaken by a trained and licensed alien vegetation removal team and must be undertaken using methodology outlined in the Best Practise Guidelines (see Martens et al 2021). • Martens, C., Deacon, G., Ferreira, D., Auret, W., Dorse, C., Stuart, H., Impson, F., Barnes, G. and C. Molteno. 2021. A practical guide to managing invasive alien plants: A concise handbook for land users in the Cape Floral Region. WWF South Africa, Cape Town, South Africa.		
Performance Indicator	Site walk-down and sweep of identified indigenous plant material is implemented before initial site establishment or clearance commences. No-go areas, working areas and areas for site camp facilities have been identified and appropriately demarcated to the satisfaction of the ECO, before construction activities commences on site.	

9.3. Objective 2: Establish Environmentally Sensitive Site Camp & Site Facilities

Impact Management Objective: ***To set up and equip the site camp and associated site facilities in a manner that will promote good environmental management.***		
Potential impact to avoid	• Failure to properly demarcate and set up site facilities may result in disorganised construction activities and unnecessary disturbance to the site. • Failure to provide the necessary site facilities and/or failure to equip these facilities with the necessary equipment/materials may impede good environmental management & compromise ability to respond to emergencies.	
Impact Management Outcome	Site camp facilities do not impact significantly on environment. The equipment required to implement the provisions of the EMPr are provided on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
<u>General</u> • The site camp and associated site facilities must be set-up and managed in accordance with the general environmental management measures specified in Section 6 of this EMPr. • The site camp must be strategically set up in a manner that will promote good environmental management during construction/ demolition, and to respond to potential emergencies (including fires, spillage of hazardous substances etc.) that may arise. • The site camp, storage facilities, stockpiles, waste bins, and any other temporary structures on site must be located in such a way that they will present as little visual impact to surrounding residents and road users as possible. <u>Site Camp Establishment</u> If in an area that contains vegetation, utilise disturbed areas only, and: • Ensure site selected is inspected and approved by ECO. • Utilise disturbed or transformed areas for site camp establishment. • Site camp facilities must be the minimum area reasonably required to accommodate the site camp facilities and must not be allowed to impact areas not within the designated footprint.	Contractor / Department of Infrastructure	Pre-construction phase (prior to start of construction activities)

• Ensure the site camp is positioned on a levelled area and is easily accessible.
• Ensure site camp is fenced off with appropriate fencing and shade cloth, to block out activities within.
• Ensure access to site is at one point, unless two existing points of entry/exit are identified.
• Ensure access onto site is controlled.
• Ensure there is 24hr security.
• Designate specific areas for specific purpose, including storage areas, machinery storage areas, parking areas, waste disposal areas, etc.
• Infographics must be available on site in public areas, including information on safety measures, potential harmful fauna (ie. snakes common to the areas, and emergency contact information, including, but not limited to: Snake catchers, Ambulance; Fire Department; the closest hospital, veterinarian (ie: for anti-venom, etc).
• Must contain a spill-kit.
• Potable chemical toilets:
  o Ensure chemical toilets are positioned on levelled areas and are protected from wind and rain that could result in them blowing over and spilling waste contents.
  o Ensure toilets are positioned at least 32m's from any watercourse.
  o Ensure toilets are rented from a registered company, with whom arrangements should be made for cleaning of these toilets on a weekly basis.
  o Disposal slips/cleaning slips from this company must be obtained following every cleaning and must be filed in the Environmental File.
  o Ensure an adequate quantity of toilets are provided at each working area.
• Hazardous substances including oil/fuel etc. should be:
  o Stored in bunded areas, on hardened/impermeable surfaces, where the barrels/drums/containers are protected from the natural elements.
  o Hazardous substances storage area must be treated as a no-go zone to unauthorised personnel.
  o Appropriate signage indicating what kind hazardous/flammable materials are stored.		

○ Material Safety Data Sheet (MSDSs) must be available. ○ A fire extinguisher and contact details for the fire department and other emergency numbers must be positioned in close proximity. ○ A spill kit must be positioned inside the hazardous substances storage area. ○ May only be decanted/filled on the aforementioned surface or with the use of drip trays. ○ If any spills do occur, the soil must be excavated and disposed of as hazardous waste at an appropriately registered facility. <u>Waste Management:</u> • Designate areas for temporary waste storage, this area should be: ○ Protected from wind/rain displacement. ○ Should be on a levelled surface. • An appropriate number of skips/bins must be made available on site, to accommodate for waste separation of the various types of waste generated. • Waste bins/skips must be weather and animal proof. Ensure weighted covers are positioned on skips/bins, to ensure that animals cannot get into the bins as well as to avoid waste dispersion. • Label bins appropriately. • No waste/excavated soil/ etc. intended to be removed from site may remain on site for more than 90-days. • Ensure that disposal is undertaken when waste has reached 75% capacity of the bin/skip. • The waste must be disposed of at a registered waste disposal facility. The disposal receipts from the facility must be kept in the Environmental File. • Ensure waste receptacles are available where works are being undertaken, this can take the form of black bin bags, etc. however it must: • Be sufficient hold the waste without tearing/spilling. • It must be removed from site on a daily basis and re-established at the start of every day, when works occurs in that area.		

• Request that the foreman responsible for the labour team in a specific area, is responsible for ensuring that this waste receptacle is utilised, removed and established daily. <u>Environmental File</u> • An environmental file is to be created by the contractor and be situated within the site camp throughout the construction phase and with the applicant thereafter. The environmental file is to include the following: o Copies of all approvals, including: Environmental Authorisation, and any other license/permit/approval. o A copy of the approved EMPr o Copies of waste disposal slips o Copies of chemical toilet cleaning/servicing slips o Disposal slips or cleaning slips (ablution cleaning) o All EMR's (Environmental Monitoring Reports) and ECO instructions o Copies of Environmental Induction Register/S o A Complaints Register o Updated method statements o Material Safety Data Sheets for all hazardous substances utilised on site. o Copies of audit reports o Risk Management, Prevention and Emergency Preparedness Plan o An Incident Register o Copy of induction registers. o Copies of purchase orders for rehabilitation material etc.		
Performance Indicator	Appropriate, well organised, and properly equipped site facilities are available on site prior to commencement of construction activities. The location and set up of the facilities don't impact on the natural resources.	

10. ENVIRONMENTAL IMPACT MANAGEMENT: CONSTRUCTION PHASE

A number of potential environmental impacts may arise during the construction phase of the development. These impacts have been identified and assessed during the Environmental Impact Assessment process. Environmental Management objectives and actions that will prevent the identified potential impacts from arising – or where avoidance is not possible, that will minimise and mitigate the impacts – are provided in this section.

The environmental management actions and mitigation measures prescribed in this section must be implemented throughout the construction phase and must be implemented in conjunction with the general management measures specified in Section 6 of this EMPr, as well as any other conditions which may be stated in the Environmental Authorisation. The Environmental Control Officer must monitor and enforce the implementation of the relevant environmental management measures and may provide guidance on the implementation of these environmental management measures as and when required.

The environmental management objectives for the Construction phase are:

- Erosion, Earthworks and Land Clearance
- Minimised loss of vegetation and disruption to ecological processes
- Minimised disturbance and displacement of faunal and floral species of conservation concern Pollution management: Pollution of hydrocarbons due to spills and leaks
- Minimised pollution management: Pollution of hydrocarbons due to spills and leaks
- Minimised visual Impacts (sense of place)
- Creation of Multiple Job opportunities and Capital Expenditure
- Traffic and Access
- Security & vandalism
- Climate change impact

The environmental management actions that must be implemented in order to achieve the desired objectives and avoid/minimise potential impacts are discussed in more detail in the sections below.

10.1. Objective 1: Erosion, Earthworks and Land Clearance

Impact Management Objective: ***To prevent soil loss on site and prevent increased sediment load exiting the site caused by earthworks.***		
Potential impact(s) to avoid	• Alien invasive encroachment. • Erosion from construction-related activities	
Impact Management Outcome	• Stormwater systems are not impacted significantly. • Minimum construction footprint to be adopted to minimise disturbance to the surrounding Fauna and flora in the vicinity of the project.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
General mitigation measures: • Ensure working area is demarcated appropriately. • Ensure the working area is not excised. • Be mindful of rainfall events, and plan construction works during the dry season where possible. • Ensure the programme of works includes rehabilitation after. • Ensure ALL works on site, remain within the working area (this includes stockpiling, if necessary, on site).	Contractor	Construction phase

Stockpiling: • Ensure stockpiles do not exceed 2m's in height. • Prohibit stockpiling of material close to slopes. • Ensure stockpiles are covered with shade cloth to avoid loss of material, where necessary. • Separate topsoil and subsoil during excavations. • Remove alien invasives/weeds established on stockpiled soils before re-instatement. • Continue with weed management throughout construction, in line with the EMPr. **Excavations:** • Ensure excavations are undertaken as per specifications. • Ensure that excavations are not left open overnight. If it is necessary to do so, the working corridor demarcation must be checked by the safety officer to ensure that there is no potential for encroachment by fauna or people. • Integrate shoring measures if pit walls are collapsing. **Exposed surfaces:** • Implement weed management measures as detailed in the EMPr. • After backfilling an area, immediately commence with rehabilitation, as detailed in the EMPr, and continue with weed management. • Ensure dust creation is controlled, as detailed in the EMPr. • No surface should be left exposed for extended periods of time. **Erosion Management:** • Suitable measures must be implemented in areas that are susceptible to erosion. Areas must be rehabilitated, and a suitable cover crop planted once construction is completed. • If natural vegetation re-establishment does not occur, a suitable grass must be applied.		

• Be mindful of weather conditions that may cause runoff. • Utilize silt fences, if necessary, at demarcated working corridor fence line, to capture runoff. **Soil Contamination:** • Ensure all machinery utilizes drip trays. • Ensure all machinery is maintained prior to allowing them to be utilized on site. • Utilize spill-kit for contaminated soil and dispose of at a registered site If cement is to be mixed, ensure this is done on a bunded impermeable surface, and transferred so that there is no interaction with natural ground. • No contaminated soil may be utilized during backfilling. **Waste Management:** • Utilize waste receptacles on site. • Do not litter on site. • Remove waste receptacles positioned outside of site camp, at the end of every day. • Do not allow food wrappers or food items to build up in any waste receptacles as this will attract scavenging fauna, and other pests. **Stormwater management:** • Stormwater Management Plans must be developed for the site and should include the following: ➢ The management of stormwater during construction. ➢ The installation of stormwater and erosion control infrastructure. The management of infrastructure after the completion of construction. ➢ Diversion channels should be constructed ahead of the open cuts, and above emplacement areas and stockpiles to intercept clean runoff and divert it around disturbed areas into the		

natural drainage system downstream of the site. Rehabilitation is necessary to control erosion and sedimentation of all eroded areas (where work will take place). ➢ Visual inspections will be done regularly concerning the stability of water control structure erosion and siltation. **Soil Aspects** • Sufficient topsoil must be stored for later use during decommissioning, particularly from outcrop areas. • Topsoil shall be removed from all areas where physical disturbance of the surface will occur prior to commencement of any operations. • The removed topsoil shall be stored on high ground • Topsoil shall be kept separate from overburden and shall not be used for building or maintenance of road. The stockpiled topsoil shall be protected from being blown away or being eroded. The application of a suitable grass seed/runner mix will facilitate this and reduce the minimise weeds. **Rehabilitation of Processing and Excavation Areas** • On completion of construction, the surface of the processing areas especially if compacted due to hauling and dumping operations shall be scarified to a depth of at least 200 mm and graded to an even surface condition and the previously stored topsoil will be returned to its original depth over the area • The area shall be fertilised, if necessary, to allow vegetation to establish rapidly. The site shall be seeded with suitable grasses and local indigenous seed mix. • Waste (non-biodegradable refuse) will not be permitted to be deposited in the excavations. • If a reasonable assessment indicates that the reestablishment of vegetation is unacceptably slow, the ECO may require that the soil be analysed and any deleterious effects on the soil		

arising from the activity be corrected and the area be seeded with a vegetation seed mix to his or her satisfaction. • Final rehabilitation must comply with the requirements mentioned in the Rehabilitation Plan. **Monitoring:** • Bush clearing • Ensure working plant has no oil or hydraulic leaks • Check the delineated footprint area not exceeded • Regular checks on trenches for trapped animals and possible drowning risks. Regular demarcation tape/ controlled fencing.		
Performance Indicator	The terrestrial environment is not significantly impacted as a result of soil erosion, and alien vegetation management.	

10.2. Objective 2: Flora and Faunal Habitat loss and degradation

***Impact Management Objective:* Reduce Habitat loss and degradation**			
Potential impact(s) to avoid	Impacts to terrestrial Biodiversity • Slight impact on the functionality of the biodiversity network. • Clearing of fallow land. • Increased opportunity for alien infestation.		
Impact Management Outcome	Impacts on terrestrial biodiversity are limited.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period

General: • The removal of protected trees should only be done in cooler months of the year, when there is less heat- and water stress on the trees. Clearance of vegetation: • Blanket clearing of vegetation must be limited to the development footprint, and the area to be cleared must be demarcated before any clearing commences. • No clearing outside of footprint to take place. • Should the proposed roadworks require the clearance of indigenous succulent vegetation and/or plant SCCs, respective permits will be required beforehand AND measures must be implemented to minimise such clearing. Alien Invasive Vegetation: • Alien species must be removed from the site as per the National Environmental Management: Biodiversity Act (No. 10 of 2004) requirements. • A suitable weed management strategy must be implemented in the construction phase and carried through the operational phase. • The Contractor is responsible for the removal of alien species within all areas disturbed during construction activities. Disturbed areas include (but are not limited to) access roads, construction camps, site areas and temporary storage areas. • All alien plant material (including brushwood and seeds) should be removed from site and disposed of at a registered waste disposal site. Should brushwood be utilised for soil stabilisation or mulching, it must be seed free. • After clearing is completed, an appropriate cover crop may be required, should natural re-establishment of grasses not take place in a timely manner.	Contractor	Construction phase

• The Applicant has stated that rehabilitation of areas outside of the construction footprint falls outside of their mandate, however, the requirement for alien vegetation removal on the larger portions of land will be discussed with the City of Cape Town, the owners of the land. <u>Fires</u> • The Contractor must ensure that an emergency preparedness plan is in place in order to fight accidental fires or veld fires, should they occur. The adjacent landowners/users/managers should also be informed or otherwise involved. • Enclosed areas for food preparation should be provided and the Contractor must strictly prohibit the use of open fires for cooking and heating purposes. • The use of branches of trees and shrubs for fire-making must be strictly prohibited. • The Contractor should take all reasonable and active steps to avoid increasing the risk of fire through their activities on-site. No fires may be lit except at places approved by the ECO. • The Contractor must ensure that the basic fire-fighting equipment is to the satisfaction of the Local Emergency Services. • The Contractor must supply all , site offices, kitchen areas, workshop areas, materials, stores and any other relevant areas with tested and approved fire-fighting equipment. • Fires and "hot work" must be restricted to demarcated areas. • The Contractor must take precautions when working with welding or grinding equipment near potential sources of combustion. Such precautions include having a suitable, tested and approved fire extinguisher immediately at hand and the use of welding curtains. **Botanical specialist mitigation:**		

• The authorised hard surface footprints should be surveyed and pegged out on site prior to any site development, and the outer fenceline of the new development (both east and west of the N7) should also be erected prior to any site development. • No areas of natural or partly natural vegetation should be disturbed outside the pegged out and authorised development footprints. No vehicular activity or dumping of material may take place outside the authorised development footprints. • All woody alien invasive vegetation should be removed from within the fenced off project area, prior to the development of any authorised development footprints. This material should be removed from site and taken to an approved organic dump. Removal of the alien vegetation must be undertaken by a trained and licensed alien vegetation removal team and must be undertaken using methodology outlined in the Best Practise Guidelines (see Martens et al 2021). **Terrestrial Faunal and Avi-faunal mitigation:** • Every effort should be made to save and relocate any mammal, reptile, amphibian, bird, or invertebrate that cannot flee of its own accord, encountered during site preparation. These animals should be relocated to the undeveloped area to the west of the site, but under no circumstances any further away. • It is further recommended that the alien and invasive vegetation in the area surrounding this Cape Flats Sand Fynbos patch be removed to allow for the rehabilitation of this area.		
Performance Indicator	Construction team limit disturbance to the surrounding vegetation.	

10.3. Objective 3: Pollution management: Pollution by hydrocarbons due to spills and leaks

Impact Management Objective: ***Reduce the impacts caused by land disturbance and impacts on the faunal habitat and faunal species of conservation concern***	
Potential impact(s) to avoid	• Should hydrocarbon spills occur on site, there is a potential that such spills can contaminate, and pollute the ground.

Impact Management Outcome	No spills and leaks on site, no contamination to ground and groundwater bodies.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
General: **General Pollution Management:** • No pollution of surface water or ground water resources may occur due to any activity on the site. • No storm water runoff containing waste, or water containing waste emanating from construction activities may be discharged into the environment. • Polluted stormwater must be contained on the site. **General Waste Management:** • Waste must be placed in the appropriate waste bins/skips/ stockpiles. **Pollution Management – hydrocarbons (oil, fuel etc.)** • Vehicles and machinery must be in good working order and must be regularly inspected for leaks. • If a vehicle or machinery is leaking pollutants it must, as soon as possible, be taken to an appropriate location for repair. The ECO has the authority to request that any vehicle or piece of equipment that is contaminating the environment be removed from the site until it has been satisfactorily repaired. • Repairs to vehicles/ machinery may take place on site, within a designated maintenance area at the site camp. Drip trays, tarpaulin or other impermeable layer must be laid down prior to undertaking repairs. • Refuelling of vehicles/ machinery may only take place at the site camp or vehicle maintenance yard. Where refuelling must occur, drip trays should be utilised to catch potential spills/ drips.	Contractor	Construction phase

• Drip trays must be utilised during decanting of hazardous substances and when refilling chemical/ fuel storage tanks. • Drip trays must be placed under generators (if used on site) water pumps and any other machinery on site that utilises fuel/ lubricant, or where there is risk of leakage/spillage. • Where feasible, fuel tanks should be elevated so that leaks are easily detected. • A spill kit to neutralise/treat spills of fuel/ oil/ lubricants must be available on site, and workers must be educated on how to utilise the spill kit. • Soil contaminated by hazardous substances must be excavated and disposed of as hazardous waste.		
Performance Indicator	No spills and or leaks detected, no contamination to the ground and groundwater bodies.	

10.4. Objective 4: General Nuisance: Noise, Dust, light and general housekeeping

Impact Management Objective: ***To prevent the site from presenting an unnecessary visual impact to the surrounding public.***	
Potential impact(s) to avoid	• Based on the dry nature of the receiving environment, there is an increased risk of dust pollution impairing the visibility of the area directly within vicinity to the proposed development site. • Should noise not be managed in a sensitive manner on site, complaints may be received by the surrounding land occupiers. • General pollution will occur as a result of a mal-managed site.
Impact Management Outcome	• No poor visibility due to the dispersal of dust • No complaints received from surrounding land occupiers due to excessive construction noises. • Disturbance due to noise and vibration to faunal and avi-faunal animal species within the surrounding areas of the proposed development.

IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
General: **Dust Mitigation:** • Land clearing and earthmoving activities should not be undertaken during strong winds, where possible. • Cleared areas should be provided with a suitable cover as soon as possible, and not left exposed for extended periods of time. • Stockpiles of topsoil, spoil material and other material that may generate dust must be protected from wind erosion (e.g. covered with netting, tarpaulin or other appropriate measures. Note that topsoil should not be covered with tarpaulin as this may kill the seedbank). • The location of stockpiles must take into account the prevailing wind direction, and should be situated so as to have the least possible dust impact to surrounding residents, road-users and other land-users. • Speed limits must be enforced in all areas, including public roads and private property to limit the levels of dust pollution. • The speed limit should be set at 20-40km/h. • Dust must be suppressed on access roads and the construction site during dry periods by the regular application of portable water or a biodegradable soil stabilisation agent. Water used for this purpose must be used in quantities that will not result in the generation of excessive run off. • Dust suppression measures such as the wetting down of sand heaps with non-potable water as well as exposed areas around the site must be implemented especially on windy days. • If dust appears to be a continuous problem the option of using shade cloth to cover open areas may be necessary or the erecting of shade netting above the fenced off are may need to be explored.	Contractor	Construction phase

• All vehicles transporting sand need to have tarpaulins covering their loads which will assist in any windblown sand occurring off the trucks. • Work on site must be well-planned and should proceed efficiently so as to minimise the handling of dust generating material. • Dust levels specified in the National Dust Control Regulations (GN 827 of November 2013) may not be exceeded. i.e. dust fall in residential areas may not exceed 600mg/m2/day, measured using reference method ASTM D1739; • A Complaints Register must be available at the site office for inspection by the ECO of dust complaints that may have been received. **Noise Mitigation**: • A noise complaints register will be opened. • Excavations and earth-moving activities must be restricted to normal construction working hours (7:30 – 17:30) as far as possible. • Work on site must be well-planned and should proceed efficiently so as to limit the duration of the disturbance. • Vehicles and equipment must be kept in good working condition. • Machinery and equipment should be fitted with mufflers/ exhaust silencers. • No unnecessary disturbances should be allowed to emanate from the construction site. • Workers should be educated on how to control noise-generating activities that have the potential to become disturbances, particularly over an extended period of time. • Noise levels must comply with the relevant health & safety regulations and SANS codes and should be monitored by the Health & Safety Officer as necessary and appropriate. • Affected parties must be informed of the excessive noise factors. • The noise management and monitoring measures prescribed in the EMPr must be adhered to. **Lights:**		

• Lights must be positioned in such a way so as to not shine directly ahead onto the road during nighttime hours (i.e. must be positioned facing downward). • Where practically possible, low intensity lighting must be used for areas which requires to be illuminated. **General housekeeping:** • A clean site policy must be adopted at all times during the construction phase. • Where possible, storage and disposal of waste must take place in a sustainable manner, where clearly marked recycle bins must be provided to workers at the site camp. • Where possible, waste bins must be placed in strategic areas on site so as to limit the amount of waste scattered (due to wind dispersal) on site. • Regular toolbox talks must be held with the construction crew in order to reiterate the importance of maintaining a clean site. • Construction rubble (such as cement bags) must be discarded promptly. • An adequate amount of waste skips must be placed on site. • Waste skips must not be allowed to overflow. • Waste skips must be closed. • Waste skips must be cleared on a weekly basis or as necessary and the waste slips must be provided to the ECO for record-keeping purposes.		
Performance Indicator	• Good "housekeeping" is evident on site. • The site does not pose a visual or noise impact to the surrounding community.	

10.5. Objective 5: Creation of Multiple Job opportunities and Capital Expenditure

<u>Impact Management Objective:</u> To create employment opportunities with potential for skills transfer, for members of the local community.

Potential impact(s) to be promoted.	• A number of temporary job opportunities for skilled and unskilled labour will be created during the construction phase of the development. • Potential transfer of skills from more experienced workers to less experienced workers. • Increase in business for local businesses within the construction industry.		
Impact Management Outcome	Social benefits from the employment opportunities created during the construction phase.		
IMPACT MANAGEMENT ACTIONS			
Promotion measure		Responsible party	Time period
• Positive, therefore no mitigation necessary. • It should be noted that this impact will benefit the local community and address the issue of unemployment within the Western Cape, and South Africa, particularly for unskilled labourers, although temporary. • The applicant is recommended to source local labour, contractors and sub-contractors, as well as utilise local materials and suppliers.		Department of Infrastructure / Contractor	Construction phase
Performance Indicator	A substantial proportion of the construction team is from the local community, with preference given to historically disadvantaged individuals and, where appropriate, unskilled labourers. Skills transfer from experienced to less experienced workers is actively encouraged on site.		

10.6. Objective 6: Road Safety: Traffic Impacts and Road Safety during the construction Phase

<u>Impact Management Objective:</u> To ensure the continued functioning of road network and road safety during construction.

Potential impact(s) to avoid	• Potential road accidents due to construction related activties. • Increased traffic volumes due to the proposed construction activities.	
Impact Management Outcome	The functioning of the surrounding road network remains efficient and the state of the infrastructure is not hampered.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
General: • Proper signage must be used and signage must align with the National Road Traffic Act (Act No. 93 of 1996). • Adequate signage, that is both informative and cautionary to passing traffic (motorists and pedestrians), warning them of the construction activities must be suitably located in the area where the construction is occurring and must be easily visible by all road users. Signage needs to be clearly visible and needs to include, among others, the following: o Identifying working area as a construction site; o Cautioning against relevant construction activities; o Prohibiting access to construction site; o Clearly specifying possible detour routes and/or delay periods; o Possible indications of time frames attached to the construction activities, and; o Details of responsible contractors and engineers are working on the site. • Construction activities will not be planned over the December/January high-season (i.e. between 15 December and 6 January) as well as the Easter holidays, unless authorised. • The procedures outlined in the Communication Plan of the Department of Infrastructure (the Applicant) must be implemented for the proposed project.	Contractor	Construction phase

• Drivers of delivery vehicles must always adhere to the traffic speed and rules of the road. This must strictly implemented on site and must be further encouraged beyond the site boundaries. • Encourage use of public/staff transportation. Compliance to permissible heavy vehicle dimensions, permissible axle mass load on vehicles (no overloading).		
Performance Indicator	• The surrounding road networks infrastructure remains in its current state. • Limited congestion and traffic.	

10.7. Objective 7: Security and Vandalism

<u>Impact Management Objective:</u> To prevent the site from presenting an unnecessary visual impact to the surrounding public.		
Potential impact(s) to avoid	• Materials positioned on site overnight may attract people with nefarious intentions. • Opportunities for criminal activities. • Damage to or loss of resources.	
Impact Management Outcome	The development remains unvandalized and safe.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
<u>General</u> • Ensure access to site is controlled and restricted. • A register must be kept of all vehicles and personnel entering the site. • At night, ensure that materials are covered/obstructed from view.	Contractor	Construction phase

•		
Performance Indicator	• Good "housekeeping" is evident on site. • The site does not pose a safety impact to surrounding community.	

10.8. Objective 8 : Climate change impacts

Impact Management Objective: ***Ensure all adaption and mitigation measures are integrated and are in good order.***		
Potential impact(s) to be avoided.	• Strain on services, as temperatures increase.Strain on water resources. • The need to capture and store rainwater during periods of rainfall, will become a priority. • Will impact negatively on groundwater capacity and availability. • Fires can be started by negligent labour activity. Which in turn can affect private properties, homes, and livelihoods (farms), etc. • Based on the variety of vegetation intended to be traversed by this proposal, drier periods may see fire hazards occurring beyond the control of the contractor or farmers, which can put lives and infrastructure at risk. • Potential for the storm event to damage infrastructure.	
Impact Management Outcome	Low climate impact as a result of the construction activities	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
General: • Implement all adaption and mitigation measures found to be feasible and reasonable. • Monitor efficiency of all adaption and mitigation measures, during operational phase.	Contractor	Operational phase

Performance Indicator	Local climate remains unchanged as a result of development – no occurrence of field fires, no additional strain on water resources.

11. ENVIRONMENTAL IMPACT MANAGEMENT: POST CONSTRUCTION REHABILITATION PHASE & OPERATIONAL PHASE

After all construction activities have ceased, the sites must be cleared of all construction related equipment, materials, facilities and waste. In addition, all disturbed surfaces – including disturbed areas around the structures and all areas utilised for site facilities – must be stabilised, rehabilitated and provided with a suitable cover. All temporary access roads constructed must be rehabilitated and access must be restricted from the public.

The environmental management objectives for this phase are:

- Botanical Resources – terrestrial Biodiversity, Alien invasive species clearance and rehabilitation.
- Nuisance and pollution management: Dust, Noise and Visual Impacts.
- Groundwater Impact.
- Provision of safer roadway and economic development

11.1. Objective 1: Botanical Resources – Terrestrial Biodiversity, Alien Invasive Species Clearance and Rehabilitation

***Impact Management Objective:* To rehabilitate all areas disturbed by construction activities, if not already transformed, in an environmentally compliant manner.**		
Potential impact(s) to avoid	• The natural vegetation of the site is fynbos, which is a fire-driven ecosystem, and fire-return intervals in is non-existent. In small habitat parches that are invaded by IAPs, edge effects are exacerbated, and natural vegetation inevitably disappears. • The long-term absence of fire has also meant that the indigenous seedbank has not had optimal conditions to germinate for a long time (>20yrs).	
Impact Management Outcome	• Limit Infestation by alien invasive species during the operational phase of the proposed development. • Minimise the effects of edge effects are seen around the site following the conclusion of the construction works.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• Regular effort must be made to keep the site clear of all IAPs, and this is also a requirement by law. • Dumping of garden refuse or leaving stacks of cleared IAP slash in natural and near-natural vegetation is not allowed. Dumping may only occur in designated areas.	Contractor / Department of Infrastructure	Construction phase – Post-Construction

• General cleanliness and order must be maintained on the site to avoid accidental impacts to the environment. Ensure that there are sufficient bins available on the site, both inside the offices and outside. • The Applicant has stated that rehabilitation of areas outside of the construction footprint falls outside of their mandate, however, the requirement for alien vegetation removal on the larger portions of land will be discussed with the City of Cape Town, the owners of the land. <u>The Botanical Specialist Recommendations:</u> • Implement an ongoing programme for the removal of woody alien invasive vegetation using the methods outlined in Martens et al. (2021) (Included with Appendix G – Alien Management) • Regularly assess the progress of rehabilitation efforts.		
Performance Indicator	No fires. No alien invasive vegetation.	

11.2. Objective 2: Nuisance and pollution management: Dust, Noise and Visual Impacts

Impact Management Objective: Limit light, vibration and noise		
Potential impact(s) to be avoided	• Should the site not be properly managed, in terms of dust, noise and visual aspects, complaints may be brought forward to the Municipality which could lead to the management team being reprimanded.	
Impact Management Outcome	• Noise and vibration can disturb the surrounding environment and the Faunal and Avi-Faunal Species within the surrounding environment.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
Visual impacts: • A clean site policy must be implemented throughout the site, with waste bins made available across the site.	Developer / Department of Infrastructure	Operational phase

• A recycling regime (where was is separated into Organic Waste, Plastics and Paper waste, and other waste) must be available at the canteen area. • A complaints register must be always kept on site. • All aspects of the facilities must be kept in a clean and tidy manner.		
Performance Indicator	• No sensory complaints, such as noise complaints and limited visibility due to dust complaints.	

11.3. Objective 3: Groundwater Impact

Impact Management Objective: ***Provision of upgraded services and infrastructure***		
Potential impact(s) to be avoid.	• Contaminated groundwater as a result of on-site activity.	
Impact Management Outcome	• Should pollutants be allowed to enter into the groundwater during the operation phase of the proposed development, this could potentially impact upon the quality of the water further downstream.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
General • A spill kit must be available on site at all times. • Employees must be trained in the proper procedures to follow in the event of a spill/leak incident occurring on site. • All incidents must be reported to the management team. • Emergency response plan must be available on site at all times, clearly stipulating the emergency procedures to be followed in the event of a spillage/leak of the tank farm infrastructure. • Contingency plans must be compiled for possible spillages of dangerous goods and include details for decontamination and process to be followed.	Developer / Department of Infrastructure	Operational phase

Performance Indicator	No pollution and contaminated waterbodies.

11.4. Objective 4: Provision of safer roadway and economic development

***Impact Management Objective:* Provision of new and upgraded services and better infrastructure**		
Potential impact(s) to be encouraged	A safer and more efficient road system designed to support the upgraded road network and cutting-edge weigh-in-motion technology, ensuring compliance with modern standards. This infrastructure will not only enhance economic mobility but also drive job creation through the development of the new weighbridge facility.	
Impact Management Outcome	• Supports efficient freight movement by reducing illegal overloading, leading to fewer road repairs and disruptions. • Enhances infrastructure lifespan, lowering long-term maintenance costs for the government. • Promotes compliance and fair competition in the transport sector by enforcing load regulations. • Creates job opportunities during both construction and operational phases. • Stimulates local economy through increased demand for goods, services, and logistics support. • Encourages investment in transport-related industries due to improved infrastructure and regulation.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
Possible enhancement measures: • The relocation of the N7 weighbridge in conjunction with the newly developed Van Schoorsdrift Diamond Interchange enables seamless integration with the regional road network. The design allows for smooth entry and exit of heavy vehicles, reducing disruptions to general traffic. Dedicated acceleration and deceleration lanes, as well as split access for northbound and southbound directions, will help manage traffic volumes more effectively and reduce congestion along the N7 corridor. • The relocated weighbridge includes several safety-focused design elements. Improved visibility and directional signage from the interchange will guide freight vehicles safely into the facility. Controlled access points reduce collision risk, and upgraded lighting ensures 24-hour	Developer / Department of Infrastructure	Operational phase

operational safety. Additional features such as surveillance systems and improved stormwater management will contribute to a safer, more resilient operating environment. • To increase throughput and reduce queuing, the weighbridge will incorporate weigh-in-motion (WIM) technology and smart scheduling systems. These allow vehicles to be pre-weighed while in motion, improving overall flow. The facility will be capable of dual-directional vehicle processing, further enhancing capacity. Integration with national traffic and enforcement databases will ensure real-time data sharing, enabling proactive regulation and vehicle tracking. • The new weighbridge location supports long-term regional freight and transport planning objectives. Aligning with the Western Cape's logistics framework, it helps strengthen the strategic role of the N7 corridor. The selected site avoids environmentally sensitive areas, ensuring a reduced ecological footprint. Additionally, the relocation contributes to reduced road degradation by enforcing overload control, thus lowering long-term maintenance costs for the N7.		
Performance Indicator	• Limited congestion on the N7 and better flow of measurable reduction in overloaded vehicles and road accidents, alongside improved freight efficiency and regional economic activity.	

12. MONITORING COMPLIANCE

This EMPr, once approved by the competent authority (DEA&DP), must be seen as binding to the Holder, and any person acting on the Holder's behalf, including but not limited to agents, employees, associates, contractors and service providers.

The Holder and all other persons who may be directly involved in the development are also bound by their general Duty of Care, as stated in Section 28 of the National Environmental Management Act, 1998:

> ***Duty of Care:***
> *"Every person who causes, has caused, or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm cannot reasonably be avoided or stopped, to minimize and rectify such pollution or degradation of the environment"*

12.1. Environmental Authorisation (EA) Holder / Proponent

It is the EA Holders responsibility to ensure that all agents/contractors/subconsultants appointed to provide services to establish the proposed development, are fully aware of the EMPr, Environmental Authorisation and any other relevant licenses/permits, which must be considered prior to actioning any activity on site. The EA Holder may choose to hold the Contractor responsible for any fines incurred as a result of non-compliant activities during implementation, however this must be done through the agent and by legal procedure. The EA Holder must ensure that:

- Financial allowances are incorporated into the Bill of Quantities, to accommodate for the requirements of the licenses and EMPr.
- An appropriately experienced/qualified Environmental Control Officer (ECO) is appointed to monitor compliance, prior to commencement of site establishment activities.
- An appropriately experienced/qualified Environmental Auditor is appointed to audit compliance, prior to commencement of site establishment activities.

12.2. Contractor

It is the Contractors responsibility to be aware of the requirements of the EMPr, Environmental Authorisation and any other relevant permits/licences and ensure that all labour, appointed sub-contractors/consultants are also made aware of these documents. The Contractor is required to ensure that as per EMPr, EA conditions, and other permits or licences:

- Time allowances/considerations are given to accommodate all relevant activities, when compiling the project programme of works.
- Financial allowances are made to meet all relevant requirements.
- All activities are implemented in an environmentally conscience manner, in line with the EMPr.
- Produce method statements for approval by the ECO and Site Engineer, prior to implementing activities.

12.2.1. Construction Phase Record Keeping

A copy of the approved EMPr, the Environmental Authorisation and any relevant construction method statements must be kept on site at all times during pre-construction, construction and rehabilitation activities. The ECO Reports must be retained by the Holder for a period of at least 5 years, and must be provided to the Competent Authority upon request.

The set up and organisation of the site camp is paramount to ensuring compliance. An environmental file is to be created by the contractor and be situated within the site camp throughout the construction phase and with the applicant thereafter. The environmental file is to include the following;

- A copy of the Environmental Authorisation
- A copy of General Authorisation or any other relative permits
- A copy of the approved EMPr
- Updated Waste slips
- Disposal slips or cleaning slips (ablution cleaning)
- All EMR's (Environmental Monitoring Reports) and ECO instructions
- Copies of Environmental induction register/s
- The Protocol for chance Palaeontological Findings
- A complaints register
- Updated method statements
- Any and all emergency procedure/s applicable to site activities
- An Incident Register

12.2.2. Method Statements

The Competent Authority and/or the ECO may require the Holder or Construction Contractor to submit Method Statements for one or more construction-related activity, or any aspect of the management of the site, before the activity is undertaken or during the performance of the activity, if the activity is causing or may cause significant environmental damage, or pose a health and safety risk.

Method Statements need not be complex and lengthy, but must clearly state **how**, **when** and **where** the activity concerned will be undertaken, and must specify **who** will be responsible for undertaking each component of that activity. Method Statements must be prepared by the Construction Contractor and submitted to the ECO for approval before undertaking the activity concerned.

The ECO and / or Competent Authority have the authority to request method statements for activities, including but not limited to:

- Establishment of site camp and stockpile area.
- Cement/ concrete batching, disposal and emergency contingencies.
- Topsoil and sub-soil storage/ stockpiling.
- Storage of fuels and hazardous chemicals and emergency contingencies.
- Waste management system.
- Storm water management and control.
- Alien invasive plant species management.
- Fire Control & Fire Emergency Plan.
- Emergency preparedness plan / emergency response procedure.
- Post-construction rehabilitation.

The ECO has the authority to prevent activities from being undertaken until such time as a satisfactory Method Statement has been submitted to the ECO and approved by the ECO.

12.3. ECO Monitoring

The appointed ECO is responsible for undertaking regular site visits to monitor and report on the implementation of the EMPr and adherence to the conditions of the Environmental Authorisation during the pre-construction, construction and post-construction rehabilitation phases. The ECO is not required to monitor the site during the operational (maintenance) phase of the development.

- Frequency of ECO visits
- The ECO must conduct **monthly** site visits during the construction phase, in addition to the start-up and closure inspections.
- Further monitoring must continue on a monthly bases following the practical completion of the proposed works, so as to ensure the success of all rehabilitation measures implemented.
- The ECO has the discretion to undertake additional visits if he / she feels this is justified due to the actions of the contractors, and to make *ad hoc* visits in order to ensure compliance.

- Monitoring Reports:
    - Must be produced monthly and submitted to the Competent Authority, Engineer, Proponent and Contractor.

- **ECO Inspections - Photographic Records**

The condition of the surrounding natural environment must be monitored regularly in order to ensure that construction and management activities are not impacting negatively on the condition of the landscape and any sensitive ecosystems. The most effective way to achieve this is by means of a detailed photographic record. In this way, a record of any shift in ecosystem condition can be maintained and potential impacts be detected at an early stage. Where necessary, the entire working area must be well documented and photographed.

- **ECO Inspections - Written Records**

The following record-keeping during the pre-construction, construction and rehabilitation phases of the development is recommended:

- The ECO must complete an ECO Checklist after each ECO site visit.
- The ECO must compile an ECO monitoring report and submit this to the Holder, the Contractor and the Competent Authority (the latter only if required by the Competent Authority). The monthly reports must be a summary of the ECO inspections from the preceding month, and must highlight the key concerns/ issues on site, instances of non-compliance with the EA and EMPr, all instructions issued to the contractor, actions taken and aspects that still require attention.
- All ECO reports and ECO instructions must be retained on file at least for the duration of the construction period (retaining reports for a period of at least 5 years is recommended, in the event that the Competent Authority must request information).
- A record (minutes) of construction site meetings, liaison site meetings between the ECO and resident engineer or contractor, monitoring reports, ECO instructions and ECO observations must be clearly documented and filed on a master file off-site for safe keeping.
- It is recommended that a site register (incident register) be kept on site at the site office for the recording of any environmental incidents (e.g. fires, spills etc.), observations which are contrary to the stipulations within the EMPr and any other contravention deemed necessary for the attention of the resident engineer. Actions taken to remedy the incidents must also be recorded.
- A complaints register must be kept on site in which complaints by any member of the public must be logged.
- The ECO must compile a final post-construction audit report, within 6 months of completion of each construction phase. The audit report must detail the rehabilitation measures undertaken, describe all major incidents or issues of non-compliance and any issues or aspects that require attention or follow-up.

12.4. ESO Monitoring

Due to the nature of this development, an Environmental Site Officer (ESO) must be appointed. The site officer will be responsible for implementing and monitoring the site activities daily. This individual must be appointed by the Main Contractor. The ESO will be responsible for actively managing activities on-site. The ESO must:

- Have a site diary wherein they report all environmental incidents daily;
- Ensure that all environmental filing relevant to the project is up to date;
- Keep proper Incident reports on record of all incidents, including all remediation action-documents. These reports and documents must be made available to the ECO, Site Contractor, Site Engineer and the DEA&DP when required;
- Be present and give report on all incidents at all site meetings for the project.

12.5. Auditing by Environmental Auditor

An environmental auditor is to be appointed by the applicant. As per Section 34 of the EIA Regulations (GN R326 of 2017), the duty of an Environmental Auditor is to be in dependent and is responsible for:

- Ensuring compliance with the conditions of the environmental authorisation and the EMPr; and
- Submit an environmental audit report to the relevant competent authority, which provides verifiable findings, in a structured and systematic manner, as per Appendix 7 of GN R326.
- Any amendments to the EMPr, which must be recorded in Appendix J.

The Environmental auditor must undertake an audit as per Appendix 7 of GN R326 at the following stages;

- Every 6 months following the commencement of the construction phase.
- At practical completion of the construction period.
- 3 months after practical completion of the construction period.

13. PENALTIES, CLAIMS AND DAMAGES

The contractor will be responsible for all costs incurred in the rehabilitation of the site and for ensuring that all procedures required to rehabilitate the site are implemented. If third parties are called to the site to perform clean up and rehabilitation procedures, the contractor will be responsible for all costs. The competent authority may impose penalties on the Holder or any of the contractors if conditions contained in this EMPr are contravened. This would be based on an agreement or contract between the Holder and the contractor.

Penalties could be imposed in terms of Chapter 11 of the Western Cape Bill on Planning and Development as published in the Extraordinary Provincial Gazette No 5183, 3 October 1997, and would be applicable for any action which leads to damage to the natural environment. Please note that the payment of any fines in terms of the contract shall not absolve the offender from being liable from prosecution in terms of any law.

In cases where severe environmental damage occurs, the competent authority law enforcement division may take legal action against the responsible parties. The reasons for this could include, among others:

- Not implementing the conditions of the EMPr;
- Spillage that result in environmental damage;
- Incorrect handling and storage of construction materials and chemicals;
- Sensitive areas that are not clearly demarcated;

- Performing ablutions in areas other than facilities provided for such actions; and
- Occurrence of an unattended and out of control fire.

The Contractor shall comply with the environmental specifications and requirements on an ongoing basis and any failure on his part to do so will entitle the ECO to issue the contractor with penalty / fine as described in the following section.

The following offences, level of severity and value of the financial fines have been drafted according to the sensitivities on the proposed site, the mitigation measures proposed, and the construction methods proposed. It must be noted that the level of severity is at the discretion of the ECO and any offences or fines will be recorded in the ECO's monitoring report. The fineable offences are not limited to the table below, additional offences may be applied by the ECO with prior agreement with the EA holder.

The following fine structure shall apply:

Table 3: Fines and offences

Finable Transgression	Min Fine	Max Fine
Failure to notify the ECO of the commencement of construction or pre-construction activities, prior to the commencement of such activities.	R1 000	R2 000
Failure to comply with the provisions relating to the demarcation of the working area, site camp and associated facilities, and the maintenance of the demarcated boundaries.	R1 000	R5 000
Failure to comply with the provisions relating to the demarcation of all "no-go" areas, and the maintenance of the demarcated boundaries.	R2 000	R5 000
Failure to provide secured ablution facilities (1:30 ratio) on site.	R500	R15 000
Failure to comply with the provisions relating to the clearance of vegetation on site.	R2 000	R5 000
Clearance of indigenous vegetation (regardless of the density of alien vegetation present) outside of the demarcated boundaries of the working area and site camp.	R2 500	R15 000
Failure to apply herbicide to alien vegetation when required to do so.	R500	R2 000
Failure to adhere to designated access routes and/or the driving of vehicles through undeveloped vegetation outside of the demarcated working area or site camp.	R1 000	R5 000
Movement of vehicles and/or construction workers in no-go areas;	R1 000	R10 000
Parking or storage of vehicles, machinery, tools and other materials or equipment related to the Contractors operations, within designated "no-go" areas.	R1 000	R10 000
Parking or storage of vehicles, machinery, tools and other materials or equipment related to the Contractors operations, outside of the areas demarcated for such parking/storage.	R500	R5 000

Finable Transgression	Min Fine	Max Fine
Failure to comply with the provisions relating to the management of topsoil and subsoil.	R1 000	R5 000
Excessive excavation of material in areas not depicted for such purpose / activity on the approved design plans.	R2 500	R10 000
Failure to comply with the provisions relating to waste management on site i.e. recycling of wastes.	R500	R5 000
Failure to comply with the provisions relating to the storage, use and management of hazardous substances and fuels on site and/or the spillage of hydrocarbons or hazardous substances on site leading to environmental damage.	R1 000	R10 000
Mixing cement or concrete on bare ground and/or failure to comply with any other provision regarding cement/ concrete batching.	R1 000	R5 000
Failure to provide adequate fire-fighting equipment (in working order) on site at all times and/or failure to comply with the provisions relating to fire prevention and/or the occurrence of unattended or out of control fires.	R500	R5 000
Refuelling of vehicles, machinery or equipment outside of the designated refuelling area.	R500	R2 000
Maintenance of vehicles, machinery or equipment outside of the designated maintenance yard, except in emergencies.	R500	R2 000
Failure to undertake refuelling or repairs over a drip tray or other impermeable bunded surface to collect spilled hydrocarbons (fuels, lubricants, oils etc.) and other hazardous substances; failure to provide drip trays under fuel burning equipment (including pumps and generators) where there is a risk of hydrocarbon leakage.	R500	R2 000
Failure to produce a required method statement/s to the engineer's and ECO's satisfaction prior to undertaking the activity concerned and/or failure to adhere to an approved method statement.	R1 000	R5 000

The above does not absolve the transgressor from being prosecuted in terms of the ***National Environmental Management Act (Act 107 of 1998)*** which may result in further penalties and other actions by State Departments.

14. EMERGENCY PREPAREDNESS

14.1. Emergency response procedures

The potential environmental risks that may arise as a result of construction activities, or during the maintenance of the structures must be identified, and appropriate emergency response procedures must be compiled for each emergency scenario. Potential environmental emergencies that require an emergency response include, but are not limited to, unplanned fires, sewage spills, spills of hazardous chemicals, snake bites etc.

- The construction contractor is responsible for identifying potential significant environmental risks that may arise as a result of pre-construction, construction and rehabilitation activities, and the contractor must formulate emergency response procedures for these potential incidents.
- The ECO, the contractor and the EA Holder are responsible for ensuring that all construction workers are aware of the emergency procedures and are properly trained on how to identify and respond to an emergency incident during construction.
- An emergency procedure must clearly indicate who will take charge during an emergency, and the roles and responsibilities of workers and authorities during an emergency.
- The construction contractor is responsible for ensuring that the requirements of the Occupational Health & Safety Act (Act 85 of 1993) (OHS Act) are adhered to during the construction phase. The Holder is responsible for ensuring compliance with the OHS Act during the undertaking of operational and maintenance activities.
- All workers on site during the construction and operational phase must be properly educated about possible emergency incidents that may arise, how to avoid such incidents and how to respond in the event of an incident. "Refresher" training sessions on emergency procedures must be held if needed.
- All workers must ideally be given basic fire-awareness training, as well as be advised on basic firefighting and safety techniques. Fire-fighting equipment must be available on-site during construction and operational activities.
- All workers must be trained on how to respond in the event of a spill of a hazardous substance (fuel, chemicals etc.), if hazardous substances are to be used on site.
- A spill kit for containing and/or neutralising spills of hazardous substances (e.g. hydrocarbons) must be available on site at all times, when hazardous substances are present.
- Any incidents of pollution or spillage of hazardous materials during construction must be reported to the ECO as soon as possible. The ECO must then (depending on the nature of the spill) notify the relevant authorities, if needed. During the operational phase of the development, the EA Holder is responsible for notifying the relevant authorities of any pollution incidents that arise.
- A first aid kit must be available on site at all times.
- Emergency contact numbers (including the fire department, police and ambulance) must be prominently displayed on site at all times and regularly updated.
- All emergency incidents must be recorded in a site incident log. The cause of the incident, the measures taken in response to the incident and the efficacy of those measures must also be recorded. This information must be used to inform future emergency preparedness planning, and to avoid prevent similar incidents from arising again.

15. ENVIRONMENTAL AWARENESS PLAN

Environmental Awareness Training must be conducted prior to the commencement of construction activities. It is the Holder's responsibility to familiarise himself/herself with the content and requirements of this EMPr. The Holder is also responsible to ensure that the contractor and all labourers working on site during the construction phase are familiar with the content of this EMPr.

The following actions must be taken to ensure that all relevant parties are aware of their environmental role and duties:

1. This EMPr must be kept on site at all times.

2. The provisions of this EMPr and the conditions of the Environmental Authorisation must be explained in detail to all staff during Awareness Training.
3. Training booklets will be handed out to all labourers and must be explained to them.
4. Weekly checks to be done by the Holder's environmental representative who must be on site at all times.
5. The ECO to conduct frequent site visits.
6. Monthly monitoring reports to be compiled by the ECO. These reports will be circulated to all parties involved (including the Holder, contractor and the competent authority where required).

The Construction Contractor must make allowance for all construction site staff, including all subcontractors that will be working at the site, to attend environmental awareness training sessions (undertaken by the ECO) before commencing any work on site. During this training, the ECO will explain the EMPr and the conditions contained therein. Attention will be given to the construction process and how the EMPr fits into this process. Other items relating to sound environmental management which must be discussed and explained during the environmental awareness training sessions include:

- The demarcated "No-Go" areas;
- General do's and don'ts of the site;
- Making of fires;
- Waste management, use of waste receptacles and littering;
- Use of the toilets provided;
- Use and control of construction materials and equipment etc.;
- Control, maintenance and refuelling of vehicles;
- Methods for cleaning up any spillage;
- Access and road safety;
- Emergency procedures (e.g. in case of fire, spillage etc.)
- General "best practice" principles, with regards to the protection of environmental resources.

Environmental awareness training and education must be ongoing throughout the construction phase and must be undertaken regularly if deemed necessary (especially if it becomes apparent that there are repeat contraventions of the conditions of the EMPr), or as new workers come to site. Translators must be utilised where needed.

APPENDIX A – CURRICULUM VITAES OF EAPs

CURRICULUM VITAE

BETSY-JANE DITCHAM

PERSONAL

Profession: Director & Environmental Assessment Practitioner

Nationality: South African

Languages: English (read, write and speak) & Afrikaans (read, write and speak)

Drivers License: Code B

EAPASA Registration: No. 1480

Betsy has a Bachelor of Science Honours Degree in Wildlife Management from the University of Pretoria and a Bachelor of Science Degree (Zoology and Ecology) obtained from the University of Cape Town in 2005. She has 11 years' experience in the environmental field, including environmental assessments, legal compliance, on-site compliance monitoring, cleaner production and business greening and sustainability (carbon and environmental footprinting). In her time as a consultant, she has compiled a number of environment assessments and management plans for both private and governmental clients. Betsy is a co-owner of SES and is Registered with EAPASA (**Reg No. 1480**).

WORK EXPERIENCE

March 2020 – Present: Sharples Environmental Services cc, Cape Town, WC

Co-Owner and Cape Town Office Manager: Principal Environmental Assessment Practitioner

Project Management / Client Liaison

Environmental Authorisation

Environmental Management Programmes

Public Participation

Legal Compliance

On-site compliance auditing

2018 – Feb 2020: Sharples Environmental Services cc, Cape Town, WC

Cape Town Office Manager: Principal Environmental Assessment Practitioner

Environmental Authorisation

Environmental Management Programmes

Public Participation

Legal Compliance

On-site compliance auditing

August 2017 – December 2017: WSP, Cape Town, WC
Assistant Consultant
Environmental Authorisation
Legal compliance
Air quality monitoring
Public participation

October 2009 to October 2015: Jeffares & Green Engineering & Environmental Consultants, Pinelands, WC
Environmental Scientist
On-site compliance auditing
Environmental footprinting (carbon, water, waste)
Business greening & sustainability
Environmental authorisations
In-house newsletter

July 2009 to September 2009: Freelance, Cape Town, WC
Environmental Control Officer
Environmental auditing of construction related projects.

TERTIARY EDUCATION

2005 University of Cape Town
Bachelor of Science Degree specialising in Zoology and Ecology
2006 University of Pretoria
Bachelor of Science Honours Degree in Wildlife Management

KEY PROJECTS

BAR: Upgrade of Trunk Road 11/1 (N7) from Potsdam to the Melkbos Interchange.

EIA: Proposed University Precinct Development at the Garden Route Dam and Associated Infrastructure on a Portion of Remainder Farm 464, George, Western Cape.

EA Amendment: Bulk Water Pipeline along Baden Powell Drive, Khayelitsha, WC.

CURRICULUM VITAE

JESSICA GOSSMAN

PERSONAL

Profession: Candidate Environmental Assessment Practitioner, Sharples Environmental Services cc, Cape Town.

Nationality: South African

Date of Birth: 16 April 1992

Languages: English & Afrikaans

Drivers' License: Code B

EAPASA Registration: No. 6154

WORK EXPERIENCE

September 2023 – Present: Sharples Environmental Services cc, Cape Town, WC
Candidate Environmental Assessment Practitioner
Basic Assessments Reports;
Environmental Impact Assessments;
Environmental Management Programmes;
Legislative documentation;
Administration.
Environmental Control Officer
Stakeholder Engagement
Reporting
Environmental Management Plans
Project Management
Rehabilitation and Monitoring Plans
Administration

TERTIARY EDUCATION

2020 University of South Africa
Bachelors Degree in Environmental Management
2022 University of South Africa
Bachelor of Science Honours Degree in Geography

Professionally registered EAPASA registration number: 2022/6154 & Registered IAIAsa

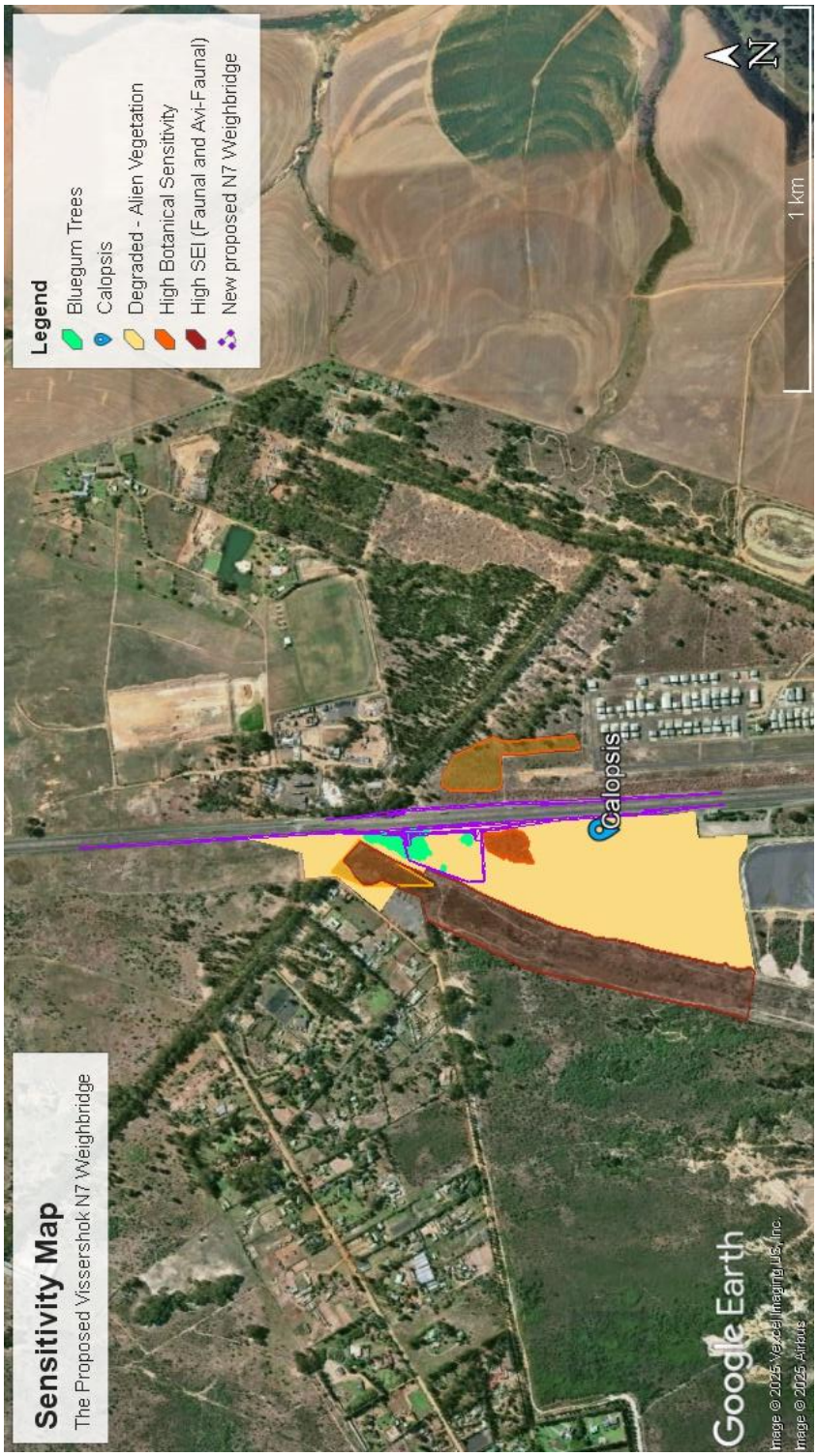
KEY PROJECTS

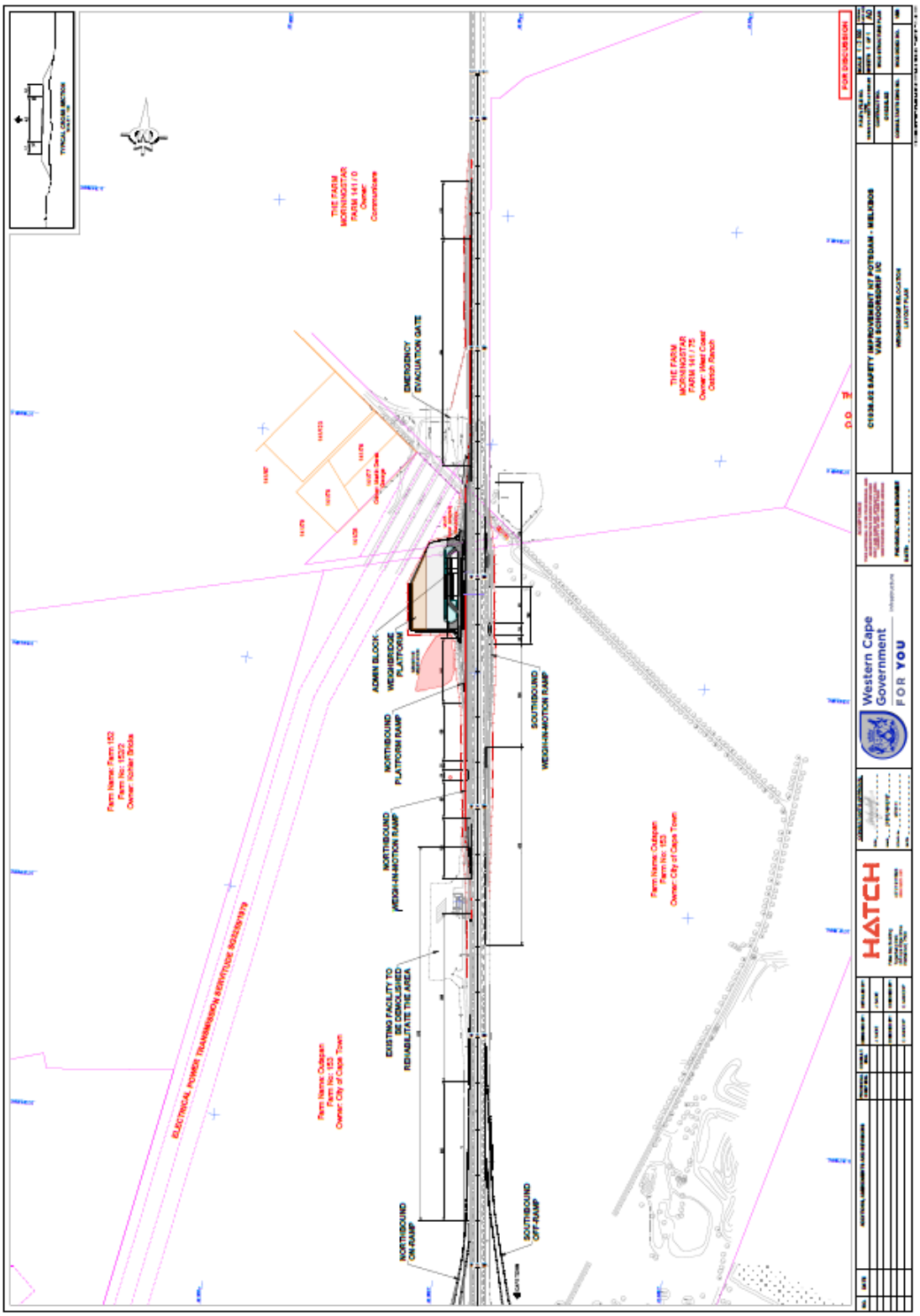
- Western Cape Government Garden Route Flood damage: Basic Assessment process
- Checklist & EMPr: Membrane Bioreactor Reactor Plan (Bonnievale).

- Checklist: Sunset Beach Subdivision
- Environmental Control Officer: N7 Van Schoorsdrift Road and culvert development, and N7 Diamond interchange
- Environmental Control Officer: Ankerlig Transmission Second Supply Project (Atlantis)

Assisted Projects: EMPr: Green Valley Housing Project (Bitou) and EMPr: Koeberg Nuclear Power Station

APPENDIX B – MAP OF ENVIRONMENTAL SENSITIVITIES & LAYOUT PLAN




FOR DISCUSSION
THE FARM MORNINGSTAR FARM 141 / 0 Owner: Communiere
THE FARM MORNINGSTAR FARM 141 / 75 Owner: West Coast Ostrich Ranch
EMERGENCY EVACUATION GATE
ADMIN BLOCK
WEIGHBRIDGE PLATFORM
NORTHBOUND PLATFORM RAMP
NORTHBOUND WEIGH-IN-MOTION RAMP
SOUTHBOUND WEIGH-IN-MOTION RAMP
EXISTING FACILITY TO BE DISMOUNTED REHABILITATE THE AREA
NORTHBOUND ON-RAMP
SOUTHBOUND OFF-RAMP
ELECTRICAL POWER TRANSMISSION SERVITUDE
Farm Name: Farm 152 Farm No: 152/3 Owner: Nobel Grass
Farm Name: Outspan Farm No: 153 Owner: City of Cape Town
Farm Name: Outspan Farm No: 153 Owner: City of Cape Town
Western Cape Government FOR YOU
HATCH

APPENDIX C - LEGISLATIVE COMPLIANCE

LEGAL FRAMEWORK

The NEMA, Act No 107 of 1998, as Amended, and the EIA Regulations (2014) (as amended 2017)

The National Environmental Management Act, 1998 (Act No. 107 of 1998) as per EIA Regulations, 2014 (as amended 2017), gives effect to the Constitution of the Republic of South Africa by providing a framework for co-operative environmental governance and environmental principles that enable and facilitate decision-making on matters affecting the environment. NEMA requires that an environmental authorisation be issued by a competent authority (CA) before the commencement of an activity listed in the Environmental Impact Assessment Regulations, 2014 (as amended 2017), in terms of the Listing Notices G.N. 324, 325, 326 & 327 published on the 7th April 2017.

Due to the fact that this development proposal consists of activities listed in the EIA Regulations, Listing Notice 1 and 3, a Basic Assessment Process was required, and the respective reports (Basic Assessment Report and Appendices) were submitted to the Department of Environmental Affairs and Development Planning (DEA&DP) for Environmental Authorisation.

The following table indicates the relevant triggered activities as per the development proposal:

Activity No(s):	Provide the relevant **Basic Assessment Activities** as set out in **Listing Notice 1**	Describe the portion of the proposed development to which the applicable listed activity relates.
24	*The development of a road—* *(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* ***(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;*** *but excluding a road—* *(a) which [are] is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) [roads] where the entire road falls within an urban area; or* *(c) which is 1 kilometre or shorter.*	The proposed weighbridge infrastructure includes a weigh-in-motion facility to be installed in both the southbound and northbound directions. There are two service roads from the main N7 national road, one entering from a southern direction and one exiting in a northern direction. These structures, along with other components of the weighbridge (and associated roadworks) are expected to influence the road reserve width and it is anticipated that the road reserve will require a minor widening of 10m to 15m, however, this is an expansion on the currently established road and no new roads are expected to be developed. **Therefore, this listing notice will not apply to the proposed development and has been confirmed by the Competent Authority within the NOI comments.**
27	*The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for –* *(i) The undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	It is anticipated that the location of the weighbridge will result in clearance of approximately 1 ha of indigenous vegetation. **Therefore, this activity will be applicable and has been added to the BAR.**
56	*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre—* *(i) where the existing reserve is wider than 13,5 meters; or*	The proposed weighbridge (and associated road on ramp and off ramp from the N7 national road) could constitute a widening and/or lengthening of the road. The outbound on-ramp from Cape Town will be about 632.86 meters long and 9 to 10 meters wide, with a 1:50 taper zone for safe heavy vehicle entry.

	(ii) where no reserve exists, where the existing road is wider than 8 metres; *excluding where widening or lengthening occur inside urban areas.*	The outbound off-ramp will be approximately 824.65 meters long and 9 to 10 meters wide. The inbound weigh-in-motion section will be around 1,026.08 meters long and 12.81 meters wide. **it is deemed that this Activity <u>will be</u> applicable and has been added to the BAR.**
Activity No(s):	Provide the relevant **Basic Assessment Activities** as set out in **Listing Notice 3**	Describe the portion of the proposed development to which the applicable listed activity relates.
4	*The construction of a road wider than 4 meters with a reserve less than 13.5 meters.* *<u>(d) IN Western Cape:</u>* *I. In an estuary;* *ii. All areas outside urban areas;* *iii) In urban areas:* *(aa) Areas zoned for use as public open space within urban areas;* *And* *(bb) Areas designed for conservation use in Spatial Development Frameworks adopted by the competent authority, or zoned for a conservation purpose.*	A portion of the the proposed weighbridge road infrastructure will be located east of the N7, just north of the Morningstar airfield. This development will encroach approximately 10 meters into the designated Protected Area known as the Van Schoorsdrift Conservation. The project requires this encroachment to facilitate the widening and lengthening of the road, allowing for better traffic accommodation in conjunction with the new weighbridge. **Therefore, this activity <u>will not</u> apply to the proposed development and has been confirmed by the Competent Authority within the NOI comments.**
12	*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *<u>i. Western Cape</u>* *i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;* *ii. Within critical biodiversity areas identified in bioregional plans;* *iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas;* *iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning; or* *v. On land designated for protection or conservation purposes in an Environmental Management Framework adopted in the prescribed manner, or a Spatial Development Framework adopted by the MEC or Minister.*	It is expected that more than 300 m^2 of land will be cleared on a mostly undisturbed area which contains some indigenous vegetation within the Western Cape. The surrounding land has been largely developed, with a large landfill site to the south-west, an airfield to the east, smallholdings to the north-west and the N7 national directly east of the proposed site. According to the DFFE Screening Tool, the site ecosystem status has been indicated to be Critically Endangered by the SANBI Red List of Ecosystem Remnants and the site sensitivity has been indicated to be Very High (Critically Endangered - Cape Flats Sand Fynbos). That will see to an area of over 300 square meters of indigenous vegetation being cleared to accommodate the proposed development, as the proposed development is 4.7 ha in extent. **Considering the definition of indigenous vegetation, as per the following ground truthing EIA Regulations (2014), as amended. This activity <u>will be</u> applicable and has been added to the BAR.**
18	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *i. <u>Western Cape</u>* *i. Areas zoned for use as public open space or equivalent zoning;*	The proposed weighbridge (and associated road on ramp and off ramp from the N7 national road) could constitute a widening and/or lengthening of the road in an area with indigenous vegetation within the Western Cape. Environmental Authorisation is currently in place for the existing N7 national road; however the proposed weighbridge and associated infrastructure is considered an expansion on the existing road

	ii. All areas outside urban areas: ***(aa) Areas containing indigenous vegetation;*** *(bb) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined; or* *iii. Inside urban areas:* *(aa) Areas zoned for conservation use; or* *(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority.*	and the on ramp and off ramp which will link the weighbridge to the main road will constitute an addition (lengthening and widening) of the road, The outbound on-ramp from Cape Town will be about 632.86 meters long and 9 to 10 meters wide, with a 1:50 taper zone for safe heavy vehicle entry. The outbound off-ramp will be approximately 824.65 meters long and 9 to 10 meters wide. The inbound weigh-in-motion section will be around 1,026.08 meters long and 12.81 meters wide therefore; **it is deemed that this Activity <u>will be</u> applicable and has been added to the BAR.**
Activity No(s):	Provide the relevant **Scoping and EIR Activities** as set out in **Listing Notice 2**	Describe the portion of the proposed development to which the applicable listed activity relates.
Not applicable.		

Note:

- Only those activities listed which will be applied for shall be considered for authorisation. The onus is on the Applicant to ensure that all applicable listed activities are included in the application. Environmental Authorisation must be obtained prior to commencement with each applicable listed activity. If a specific listed activity is not included in an Environmental Authorisation, a new application for Environmental Authorisation will have to be submitted.
- The Minister responsible for mineral resources is the Competent Authority to deal with all applications where the listed or specified activity is directly related to-
  (a) prospecting or exploration of a mineral or petroleum resource; or
  (b) extraction and primary processing of a mineral or petroleum resource.

Therefore, in summary, the following activities will be applied for:

- Listing Notice 1: Activity No: 27 and 56
- Listing Notice 2: None; and
- Listing Notice 3: Activity No: 12 and 18.

Other Applicable Legislation

The *Proponent* is responsible for ensuring that all contractors, labourers and any other appointed person/entity acting on their behalf, remain compliant with the conditions of the received authorisations, as well as the provisions of all other applicable legislation, including *inter alia*:

- National Environmental Management Act (NEMA) (Act No 107 of 1998, as amended);
- National Environmental Management Biodiversity Act (Act 10 of 2004);
- National Environmental Management: Waste Act (Act 59 of 2008);
- National Heritage Resources Act (Act No 25 of 1999);
- Occupational Health and Safety Act (Act 85 of 1993);
- National Veld and Forest Fire Act (Act No. 101 of 1998).

The above-listed legislation has general applicability to most development applications, and it is the responsibility of the *Proponent* to ensure that all contractors and employees are aware of their obligations in terms of these Acts. This EMPr does not detract from any other legal requirements.

APPENDIX D - ROLES & RESPONSIBILITIES

ROLES & RESPONSIBILITIES

Duties and Responsibilities of the Holder

The Holder is ultimately responsible for ensuring that the environmental management measures specified in this EMPr, as well as any other conditions specified by the competent authority, are implemented and adhered to during the construction and operational phase (maintenance activities) of the proposed development.

The Holder or delegated party is responsible for monitoring and maintenance during the operational phase. The Holder must ensure that all appointed service providers, contractors and maintenance workers are capable of complying with all statutory requirements of this EMPr and the conditions of the Environmental Authorisation. The Holder is responsible for ensuring that this EMPr and the conditions of the Environmental Authorisation are implemented and adhered to during construction.

The Holder or appointed consultant is responsible for identifying emergency situations that may arise during operational and maintenance activities and must formulate appropriate emergency response procedures for these emergency scenarios.

Duties and Responsibilities of the Contractor

The "Construction Contractor" is the entity responsible for undertaking the physical construction of the residential development. The construction contractor is responsible for ensuring that all environmental management measures specified in this EMPr and in the EA are implemented during the pre-construction, construction and post-construction rehabilitation phases, unless agreed otherwise with the Holder. The contractor will be responsible for all costs incurred, in relation to any non-compliances which may occur during implementation of construction activities/rehabilitation activities. The contractor must therefore make adequate financial provision_for the implementation of all prescribed measures, in accordance with the Bill of Quantities and the EMPr.

It is strongly recommended that the Construction Contractor appoint an Environmental Site Officer (ESO), who will act as the Contractor's representative to enforce compliance with the conditions of this EMPr, throughout all phases of construction.

In addition to the above, the Construction Contractor is responsible for the following:

- Identify emergency situations that may arise as a result of construction activities and formulate appropriate emergency response procedures.
- Ensure that all construction workers, including sub-consultants and service providers, undergo environmental awareness training prior to commencing work on site, or as soon as possible thereafter.
- Compile the required method statements, which must be to the satisfaction of the ECO, before commencing with the activity to be governed by the method statement.

- Respond to concerns or issues identified by the ECO, as relates to environmental management, and implement the appropriate management or remediation measures, at the Contractor's own expense (unless agreed otherwise).
- Any damage to the surrounding environment (site camp location and outskirts of working corridor) must be noted by the contractor with photo evidence. Any damage identified throughout the operational phase of the proposed extension will be the contractor's responsibility to repair.
- Should third parties be called to the site to perform clean up and rehabilitation procedures, the Construction Contractor will be responsible for all associated costs.

Note that failure to comply with the requirements and conditions of this EMPr and the Environmental Authorisation may result in fines or other penalties being levied against the Construction Contractor by the Competent Authority.

Duties And Responsibilities of the ECO

The appointed ECO is responsible for undertaking regular site visits to monitor and report on the implementation of the EMPr and adherence to the conditions of the Environmental Authorisation during the pre-construction, construction and post-construction rehabilitation phases. The ECO is not required to monitor the site during the operational (maintenance) phase of the development.

- Competency of the ECO

The ECO must be independent of the Environmental Auditor, Holder, Engineer, Construction Contractor and their service providers. The appointed ECO must be suitably qualified and experienced and must be able to demonstrate that he / she is of sufficient competency to undertake the required task. The ECO must preferably be a resident in close proximity to the development area to ensure quick response if required. The ECO must work in close co-operation with the Construction Contractor, resident engineer or EO (where applicable) and all contractors in order to identify potential problems before they occur, and provide suitable guidance as to how the identified problems (environmental impacts) can be avoided.

- Duties of the ECO

The duties of the ECO include, but are not limited to:

- Conduct a pre-construction site inspection to ascertain the pre-commencement condition of the site (i.e. the status quo);
- Conduct environmental awareness training, which must include;
    - A brief description of the surrounding environment
    - Importance of the EMPr
    - Roles and responsibilities
    - Identified environmental risks
    - Mitigation measures to be implemented
    - No-go areas
    - Emergency procedures (Hydrocarbon spill)
- Undertake regular site visits to monitor compliance with all mitigation, monitoring and management measures contained in the EMPr and the Environmental Authorisation, during the pre-construction, construction and rehabilitation phases of the development;
- Evaluate the achievement of the performance indicators associated with each impact management objective specified in this EMPr;

- Liaise with site contractors, engineers and other members of the development team with regard to the requirements of the EMPr;
- Provide guidance as and when required regarding the implementation of the environmental management measures contained in the EMPr and EA, so as to assist the Holder and contractor in remaining compliant with these measures;
- Assist in finding environmentally acceptable solutions to construction problems;
- Ensure that the working areas, site camp facilities, access roads and no-go areas are properly demarcated;
- Ensure that proper topsoil management practices are adhered to on site;
- Ensure that proper waste management & pollution prevention strategies are practised on site;
- Examine method statements, where required;
- Recommend additional environmental protection measures, should this be necessary;
- Furnish contractors with verbal warnings in case of contravention of the EMPr;
- Recommend that the competent authority furnish errant contractors with predetermined fines, when verbal and / or written warnings are ignored;
- Ensure satisfactory rehabilitation of disturbed areas on site, after construction is complete;
- Keep detailed records of all site activities that may pertain to the environment, and produce **monthly** compliance-monitoring reports (ECO Reports) for submission to the Holder, and the Competent Authority at regular intervals during the construction phase;
- Submit a final post-construction inspection report, within 6 months of completion of the construction phase. The audit report must detail the rehabilitation measures undertaken, describe all major incidents or issues of non-compliance and any issues or aspects that require attention or follow-up.
- All ECO Reports and Inspection Reports must be submitted to the Holder and Competent Authority.

- Frequency of ECO visits

The ECO must conduct **monthly** site visits during the construction phase, in addition to the start-up and closure inspections.

The ECO must conduct a monthly site visit for a period of 24 months following the completion of the construction phase of the proposed project, so as to ensure all implemented rehabilitation works are successful.

The ECO has the discretion to undertake additional visits if he / she feels this is justified due to the actions of the contractors, and to make *ad hoc* visits in order to ensure compliance.

- Authority of the ECO

The ECO has the authority to recommend to the decision-making authorities that they suspend all works (or part thereof) occurring on site, should any action being undertaken on site not comply with the environmental requirements, and where such actions pose a serious threat to any element of the surrounding environment.

The ECO has the authority to issue instructions to the Construction Contractor and/or Holder, regarding measures that must be implemented on site in order to ensure compliance with the EMPr and Environmental Authorisation, and/or to prevent environmental degradation or pollution from occurring.

The ECO has the authority to issue verbal and written warnings to contractors. Should verbal and written instructions and/or warnings be ignored, the ECO has the authority to request the Competent Authority to issue pre-determined fines or other penalties.

The ECO has the authority to report incidents of non-compliance to the Competent Authority at any time.

Duties and Responsibilities of the Environmental Auditor

In accordance with the requirements of the Environmental Impact Assessment Regulations, 2014 (as amended), the Holder of the Environmental Authorisation must, for the period that the Environmental Authorisation is valid, appoint a suitably qualified independent person to conduct an environmental audit to audit compliance with the conditions of the Environmental Authorisation and the EMPr.

The Holder is responsible for appointing, managing and remunerating the appointed auditor. The auditor may **not** be the appointed ECO.

The appointed auditor is to be provided with the completed EMR's and Checklists, as well as any other crucial information that may be relevant or requested (incident report, waybills etc) in order to effectively report on the level of compliance with the conditions of the environmental authorisation and the EMPr. The appointed auditor must undertake environmental audits at the following stages;

- Every 6 months following the commencement date of the construction works.
- At practical completion of the construction period.
- 3 months after practical completion of the construction period.
- Once a year, for the following 3 years after practical completion of the construction period.
- Or according to the frequency specified in the Environmental Authorisation.

Following each audit, the environmental auditor must submit an audit report to the Competent Authority (in this instance the DEA&DP).

- Environmental auditing and environmental audit reports must adhere to the requirements of the amended 2014 Environmental Impact Assessment Regulations, in particular Section 34 (*Auditing of Compliance with Environmental Authorisation, Environmental Management Programme*) and Appendix 7 (*Objective and Content of Environmental Audit Report*)
- The audit report must provide verifiable findings on the level of compliance with the provisions/ conditions of the Environmental Authorisation and the EMPr and must also comment on the ability of the measures contained in this EMPr to sufficiently avoid, manage and mitigate environmental impacts.
- Where the findings of the audit report indicate that the impact management measures stated in the EMPr are insufficient to adequately address environmental impacts, recommendations as to how the EMPr must be amended so as to address the identified shortcomings must be made and submitted to the competent authority together with the audit report.

APPENDIX E - PROTOCOL FOR CHANCE FOSSIL FINDS

<table>
<tr><td>Province & region:</td><td>Cape Town, Western Cape</td></tr>
<tr><td>Responsible Heritage Resources Agency</td><td>111 Harrington Street Cape Town 8001
Tel: (021) 462 4502 Fax: (021) 462 4509
Email: hwc@pgwc.gov.za)
Tel: 086-142 142.
Fax: 021-483 9842.</td></tr>
<tr><td>ECO protocol</td><td>1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
• Context – describe position of fossils within stratigraphy (rock layering), depth below surface
• Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
• Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
• Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
• Photograph fossils against a plain, level background, with scale
• Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
• Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
</table>

PROTOCOL FOR CHANCE FOSSIL FINDS

Procedure to follow if it is likely that the material identified is a fossil:

i The ECO or site agent must ensure that all **work ceases** immediately in the vicinity of the area where the fossil or fossils have been found;

ii The ECO or site agent must **inform HWC of the find immediately.** This information must include photographs of the findings and GPS co-ordinates**;**

iii The ECO or site agent must compile a **Preliminary Report and fill in the Fossil Discoveries: HWC Preliminary Record Form** within 24 hours without removing the fossil from its original position. The **Preliminary Report** records basic information about the find including:

- The date
- A description of the discovery
- A description of the fossil and its context (e.g. position and depth of find) Where and how the find has been stored
- Photographs to accompany the preliminary report (the more the better):
  - A scale must be used
  - Photos of location from several angles Photos of vertical section should be provided
  - Digital images of hole showing vertical section (side);
  - Digital images of fossil or fossils.

iv Upon receipt of this **Preliminary Report**, HWC will inform the ECO or site agent whether or not a rescue excavation or rescue collection by a palaeontologist is necessary.

v **Exposed finds must be stabilized where they are unstable and the site capped, e.g. with a plastic sheet or sand bags.** This protection should allow for the later excavation of the finds with due scientific care and diligence. HWC can advise on the most appropriate method for stabilization.

vi If the find cannot be stabilized, **the fossil may be collect with extreme care** by the ECO or the site agent and put aside and protected until HWC advises on further action. Finds collected in this way must be safely and securely stored in tissue paper and an appropriate box. Care must be taken to remove the all fossil material and any breakage of fossil material must be avoided at all costs.

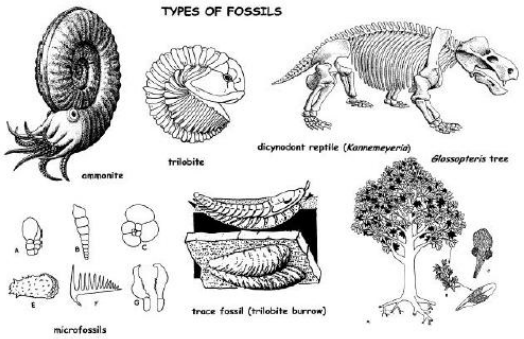
No work may continue in the vicinity of the find until HWC has indicated, in writing, that it is appropriate to proceed.

FOSSIL DISCOVERIES: HWC PRELIMINARY RECORDING FORM		
Name of project		
Name of fossil location		
Date of discovery		
Description of situation in which the fossil was found:		
Description of context in which the fossil was found:		
Description and condition of fossil identified:		
GPS coordinates:	Lat:	Long:
If no co-ordinates available then please describe the location:		
Time of discovery:		
Depth of find in hole:		
Photographs (tick as appropriate and indicate number of the photograph)	Digital image of vertical section (side)	
	Fossil from different angles	
	Wider context of the find	
Temporary storage (where it is located and how it is conserved)		
Person identifying the fossil	Name: Contact:	
Recorder:	Name: Contact:	
Photographer	Name: Contact:	

Palaeontology: what is a fossil?

Fossils are the traces of ancient life (animal, plant or microbial) preserved within rocks and come in two forms:

- Body fossils preserve parts, casts or impressions of the original tissues of an organism (e.g. bones, teeth, wood, pollen grains); and
- Trace fossils such as trackways and burrows record ancient animal behaviour.



How to report chance fossil finds: What should I do if I find a fossil during construction/mining?

If you think you have identified a fossil:

Types of palaeontological finding - What does a fossil look like?

Fossils vary in size, from fossilised tree trunks and dinosaur bones down to very small animals or plants. Finds can be **individual fossils** (one isolated wood log or bone) or **clusters and beds** (several bones, teeth, animal or plant remains, trace fossils in close proximity or bones resembling part of a skeleton). A bed of fossils is a layer with many fossil remains.

Below there is a list of few examples of fossils which may be identified during excavations in the Western Cape.

Image	Description	Image	Description
	Leaves		Snail shells and other shells
	Fossil wood		Bones of larger animals
	The remains of fish and marine life (e.g. teeth, scales, starfish)		Large burrows made by moles and other animals

APPENDIX F - EMPR REVIEW AND AMENDMENT REGISTER

EMPR REVIEW AND AMENDMENT REGISTER

Review Date	Description of Review and/or Amendment	Signature

WWF
SOUTH AFRICA

A PRACTICAL GUIDE TO MANAGING INVASIVE ALIEN PLANTS

A concise handbook for land users in the Cape Floral Region

This handbook has been produced in collaboration with these partners to guide the management of invasive alien plants in the Cape Floral Region.

ARC • LNR
CITY OF CAPE TOWN ISIXEKO SASEKAPA STAD KAAPSTAD
CORTEVA agriscience
environment, forestry & fisheries
Department: Environment, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA
Fynbos Trust Landscape Scale Conservation
LANDWORKS™ Working with people in the landscape
ncc

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Cover photo: Member of a clearing team stacking biomass in the Vyeboom Wetland near the Theewaterskloof Dam.
© Rodney February / WWF

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If you would like to share copies of this paper, please do so in electronic PDF format. Available online at www.wwf.org.za/report/invasive_plants_handbook

The Afrikaans version is available at www.wwf.org.za/report/invasive_plants_handbook_Afr

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Supporting documents for more information are available as appendices at www.wwf.org.za/report/invasive_plants_appendices

For more information, contact info@wwf.org.za or call 021 657 6600

WWF is one of the world's largest and most experienced independent conservation organisations with over 6 million supporters and a global network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

WWF South Africa is a national office in the global WWF network. Started in South Africa in 1968, we are a local NGO with a vision of building a sustainable and equitable future in which humans and nature thrive. We work to champion the Earth's capacity to provide a source of inspiration, sustainable food, freshwater and clean energy for all. For Nature. For You.

wwf.org.za

Funders: Corteva Agriscience, the Fynbos Trust, Nedbank, Sanlam and Woolworths.

Corteva Agriscience, through its local subsidiaries, has introduced environmentally accepted herbicides in South Africa since the early 1980s. As global market leader in Green Chemistry Principles, Corteva is committed to new innovations for the control of introduced invader plants that threaten the biodiversity and functioning of our forests, wetlands and especially the species diversity of the Cape Floral Kingdom, without negative impacts to the environment.

The Fynbos Trust is an NGO that promotes and supports landscape-scale conservation (primarily in the Overberg). Conservation leadership and innovation, partnerships with communities, technical support and collaboration with land users, decision-makers and other stakeholders are key areas of focus to ensure that natural diversity and processes persist across the landscape. Integrated invasive alien plant and fire management are key elements of the Fynbos Trust's landscape-scale conservation approach.

Nedbank is proud to fund the production of this guide as part of its support for WWF as we work together to safeguard South Africa's water source areas, improve rural livelihoods and promote land stewardship. WWF and Nedbank have been working together in various forms for almost 30 years – a long-term NGO/business partnership that continues to evolve and innovate to find solutions to complex sustainability challenges in South Africa.

WWF South Africa's partnership with Sanlam works to conserve and ensure the healthy functioning of South Africa's important freshwater ecosystems and, in so doing, the well-being of people that depend on this natural resource. This practical guideline to managing invasive alien plants is one of the tools contributing towards this purpose.

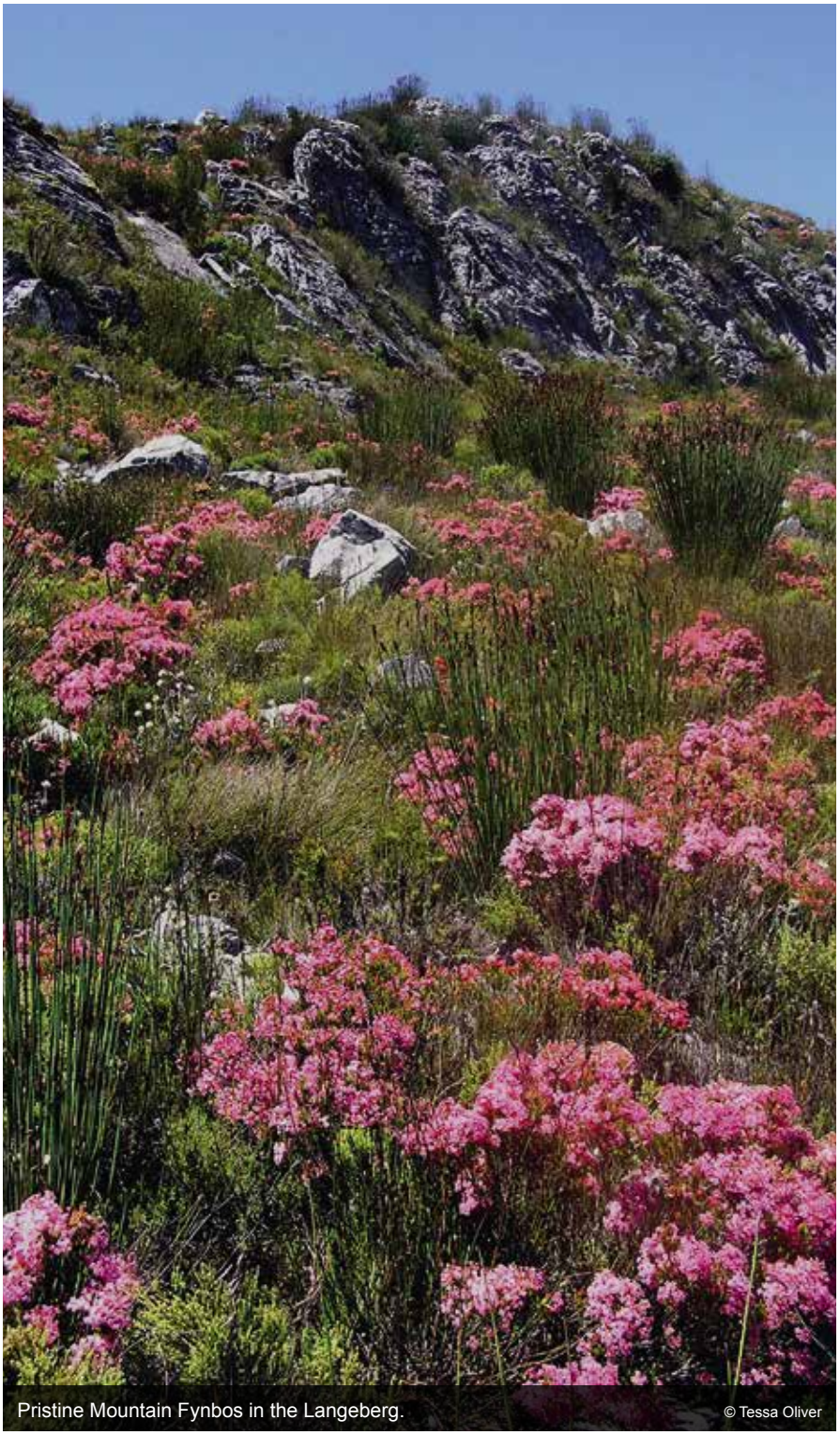
The WWF–Woolworths partnership seeks to improve the stewardship of water resources nationally, explore low-carbon pathways, reduce potential negative impacts of agriculture, improve seafood production and reduce food waste throughout the supply chain. The management of invasive alien plants contributes towards this mission. Therefore, Woolworths is proud to be part of this publication that summarises the lessons and tips for land users who want to join the practice of keeping alien plants at bay.

Indigenous common pagoda (*Mimetes spp*) after a fire in Luiperdskloof, Betty's Bay. © Tessa Oliver

CONTENTS

INTRODUCTION

This practical guide aims to empower land users (landowners, land managers and contractors) in the Cape Floral Region to understand the threat of invasive alien plants (IAPs) and manage the IAPs on their land.



Pristine Mountain Fynbos in the Langeberg. © Tessa Oliver

The guide was developed by WWF South Africa in collaboration with the Agricultural Research Council; the City of Cape Town; Corteva Agriscience; the Department of Environment, Forestry and Fisheries; LANDWORKS; the Fynbos Trust; and NCC Environmental Services. It not only contains a detailed set of instructions on how to proceed when clearing IAPs (this often differs per context) but also aims to be a first-stop resource that can be adapted to local conditions, while giving useful pointers for where to find further information from numerous other sources.

Land users are given an overview of how to approach an IAP management programme: understanding what IAPs are, the relevant legislation, planning, the methods that are available, health and safety considerations, the safe use of herbicides, and successfully rehabilitating the cleared land, if that is the end goal. The authors' intentions are to update the necessary sections on an annual basis, and it is in the reader's best interest to use the latest version of the guide at www.wwf.org.za/report/invasive_plants_handbook and of the supporting Appendices at www.wwf.org.za/invasive_plants_appendices/.

Additional resources are noted throughout the guide in the "For more information (page xx)" sections, and options to source funding for IAP management are given.

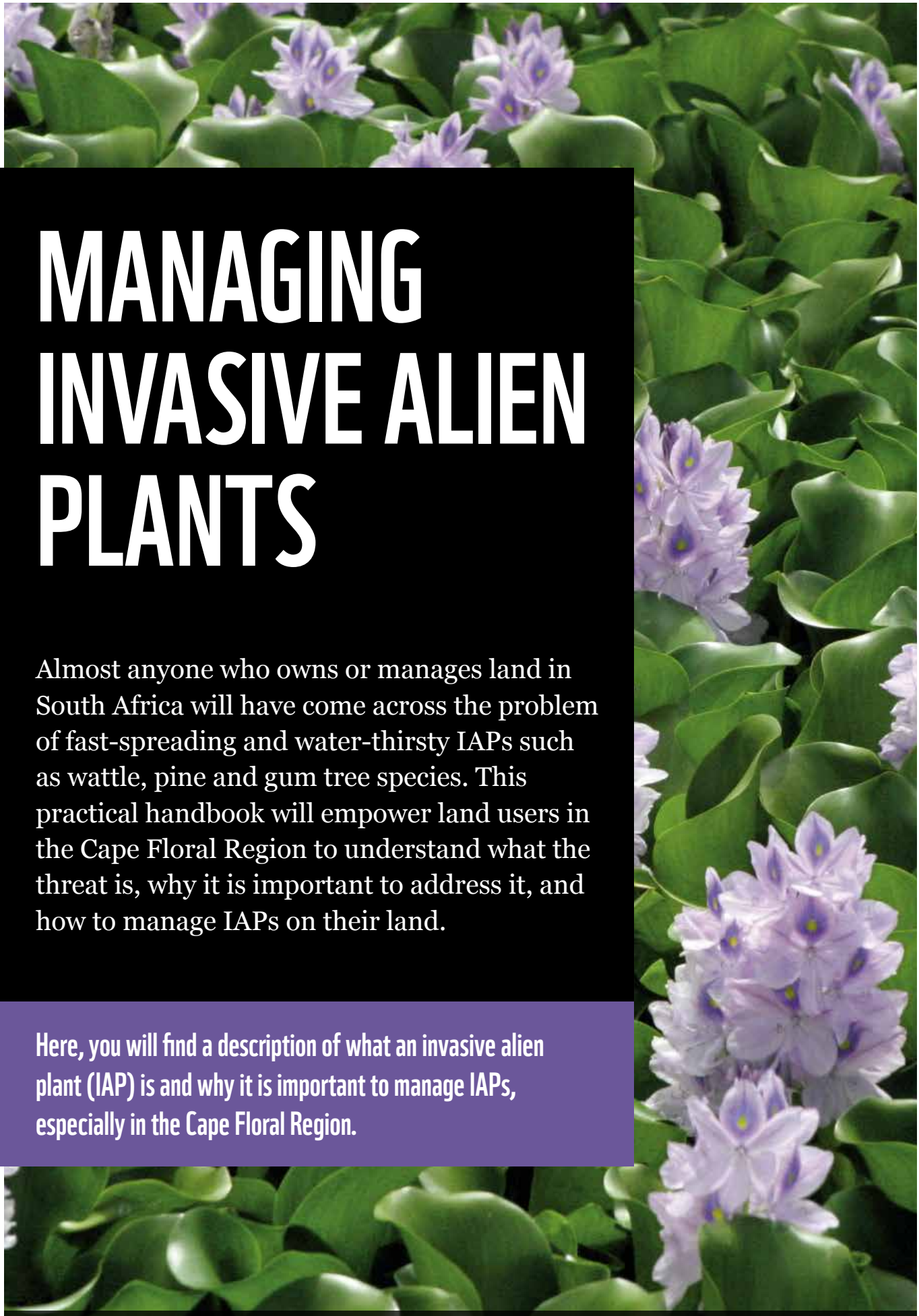
A land user can mean the legal owner of the land, or a land manager, someone leasing land or an IAP contractor.

Introduction	In this section, the origin and purpose of this guide is explained.
Managing IAPs	Here, you will find a description of what an invasive alien plant (IAP) is and why it is important to manage IAPs, especially in the Cape Floral Region.
Legal	The legal obligations of landowners with IAPs on their land are summarised in this section. You will find a brief explanation of the relevant laws and regulations relating to IAPs, including what actions are required for different categories of IAPs.
Planning	This section provides the main considerations to think about before beginning an IAP management operation, including steps to develop a management plan, how to prioritise IAP clearing, mapping management units, planning for wildfires, and the labour and budget requirements.
Methods	Here, you will find simple instructions for the four main methods of managing IAPs: manual, mechanical, chemical, and biological control. Further information is given on how to dispose of plant and waste material.
Health and Safety	This section covers the legal background for health and safety, as well as minimum safety requirements. You will also find information on safety in the field, fire preparedness and a list of personal protective equipment.
Herbicide safety	In this section, information is given on herbicide labels and the safe storage, mixing and disposal of herbicides. Following these precautions will help to reduce the risks associated with these dangerous chemicals.
Rehabilitation	Here, you will find an overview of the reasons for rehabilitating cleared land, the types of rehabilitation and the phases in a rehabilitation project. Useful resources with more detailed information on rehabilitation are suggested.
Funding	This section contains information about government and other funding opportunities for IAP management. Options include accessing government programmes, working cost effectively with neighbours, and finding resourceful ways to recoup funds from IAPs.

MANAGING INVASIVE ALIEN PLANTS

Almost anyone who owns or manages land in South Africa will have come across the problem of fast-spreading and water-thirsty IAPs such as wattle, pine and gum tree species. This practical handbook will empower land users in the Cape Floral Region to understand what the threat is, why it is important to address it, and how to manage IAPs on their land.

Here, you will find a description of what an invasive alien plant (IAP) is and why it is important to manage IAPs, especially in the Cape Floral Region.



Water hyacinth (*Eichhornia crassipes*), an aquatic invasive alien plant native to the Amazon basin, is widely spread throughout South Africa and is found in many of our water bodies.

THE CAPE FLORAL REGION – WHAT ARE WE CONSERVING?

The Cape Floral Region is an area of special and unique biodiversity. It is the smallest of only six floral kingdoms around the world and the only one found within a single country.

The Cape Floral Kingdom extends across the Western Cape and parts of the Northern and Eastern Cape provinces of South Africa, from Gqeberha (formerly Port Elizabeth) to Cape Town and north towards Nieuwoudtville. There are many ways in which the natural ecosystems in this area are recognised as extraordinary.

Cape Floral Region

Biodiversity and endemism

The Cape Floral Region is home to more than 9 000 different species. This is one of the highest concentrations of plant species anywhere in the world. Covering only 0,5% of Africa's area, the Cape Floral Region hosts more than 20% of the continent's plant species. About two-thirds of these plants are endemic, meaning they are not found anywhere else.

Fynbos, Renosterveld and Strandveld

The Fynbos biome comprises various Fynbos, Renosterveld and Strandveld vegetation types. These are the dominant vegetation communities of the Cape Floral Region. Fynbos is a type of shrubland adapted to a mild climate with winter rainfall, poor soils and regular wildfires. It is known for its unique proteas, ericas and restios. Renosterveld is also part of the Fynbos biome but occurs on more fertile soils. It has more grasses, annual plants and bulbs than typical Fynbos. All lowland types of Renosterveld are considered critically endangered, because only small fragments of natural vegetation remain. Strandveld vegetation grows in deep, well-drained alkaline sand along the West Coast and on the Cape Flats. Many Strandveld plants are succulent, so the vegetation does not burn as regularly as Fynbos and Renosterveld.

Biodiversity hotspot

The high biodiversity and endemism of the Cape Floral Region have led to it being considered a biodiversity hotspot. There are 36 recognised biodiversity hotspots around the world. These are areas with very high levels of biodiversity that are also under significant threat from human activities.

World Heritage Site

In 2004, the Cape Floral Region was designated as a World Heritage Site in recognition of its unique biodiversity. The World Heritage Site currently consists of 13 clusters of national parks, nature reserves and wilderness areas, covering more than a million hectares. It is considered of global value because of the unique ecological processes and high biodiversity associated with the Fynbos biome.

Water Source Area

The mountain catchments of the Cape Floral Region are part of South Africa's Strategic Water Source Areas. These are areas that cover only 10% of the country's land but contribute a disproportionate 50% of its water supply. The rainwater that fills the rivers of the Cape Floral Region is a vital water source for millions of people, farms and industries downstream.

Threats

Invasive alien plants are one of the biggest threats to the Cape Floral Region. Fynbos is a shrubland and is vulnerable to invasion by wildfire-adapted tree species. Pines, woody acacia and hakea have the most negative impacts, particularly on water supply, and are the most difficult to deal with. Infestation levels vary from areas that are completely infested to areas free of IAPs. If IAPs are not controlled, they will continue to be an ever-expanding threat to this remarkable biodiversity area and all the benefits provided by a functioning environment. It is therefore critical to maintain IAP-free land and prioritise low infestations for clearing.

INVASIVE ALIEN PLANTS – WHY ARE THEY A PROBLEM?

Invasive alien plants are problem plants. They are plants that are not native to an ecosystem. They spread rapidly and cause harm to the environment, the economy and even to human health.

Purple loosestrife (*Lythrum salicaria*), native to Eurasia, spreads easily and replaces indigenous vegetation, creating its own dense stands. © Debbie Muir / NRM

4 MAIN CHARACTERISTICS OF INVASIVE ALIEN PLANTS

1 Non-indigenous

Alien species are those that do not occur naturally in an area. They are brought in by people, either on purpose (as garden plants or plantation trees) or by accident (such as seeds in bags of animal feed).

2 From a similar climate

Many IAPs in South Africa come from Australia, Europe or North and South America. They are well adapted in their natural habitat to enjoy similar temperatures, rainfall patterns and fire regimes. This means they can spread easily and thrive in the place to which they have been introduced.

3 No natural enemies

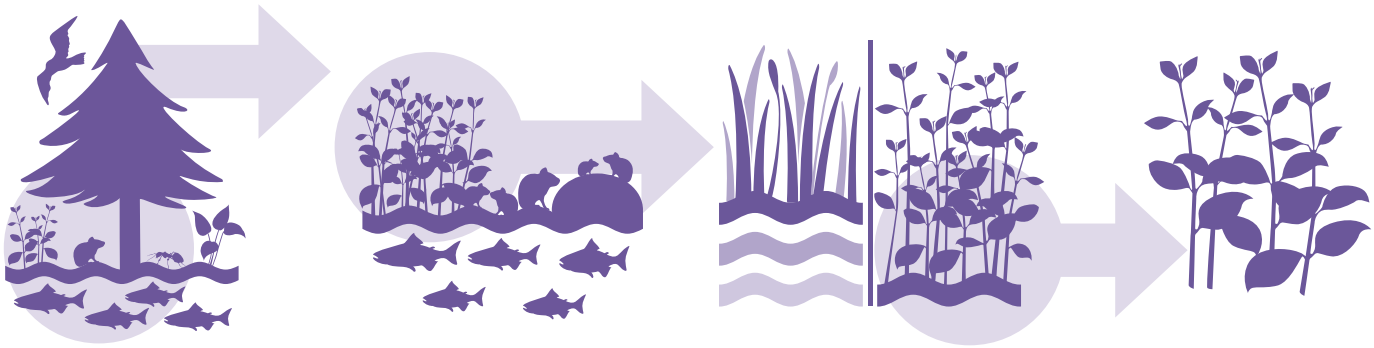
Because IAPs have been artificially introduced to an area by humans, they have not evolved to be a part of the local ecosystem. In their country of origin, they are kept in check by insects, diseases or fungi that feed on them and control their numbers. These natural enemies are often missing in the new environment, which means the IAPs can grow without anything to stop them.

4 Invasive and competitive

Not all alien plants become invaders. But those that find themselves in a suitable climate where there are no natural enemies can quickly become a serious problem. Many IAPs can grow fast, produce large, long-lived seedbanks and disperse easily. IAPs, especially trees, tend to use more water than natural indigenous vegetation. Pines (*Pinus* species), wattle (*Acacia* species) and gum trees (*Eucalyptus* species) invade water courses and can form dense stands.

INVASIVE ALIEN SPECIES IN THE SOUTH AFRICAN CONTEXT

There are currently 2 033 listed alien species in South Africa, consisting of marine organisms, freshwater fish, insects and plants. Altogether 771 of these are invasive, while 107 of them are found to have a major impact on the environment. Of the 107 problem species, 80 of them are plants. This practical guide focuses only on the invasive alien plant species.



2 033
ALIEN SPECIES IN SOUTH AFRICA

771
OF THESE ARE INVASIVE

107
OF THESE CAUSE MAJOR IMPACTS

80
OF THESE ARE PLANTS

European blackberry (*Rubus fruticosus*) originates from the Mediterranean region of Europe. It outcompetes indigenous woody and grassland species.

MANAGING INVASIVE PLANTS – WHY IS IT NEEDED?

By disrupting natural ecosystems, taking up space and using natural freshwater resources – especially in a water-scarce country like South Africa – IAPs can cause serious damage to the natural environment. Clearing and controlling IAPs can help to prevent some of these negative impacts.

7 NEGATIVE IMPACTS OF INVASIVE ALIEN PLANTS

1 Overuse of water

A single large invasive alien tree can use between 100 and 1 000 litres of water per day, significantly more than the average indigenous plant. They use so much water that they decrease the flow of streams and reduce the amount of water that reaches dams. South Africa loses as much as 2 500 million m^3 of water to IAPs every year. This is a significant amount in a country that is already suffering from water shortages. Some of the worst-affected river catchments are in the Western Cape.

2 Decreased agricultural production

IAPs that spread through agricultural land reduce the space available for crops or livestock and this can decrease agricultural production. Managing IAPs is an added expense for farmers. The consequence is that these plants have a negative impact on the agricultural economy and ultimately affect food security.

3 Increased impact of wildfires

IAPs increase the risk of wildfires by increasing the amount of fuel available. Woody IAPs grow in dense stands that increase the biomass available to burn. Some species also contain flammable compounds. Wildfires in IAP-infested areas burn hotter and more intensely than wildfires in natural vegetation, and are more difficult to contain, increasing the danger to lives, livelihoods and the environment.

4 Reduced ecosystem services

IAP-infested habitats have a reduced capacity to deliver ecosystem services – such as providing clean water and healthy soils – that support a healthy living environment for people and animals. They can also cause a decrease in the availability of natural products such as medicinal plants, fodder and building materials.

5 Lower land values

IAP invasions have a significant impact on the sale value of land because the land has lower agricultural production value or the new owner will not want the expense of dealing with the problem.

6 Impacts of climate change

Many IAPs can easily adapt to take advantage of the changing climate and global warming. The Western Cape is predicted to get hotter, drier and have more extreme weather events, leading to significant shifts in biomes like the Fynbos. These changes favour the growth of IAPs. This means that some IAPs will become more aggressive and spread faster. There may also be new and emerging ones that benefit from a changing climate. Some species, like the Acacia, are legumes that can fix nitrogen, changing the chemical composition of the soil. This can make the natural ecosystems less resilient to climate change and more susceptible to secondary invasive species.

7 Biodiversity loss

Biodiversity is the variety of natural species living in an area and the relationship between them. IAPs outcompete and replace indigenous plants, causing a decline or even disappearance of biodiversity. Because IAPs tend to form dense stands where very little else can survive, they can have a devastating impact on local biodiversity. IAPs are one of the biggest causes of biodiversity loss worldwide. This is especially severe in places with unique and rich biodiversity, like the Cape Floral Region (see The Cape Floral Region – What are we conserving? page 7).

To address these negative impacts of IAPs, the government has put in place laws and regulations. The regulations identify which IAPs need to be eradicated or controlled based on their degree of impact. There are also measures to detect and prevent new invasions (see Legal requirements, page 14).

MANAGING IAPS – WHAT ARE THE KEY PRINCIPLES?

The management of IAPs is driven by two fundamental principles: **acting early and following up**.

1 Act early

Taking action to manage IAPs when they first appear is much easier and cheaper than addressing severe infestations. Younger IAPs that cover smaller areas of land can be controlled with less time, labour and equipment. So, making an investment in IAP management at an early stage will save costs over the long term. Monitoring land for new IAP infestations will help to combat them in good time.

2 Follow-up

Follow-up and ongoing maintenance are essential to protect the investment made in IAP management. Regular follow-up treatment will stop any regrowth and prevent secondary infestation.

Any IAP management programme should follow three phases:

Phase 1 – Initial control

Drastically reducing the existing population (potentially including biocontrol)

Phase 2 – Follow-up

Controlling seedlings, root suckers and regrowth

Phase 3 – Maintenance

Sustaining low and decreasing IAP numbers with annual control

A clearing team in the Vyeboom Wetland near Theewaterskloof Dam in the Western Cape stacking cut black wattle. © WWF

TYPES OF IAPS – HOW DO THEY DIFFER?

Invasive alien plants are often grouped into different types. The management methods for each type can be more or less effective depending on where the IAPs grow, how they grow or how they reproduce. The types of seeds will influence how they need to be managed.

Water hyacinth (*Eichhornia crassipes*) is often labelled as the world's worst aquatic weed because of its invasive potential, negative impact on aquatic ecosystems and the costs involved in controlling it. © Debbie Muir / NRM

WHERE THEY GROW

In water

These IAPs are known as aquatic IAPs, live mainly in water and can tolerate very wet conditions. Aquatic species invade rivers, dams and wetlands. Water Hyacinth (*Eichhornia crassipes*), for example, is a floating plant that is highly invasive in South Africa.

On land

These IAPs are known as terrestrial IAPs and grow on land. Silky hakea (*Hakea sericea*) is an example. Because so many IAPs fall into this type, they are usually further categorised according to other growth forms.

On riverbanks

These IAPs are plants that grow on the land along the edge of a river, also known as riverbanks or riparian areas. Black wattle (*Acacia mearnsii*) is an example. This can be viewed as a subset of the terrestrial grouping. The interface between land (terrestrial) and water (aquatic) areas are particularly susceptible to severe infestations that cause serious impacts.

HOW THEY GROW

Root systems

Some IAPs have long, deep taproots that make pulling out the plant difficult. Port Jackson (*Acacia saligna*), for example, has a tap root system. If pulled it can break off at the base and the plant will resprout. IAPs with shallow root systems can be pulled out more easily. Some plants grow from root suckers or rhizomes (underground stems) that connect plants below the ground. Saplings of invasive poplars (*Populus* species), for example, are connected to the parent tree. Both need to be treated during clearing operations.

Dormancy

Some IAPs may go through periods of dormancy, which is when growth stops for a while and the plant may lose its leaves. *Populus* species, for example, are widely invasive in South Africa and are deciduous. Some control methods are more effective when the plant is actively growing or has leaves, so it is important to know which IAPs have a dormant period, and when it is.

Bark types

Some IAPs have very thick bark. This will influence the method of control that should be used. The bark of *Eucalyptus*, for example, is thick, so tougher ring-barking methods will be needed.

Climbers

Some climbing plants are particularly serious invaders, like the Madeira vine (*Anredera cordifolia*). Invasive climbers can grow over and overwhelm natural plants. They spread rapidly and can be difficult to control.

An invasive alien weed: pampas grass (*Cortaderia jubata*), which is native to South America. © Ed February

Other ways of grouping IAPs

Emerging IAPs

Some plants with invasive tendencies are already present outside of their natural distribution, but have not become widely established as yet. They often have horticultural value, but can have a negative impact on natural ecosystems, biodiversity, livelihoods and human health if allowed to continue to expand outside of their natural range. It is important to be on the lookout for new invasive species.

Indigenous invasive plants

A few native species can become invasive due to human-made changes to the environment, such as altered wildfire regimes or pollution. The indigenous bitou (*Osteospermum moniliferum*), for example, can become dominant and cover large areas, reducing the species diversity in smaller isolated remnants in Fynbos systems. Nutrient enrichment (eutrophication) of wetlands also leads to indigenous reeds such as bulrush (*Typha capensis*) becoming dominant.

HOW THEY REPRODUCE

Reseeders

These are plants that reproduce by producing lots of seeds. The parent plant may be killed, but new plants will grow from the seedbank in the soil or from seeds released from cones which had stored the seeds in the canopy. Different species have various methods of spreading their seeds, such as wind or water dispersal. Many species also exhibit fire-activated seed germination. Hakea, for example, is a serious invasive plant in South Africa. It produces seed pods that split open after a wildfire to release winged seeds that disperse in the wind.

Resprouters

These types of plants can grow back after they have been damaged by wildfire or cut down. New shoots grow from the base after the top of the plant has been removed. This is also known as coppicing. Invasive eucalypts in South Africa, for example, will grow new stems if the main trunk is felled. Resprouting may mean that more than one control method, including herbicide, will be required for follow-up treatment.

Vegetative regrowth

Some plants do not only rely on their seeds for survival. Some IAPs can grow from a piece of the parent plant, like a leaf or stem. This is called vegetative regrowth. In some invasive cactus species, for example, each leaf has the potential to grow into a new plant if it comes into contact with the ground.

LEGAL REQUIREMENTS

Landowners have certain legal responsibilities relating to invasive alien plants on their land. These are specified in laws about environmental management, agriculture, water, heritage, health and safety, and the application of herbicides.

The legal obligations of landowners with IAPs on their land are summarised in this section. You will find a brief explanation of the relevant laws and regulations relating to IAPs, including what actions are required for different categories of IAPs.

The headwaters of the Jonkershoek / Eerste River in the Jonkershoek Nature Reserve near Stellenbosch in the Western Cape.

BIODIVERSITY LAWS – WHAT ARE THE LEGAL OBLIGATIONS?

As invasive alien plants can have a negative impact on biodiversity, laws protecting biodiversity include regulations to control the spread of IAPs. The owner of land where IAPs occur carries responsibilities under these laws.

BIODIVERSITY ACT

The National Environmental Management: Biodiversity Act 10 of 2004 is administered by the Department of Environment, Forestry and Fisheries. Its purpose is to conserve South Africa's biodiversity. The Alien and Invasive Species Regulations are published under the Act. These regulations go together with a national list of invasive species that puts IAPs into categories.

Duty of care

Certain sections of the Biodiversity Act impose a 'duty of care' that applies to landowners. A duty of care means that people must take reasonable action to prevent harm to the environment. A person who owns land where IAPs occur needs to take steps to control them, prevent them from spreading and minimise harm to biodiversity.

Categories

The list of invasive species under the Biodiversity Act has four different categories. Different obligations apply to each of these categories (Table 1).

Table 1: Categories of IAPs under the Biodiversity Act

	Category 1a	Category 1b	Category 2	Category 3
Definition	A species that must be combated or eradicated	A species that must be controlled	A species that requires a permit	A species that is subject to certain prohibitions
Actions required	• Take immediate steps to eradicate the invasive species using appropriate methods.	• Take steps to control the invasive species using appropriate methods.	• Apply for, and comply with, a permit to conduct restricted activities (e.g. import, possess, grow, move, trade, dispose of or spread the species).	• Control the species if it spreads to riverbanks. • Planting, propagating, and trading in the species are not allowed.

Obligations

Landowners are required to do the following:

- Notify the responsible provincial agricultural authority in writing if a Category 1 invasive species occurs on their land.
- Comply with any relevant Invasive Species Management Programme.
- Allow an official onto the land to monitor, assist with, or implement control of a listed invasive species.
- Take measures to control the invasive species, depending on the category it is listed under.
- Conduct control activities cautiously to cause the least harm to biodiversity and the environment.
- Inform the buyer in writing of invasive species on the land, if the land is to be sold.

Offences

If a landowner does not obtain the necessary permit or does not take the required steps to control an invasive species, they can be found guilty of an offence. They may be sentenced to a fine of up to R10 million, or imprisonment for up to 10 years, or both.

AGRICULTURAL LAWS – WHAT ARE THE LEGAL OBLIGATIONS?

Invasive alien plants can have a negative impact on agriculture, so agricultural laws include regulations to prevent their spread. Requirements under agricultural laws may apply to a landowner, or to a land user who has a right to use the land for a certain purpose.

CARA

The Conservation of Agricultural Resources Act 43 of 1983 (CARA) is administered by the Department of Agriculture, Land Reform and Rural Development. Its purpose is to look after South Africa's agricultural resources. The CARA does not use the term IAPs but refers to "declared weeds" or "declared invader plants".

Methods

The CARA places a general ban on any conduct that would disperse a declared weed (e.g. selling, advertising, keeping, delivering). It can also require land users to use specific methods to control weeds, depending on what is most appropriate for the species and ecosystem concerned (see IAP management methods, page 32). Methods include:

- Uprooting, felling, cutting or burning
- Treatment with a registered herbicide
- Biological control
- Any other method of treatment
- A combination of one or more methods.

Categories

The actions required depend on which category the plant falls under in the CARA regulations (which might differ from province to province) (Table 2).

Table 2: Categories of IAPs under the CARA

	Category 1	Category 2	Category 3
Definition	Alien plants that are absolutely prohibited and will no longer be tolerated. Their harmfulness outweighs any useful properties they might have.	Alien plants with proven potential to become invasive, but which have some beneficial properties that warrant their continued presence in some circumstances.	Alien plants with proven potential to become invasive but that are popular ornamentals or shade trees that will take a long time to replace.
Actions required	• Take steps to prevent the occurrence of these plants on any land or water surface. • These plants may no longer be planted, and all trade in them is prohibited. • They may not be transported or allowed to disperse.	• Take steps to prevent the occurrence of these plants on any land or water surface. • An exemption can be obtained. • These plants may be kept in special areas, demarcated for that purpose. • Growing these plants is a "water use" in terms of the National Water Act 36 of 1998.	• These plants are allowed to remain where they are, as long as they do not grow in watercourses and steps are taken to prevent them from spreading.

Offences

Failure to comply with any measure in terms of the CARA regulations can attract a fine of up to R5 000 or up to two years in prison (or double for a second conviction).

WHICH OTHER LAWS REFER TO IAPS?

Several other national laws may have some relevance to invasive alien plants. These are listed below. There may also be some regional requirements, like municipal by-laws, but those are not covered here.

Environmental laws

The National Environmental Management Act 107 of 1998 (NEMA) is the main law governing environmental management in South Africa, including environmental impact assessments. It too contains a "duty of care": every person must take reasonable care to prevent harm to the environment. Importantly for IAP management, it allows employers or company directors to be held responsible for offences under the Biodiversity Act or the CARA. If a person is convicted, the court can also ask them to pay the costs to deal with environmental damage that was caused.

Water laws

The National Water Act 36 of 1998 places all South Africa's water resources under the ownership and governance of the state. Anyone who wants to use water for certain purposes must apply for authorisation. There are some water uses that may be relevant to IAPs. Planting IAPs is considered a "stream flow reduction activity" that requires a water-use licence. Also, if mechanical removal of IAPs alters the banks of a river, or changes the flow, it can be considered a water use.

Forest laws

The National Forests Act 84 of 1998 can declare some trees, including IAPs, as "champion trees". The River Red Gum (*Eucalyptus camaldulensis*) that was planted in Bergzicht market square, Stellenbosch, in 1880 is an example of a "champion tree". These individual trees are protected and it is illegal to cut them down.

Agricultural remedies

The Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36 of 1947 regulates fertilisers, feeds and remedies used in agriculture. The chemicals used for IAP management are regarded as agricultural remedies. The Farm Feeds Act contains some requirements for the registration, proper use and handling of these chemicals (see Herbicide safety, page 52).

Health and safety laws

The Occupational Health and Safety Act 85 of 1993 promotes the health and safety of workers in the workplace. It contains information on the duties of employers and employees to ensure safe working conditions (see Health and safety, page 46). It also has some provisions that may be relevant for handling IAPs that are dangerous to human health.

Heritage laws

The National Heritage Resources Act 25 of 1999 protects South Africa's heritage resources. IAPs are sometimes protected under these laws, e.g. trees growing on heritage sites.

Fire management laws

The purpose of the National Veld and Forest Fire Act 101 of 1998 is to prevent and combat wildfires. It requires every owner of land where a fire may start, burn or spread to maintain a firebreak that is free from flammable material (see Integrated planning for fire and IAPs – Why is it important? page 24).

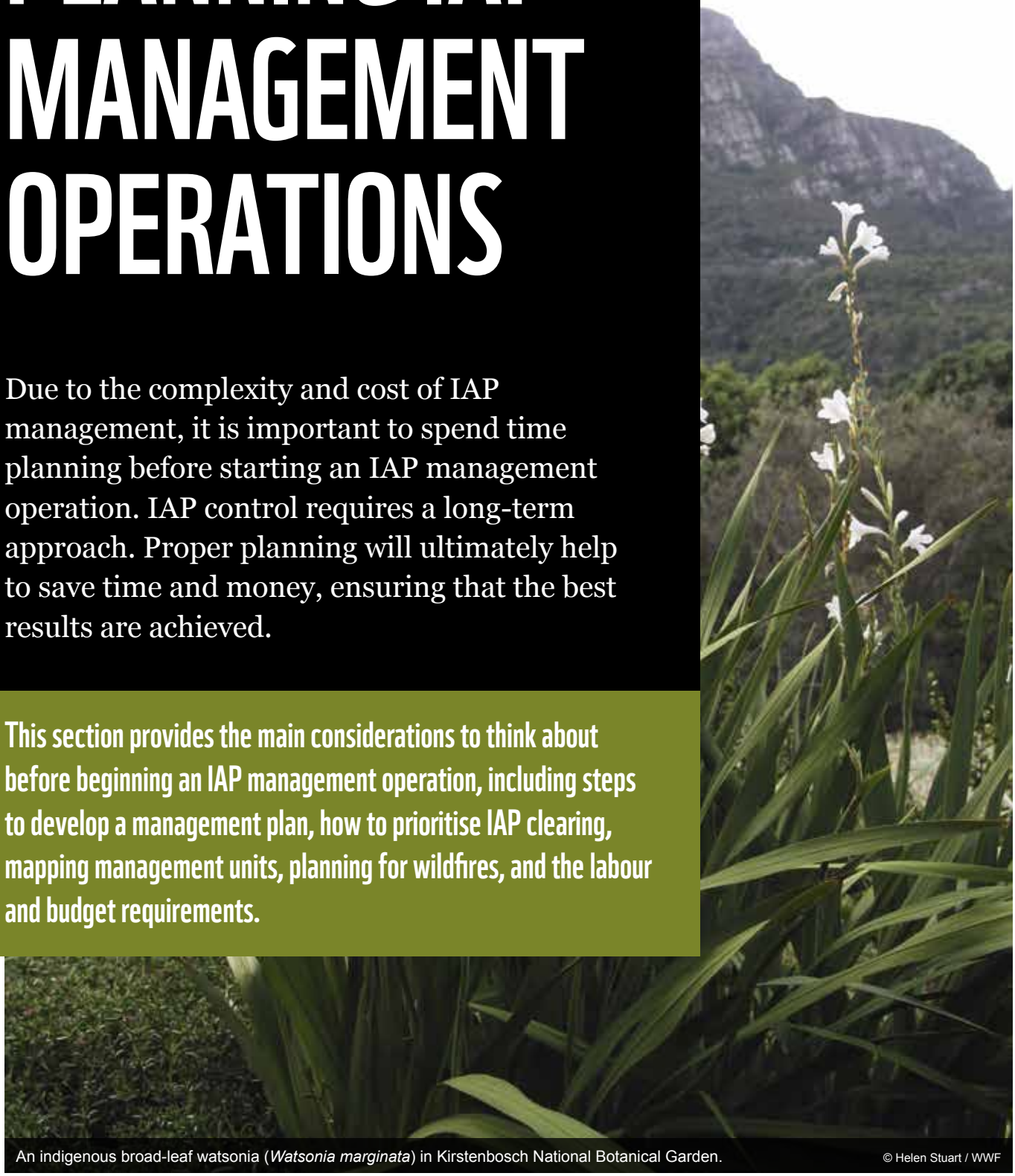
For more information, see Appendix 1: Legislation guideline for invasive alien species (page 66).

Houses in Lakeside, Cape Town, coming under threat from a wildfire above Boyes Drive during 2005. © Bruce Sutherland

PLANNING IAP MANAGEMENT OPERATIONS

Due to the complexity and cost of IAP management, it is important to spend time planning before starting an IAP management operation. IAP control requires a long-term approach. Proper planning will ultimately help to save time and money, ensuring that the best results are achieved.

This section provides the main considerations to think about before beginning an IAP management operation, including steps to develop a management plan, how to prioritise IAP clearing, mapping management units, planning for wildfires, and the labour and budget requirements.



An indigenous broad-leaf watsonia (*Watsonia marginata*) in Kirstenbosch National Botanical Garden. © Helen Stuart / WWF

IAP MANAGEMENT APPROACH – WHAT SHOULD A LAND USER CONSIDER?

The context within which IAP management is planned will determine the approach taken to the management programme.

CONSIDER THE CONTEXT

Goals

Much depends on your goals for the future management of the invaded area. Clearing IAPs for immediate development of the land, for example, will require different methods compared to managing IAPs to restore functioning of the natural environment.

Environment

The type and condition of natural vegetation in the area may determine the IAP control methods so as to limit a negative impact on the surrounding environment.

Season

The season of the year may influence accessibility to the site, visual identification of species through flowering, the safe and effective use of herbicide and fire, and the ecological impact of IAP management. All these factors will have an impact on the number of available work days for clearing.

A Genadendal community member collecting firewood along the densely invaded Riviersonderend River. © Helen Stuart / WWF

4 STEPS TO DEVELOPING A LOGICAL IAP MANAGEMENT PLAN

As important as considering the context within which one is planning IAP management, is considering the steps to develop a logical plan and set priorities for the IAP clearing process. By following a few basic steps, it is relatively easy to put together a simple but effective IAP management plan for a property.

1. SURVEY THE AREA

- Walk the area
- Take photographs
- Review aerial photographs
- Identify IAPs

2. IDENTIFY UNITS

- Uniform areas
- Similar IAPs
- Topography
- Manageable size
- Fire history

3. PLAN ACTIONS

- IAP control methods
- Burning schedule
- Optimal sequence
- Seasons

4. CALCULATE COSTS

- Equipment needed
- Labour required
- Areas and norms
- Keep records

1 Survey the area

A suitably experienced person should survey the areas to be cleared and identify the IAPs that occur there. For very large areas, mapping of IAP coverage is essential, but for small sites it may not be necessary. It is best to walk the area to be mapped, and not just to rely on viewing the area from a distance or via an aerial photo. Photographs of the site should be taken to assist the process of monitoring the impact of the IAP management programme (see Mapping management units – What does this involve? page 23).

2 Identify units

Break the property down into sensible management units. A management unit is a uniform block of land, with similar soil, slope, history, etc. that will respond in a similar way to a management action. For IAP management, a management unit may be an area of uniform species, age classes and densities (and the potential for the use of fire as an IAP management method, if appropriate) (see Mapping management units – What does this involve? page 23).

Give each management unit a unique identification number. Compile an inventory for each management unit, including the density and age of IAPs.

3 Plan actions

Identify what management actions are needed in each management unit, taking into account the integration of fire and IAP management, if appropriate. Determine the sequence and which methods or combination of methods is best for the site and target species. Consider what field equipment and herbicides are required. Plan the order in which management actions should be implemented, taking into account the effect or advantage of implementing actions in a particular season (see 9 priorities when clearing IAPs, page 21).

Check with your local Fire Protection Association (FPA) to ensure that your operation has received approval from the relevant authorities.

4 Calculate costs

Using the information gathered on the size of the management units, the density of IAPs and selected control methods, calculate the labour required and the costs (see How much labour and budget will a land user need? page 26).

Land users should keep a note of all expenses incurred from IAP management as these are tax deductible.

For more information, see Appendix 5: Template for a farm-level alien plant control plan (page 66).

9 PRIORITIES WHEN CLEARING IAPs

It is often not possible to tackle all stands of IAPs at once. It is also important not to take on too much at one time, remembering that each area will require follow-up treatments. For this reason, it is useful to plan where to start by setting priorities.

1 Prevent new invasions

Target emerging or new species before they have a chance to set seed and spread.

2 Follow-up first

Areas that require follow-up treatment should be prioritised over areas that still require initial clearing. Follow-up treatment is essential to curb the further growth and spread of IAPs. Follow-up reinforces previous efforts in which you have already invested time and money, so it is important not to waste this investment. This also applies to an area that has recently been burnt: the fire acts as an initial clearing mechanism, so if these areas are prioritised, it will cost less to clear while the growth is young.

3 Limit wildfire risk

Areas of IAPs that pose a wildfire risk to houses or infrastructure should be targeted as a priority. Effective firebreaks should be created where woody or fire-prone IAPs are located in dense stands near settlements, power lines, etc.

4 Start with less dense stands

Treatment of low-density, young invasions should be a priority to halt the invasion and prevent the build-up of IAP seedbanks. This is especially important in fast-maturing, wind-dispersed species such as hakea and pine (*Pinus* species). Less dense areas will also require fewer resources and easier follow-up treatment. Dense mature stands should be left for last, as they probably will not increase in density or pose a greater threat than they do at present. Clearing very dense areas requires a commitment to expensive, long-term follow-up treatments.

5 Start upslope

Consider the natural gradient of the area being cleared. All operations should ideally follow the slope or drainage lines. Clearing needs to start from the highest point and move downstream and downslope. This ensures that potential sources of IAPs – seeds and other regenerative material – are eliminated upstream of the working area to avoid reinfestation.

6 Work from the outside inwards

On gentle gradients, clearing should start from the outside of a work block and move inwards towards the centre, to contain IAPs within a confined area.

7 Follow contours

To avoid the threat of soil erosion when clearing dense infestations of IAPs on steep slopes, work should progress horizontally along the contours. IAPs should be cut in bands of 3 m wide along the slope contour and the cut material should then be rolled back so that it forms a “frill” along the band. Openings between contoured stacks should be staggered to further reduce water run-off.

8 Focus on riparian areas

Rivers, streams and wetlands are a priority when planning the clearing of IAPs. IAPs often use a lot of water and can reduce water flow and quality if water systems are heavily invaded. Waterways also provide a way for IAPs to spread rapidly downstream.

9 Collaborate with neighbours

Collective management and planning with neighbours allow for more cost-effective clearing and maintenance. This reduces reinfestation. It also allows a more integrated approach with respect to fire and fuel-load management.

Cleared material stacked along contour lines. © Saskia Fourie / WWF

MAPPING – WHY IS IT ESSENTIAL?

Mapping skills are useful for anyone undertaking the management of IAPs. Maps such as topographical and aerial maps can help land users to understand the location of the area, its boundaries and the layout of the landscape to successfully plan and carry out the IAP management work.

Maps can be used to show where the IAP infestations are, and how management operations should be approached. They can also be used to schedule IAP control treatments and calculate costs.

TYPES OF MAPS NEEDED FOR PLANNING IAP MANAGEMENT

1:50 000 topographical map of the Berg River Dam, one of Cape Town's six water supply dams.

1:10 000 aerial photograph used for mapping invasive alien plants.

Topographical maps

A topographical map shows the layout (or the topography) of the land. It shows the height above sea level using contour lines, which also gives an indication of the slope of the land. This type of map is useful for assessing accessibility and walking time to an area. Rivers, roads and compass bearings are shown on these maps.[1]

It is advisable that a contractor has a topographical map of the area where the work is to be conducted.

Aerial maps

Aerial maps are made from photographs taken from aeroplanes, drones or satellites. These types of maps are easy to understand because they provide a picture and not just a line drawing of the area. But they give less detail than topographical maps. It is important to remember that you need to get the most up-to-date aerial map, as landscapes change over time due to fires, development, etc.

Free open source GIS software is available to anyone to view and manipulate spatial information, e.g. Quantum GIS, Google Earth.

For more information, topographical and aerial maps are available from the National Geospatial Information (NGI) agency (Appendix 9) (page 66).

[1] Deacon, G. and Harding, G. 2007. *Worksite Management Manual.*

MAPPING MANAGEMENT UNITS – WHAT DOES THIS INVOLVE?

Walk the area

Before starting the clearing work, it is essential to walk through the whole area in a set pattern. Walking the area will help to gather information about the IAPs on the land. This information can be used to map out management units.

Information will need to be gathered about:

Species

Managing IAPs cannot be done if the IAP species have not been identified. Only once the species has been identified can the appropriate IAP control methods be selected.

Growth form

How the IAP grows is known as its growth form or habit (see Types of IAPs – How do they differ? page 12). There are many different growth forms for plants, each with different control strategies.

Age classes

The age, stem thickness and height of the IAPs will determine the type of control method. The age of a plant is usually divided into the following classes:

- Seedling (diameter at ankle height: 0–15 mm)
- Young (diameter at ankle height: 16–50 mm)
- Adult (diameter at ankle height: > 50 mm)

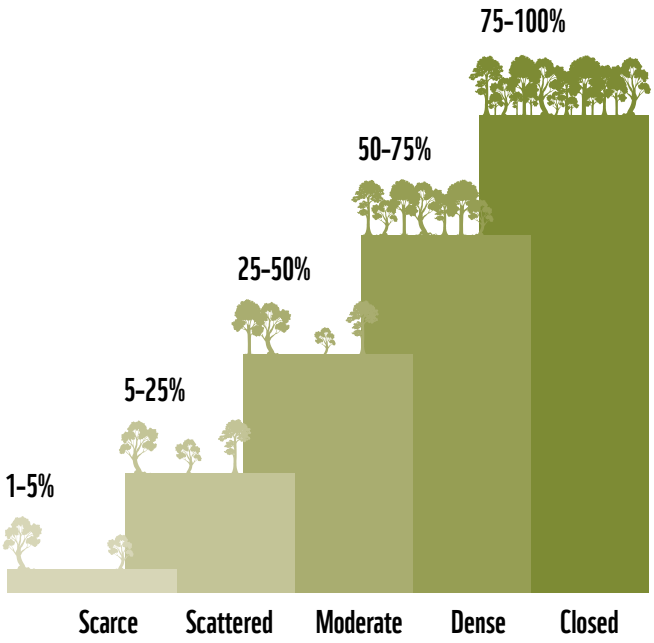
See IAP management methods (page 32).

Remember, height does not equate to age. Some mature plants do not grow very tall. Generally, anything lower than hip height is classified as a seedling.

Density class

The density of IAPs refers to how closely packed they are. It is measured by estimating the ground cover or the number of stems in an area. Density is usually expressed in percentage, ranging from 0% (no IAPs) to 100% (fully covered with IAPs). It is commonly estimated using simple visual methods to assess the coverage of each IAP species within a set area. The categories generally used are shown in Figure 1. Densities will be a significant determinant of how much time and money it will take to clear the area.

Figure 1: Density class categories for IAPs



Size of area

The size of the area, measured in hectares, will affect the number of working days needed to complete the treatment area. Integrated fire and IAP management may include smaller IAP management units within larger fire management units. In these cases, a fire management unit is an area that can be burnt in a prescribed burn. The rule of thumb is that the unit size is determined by what can be burnt in one day.

Ensure that the boundaries of the area to be cleared are visibly marked to orientate the team.

The information gathered on the species, growth form, age and density across the land will help to decide on management units. A useful management unit is one where the IAPs are of the same species, age and density. Then the most appropriate control treatment can be applied to each unit (see 4 steps to developing an IAP management plan, page 20). Also consider appropriate units for Integrated planning for fire and IAPs – Why is it important? (page 24).

For more information, see Appendix 6: Basic mapping skills (page 66).

INTEGRATED PLANNING FOR FIRE AND IAPS – WHY IS IT IMPORTANT?

Fire management and the management of IAPs are inextricably linked. The role of wildfire is central to planning IAP control as it presents both a threat to IAP management operations and an opportunity for IAP control.

Threat

Wildfire management is necessary to reduce fire hazards and control unscheduled wildfires that threaten property, crops, infrastructure and IAP management investments already made. In the absence of IAP control, successive wildfires in areas invaded by IAPs lead to densification and further invasion. This in turn increases fuel loads and rate of spread, fuelling a vicious cycle. Uncontrolled wildfires often defeat the purpose of mechanical and biological control. Only once a sound level of wildfire management is in place should alternate IAP control strategies be implemented and integrated.

Opportunity

Fire, with appropriate management, is a cost-effective IAP control method. Fire can be used to control IAPs and maintain optimal water yield in catchments. It is critical to understand the effect of fire as a driver in Fynbos and other fire-driven systems and recognise that fire may be used as an effective management tool.

Integrated planning is required to coordinate the management of fire and IAPs to take advantage of the opportunities and limit the threats. Planning firebreaks (fuel breaks) and treatment blocks, and being adequately prepared are essential for successful fire management. Land users should devise a joint strategy guided by both legal and practical management requirements. An understanding of fire ecology and the natural processes will further enhance land users' wildfire management capabilities. There are significant benefits to membership of a Fire Protection Association, which promotes and supports fuel-load management.

For more information, see Appendix 7: Fire Protection Associations in the Western Cape (page 66).

To set up integrated fire and IAP management, it is necessary to identify management units that can be subjected to planned burns. Management actions can then be scheduled in these units to optimise both ecological burning and IAP management at the right time. It is important to note that too frequent or unseasonal fires can have a significant negative ecological impact. It is also crucial to strive for a mosaic of different veld ages across the greater landscape.

For more information, see CapeNature's fact sheet Appendix 10: What a landowner needs to know about fire management (page 67).

A member of a fire management team in action. © Tessa Oliver

HOW TO PREPARE FOR AND MANAGE WILDFIRES

Landowners should take measures to prevent wildfires from starting and spreading to neighbouring land. They should be ready to manage any wildfire that occurs on the property.

Legislation

The requirements for fire prevention and preparedness are covered in the National Veld and Forest Fire Act 101 of 1998. There are penalties if landowners fail to follow these provisions (e.g. firebreaks, notification of intention to burn).

Invasive alien plants

Bringing IAP infestations under control is an important step towards preventing wildfires, as these fires burn hotter than Fynbos fires. Wildfires on IAP-infested land are very difficult to control, especially under dry, windy and hot conditions.

Firebreaks

A firebreak (fuel break) should be prepared and maintained around the property, or firebreak exemption should be sought. It should be wide and long enough to assist in managing a wildfire. It should also be reasonably free of flammable material that might carry a fire across it. The firebreak should not cause soil erosion.

Fire Protection Association (FPA)

The landowner should join the local FPA. Landowners should notify the FPA and neighbouring landowners about fires. Landowners should be ready to fight fires by acquiring equipment and having competent personnel available to fight fires, or appoint an agent to do so. In an emergency, fire services and FPA officials should be given permission to enter the land to fight fires.

For more infomation, see Appendix 7: Fire Protection Associations in the Western Cape (page 66).

A member of a fire management team using a drip torch to set fire to the veld. © Tessa Oliver

HOW MUCH LABOUR AND BUDGET WILL A LAND USER NEED?

The amount of labour (in person days) and the budget a land user will need will depend on the size of the area to be cleared of IAPs, the nature of the terrain, the species present and the age and density of the IAPs.

By mapping out management units, the area can be worked out in hectares (see Mapping management units – What does this involve? page 23). This information can be used to estimate labour (see Funding opportunities, page 64) and herbicide costs. Also see Figure 2.

Person days

Labour required for IAP management is measured in person days (Pd). A person day is the amount of work that one person can do in one day. The number of person days needed for certain species, ages and densities of IAPs have already been worked out and these norms are available on norm sheets.

> Norm sheets are available from the Department of Environment, Forestry and Fisheries Natural Resource Management Programmes offices.

To calculate person days, the area to be cleared (ha) is multiplied by the "norms". If working in a riparian area, add 50% to the total person days to include time for carrying out the material from the natural flood zone. If cutting and stacking is required, add an additional 20%.

The cost of labour can be calculated by multiplying the total person days by the cost per person per day. Every team's dynamics are different, so it is advisable to eventually work out one's own norms over time. Keep records of production against the norms and adapt the norms to local conditions.

Person days	=	area (ha) × norm
Cost	=	total person days × cost per person day

Herbicide cost

Herbicide norms appear on the herbicide norm sheets, which are included when the product is purchased, and are used to calculate herbicide requirements and costs. Herbicide cost is calculated by multiplying the area (ha), the density of IAPs, the litres of herbicide required according to the norm sheet, and the cost per litre.

Herbicide required	=	area (ha) × density (proportion) × dilution factor (ha/litre)
Cost	=	total litres required × cost per litre

Figure 2: Aspects that may influence the costing of an IAP management operation

Vegetation
- Species
- Density (coverage % or stems/ha)
- Area (ha)
- Height (m)
- Growth stage

Terrain
- Slope
- Access
- Transport costs

Herbicide
- Herbicide type
- Rate spray volume (per ha or %)
- Knapsacks/sprayers/nozzles
- Herbicide costs

Equipment
- Slashers/brush cutters
- Maintenance
- Equipment costs and depreciation

Labour
- Type (skilled/unskilled)
- Task rate (person days/ha)
- Number of labourers
- Availability
- Salaries/wages
- Benefits/bonuses
- Training costs

Programme
- Duration
- Number of treatments

For more information, see:
Appendix 3: Work sheet for field verification (page 66).
Appendix 4: Guidelines for clearing time (Person days/ha norms) (page 66).

An indigenous pincushion protea (*Leucospermum spp*.) in Kirstenbosch National Botanical Garden. © Helen Stuart / WWF

WHAT OTHER FACTORS SHOULD ONE CONSIDER FOR IAP MANAGEMENT?

In addition to the context, methodology and priorities, other factors may influence the methods, extent and location of an initial IAP management operation, and warrant consideration.

A chainsaw operator undertaking alien clearing in the Kouga River in the Eastern Cape, an important catchment for water supply to the Nelson Mandela Metro. © Rodney February / WWF

Combinations of control methods

An IAP control plan should integrate the various control methods to optimise effectiveness and limit environmental impact. Moderate to low IAP infestations in wetland areas, for example, can be treated by implementing controlled burning at the beginning of autumn, followed by mechanical removal or herbicide application in mid-spring (see IAP management methods, page 32).

Infestations in wetlands

Note that wetlands are protected by the National Water Act 36 of 1998 and the National Environmental Management Act 107 of 1998. No heavy machinery may be used to remove IAPs in wetland areas without prior authorisation from the relevant government departments.

Disposal of material

Disposal of the cut IAP material needs to be carefully considered. Whatever disposal method is selected must meet all the legal requirements and must not create a risk for residents and infrastructure (see How can one responsibly manage plant material? page 45).

Biomass potential

Dense stands of IAPs may have the potential to be harvested for additional value, e.g. timber, firewood, briquettes or biochar, or even fuel for boilers. Using biomass provides additional benefits, as reducing fuel loads improves fire safety and rehabilitation potential.

Indigenous vegetation

Natural vegetation – including individual indigenous trees located among stands of IAPs – must be protected from damage during the clearing process. Indigenous trees and vegetation can be cordoned off or marked using danger tape to make sure workers know what must be protected. This approach will reduce the long-term cost of managing invasive alien plants by reducing the need for active rehabilitation, and protecting the cleared area from erosion and regrowth. In very sensitive ecosystems, IAP clearing interventions should ideally be done during the dry season when the vegetation is less sensitive to disturbance.

Rehabilitation potential

If the intention is to rehabilitate the area, further restoration methods may be needed. If appropriate in terms of locality and wildfire risk, stands of alien trees can be used to create nursery stands for forest species. This may be managed by selective removal of alien trees to allow indigenous forest to emerge over time (see Long-term rehabilitation, page 58).

Labour considerations

Consider the possible seasonal availability of human resources (e.g. personnel shortage in spring and summer due to irrigation, harvesting and other activities). Also consider the level of skills required.

Practical considerations

Think about the location of the site, the distances to travel and the accessibility for machinery. Plan to use existing access roads.

Threat to pastures and planted crops

Think about how the IAP management operation may enhance the essential economic activity on the property.

Ability to follow up

Follow-up treatments will be needed to maintain the initial investment. Do not start clearing an area if you will be unable to follow up as this can make infestations worse. IAPs are quick to regrow in disturbed areas and often out-compete indigenous vegetation. Different follow-up schedules (e.g. in terms of timing, frequency and approach to follow-up treatments) may be required for different species.

Management history

Previous management actions in the area that you intend to clear could play a role. Understanding the fire and IAP management history of the site will help to choose the appropriate methods and sequence of treatments. Wildfires, for example, may stimulate Acacia seedbanks in areas where seed-limiting biocontrol methods are not yet present. This will determine the appropriate follow-up methodology and costs (see What is biocontrol? page 41).

Ongoing evaluation

Land users will need to continually evaluate the success of the IAP management operations and potentially adjust the methods used. Other species may invade after initial clearing – this is known as secondary invasion – which may require different management methods.

For more information, see CapeNature's fact file Appendix 8: A landowner's guide to planning alien control (page 66).

An active restoration site on the Meul River, a tributary of the Riviersonderend near Greyton in the Western Cape. © Rodney February / WWF

WHAT BASIC TOOLS ARE REQUIRED FOR IAP MANAGEMENT OPERATIONS?

Conducting an IAP management operation will require a basic set of tools and equipment. Further requirements may depend on the specific control methods used.

Table 3: Tools and equipment for IAP management operations

(also see Personal protective equipment – What does it include?, page 50)

Item	Supervisor	Machine operator	General workers	Herbicide applicator
First-aid kit (and maintenance)	✔			
Fire beaters	✔			
Wajax can[2]	✔			
Chainsaw		✔		
Chainsaw maintenance items Chain lube Fuel mix Chain Bar Sprocket Sparkplug Round files Flat files		✔		
Combi-can		✔		
Fire extinguisher[3]		✔		
Sharpening kit		✔		
Sharpening kit tool pouch		✔		
Axe Axe handles Sharpening stones			✔	
Bow-saw/pruning saw Blades			✔	
Lopping shears			✔	
Spray can hand-held			✔	
Drip tray or sheet		✔		✔
Measuring jug, bucket, container				✔
Knapsack maintenance Parts				✔
Knapsack sprayer				✔
Stopwatch				✔
Tape measure (> 30 m)				✔

[2] A specially designed, rugged knapsack with a pump action that has been developed to squirt water on a fire. Very effective in extinguishing small fires.

[3] A fire extinguisher must be kept at the refuelling area to extinguish fires that can start when petrol lands on the exhaust of a hot chainsaw.

CHECKLIST FOR AN IAP MANAGEMENT OPERATION

When embarking on an IAP clearing programme, land users should bear in mind certain general principles. This will help them to choose the appropriate clearing method, be it manual, mechanical, chemical, biological or a combination thereof.

10 POINTS TO REMEMBER WHEN CONDUCTING AN IAP MANAGEMENT OPERATION

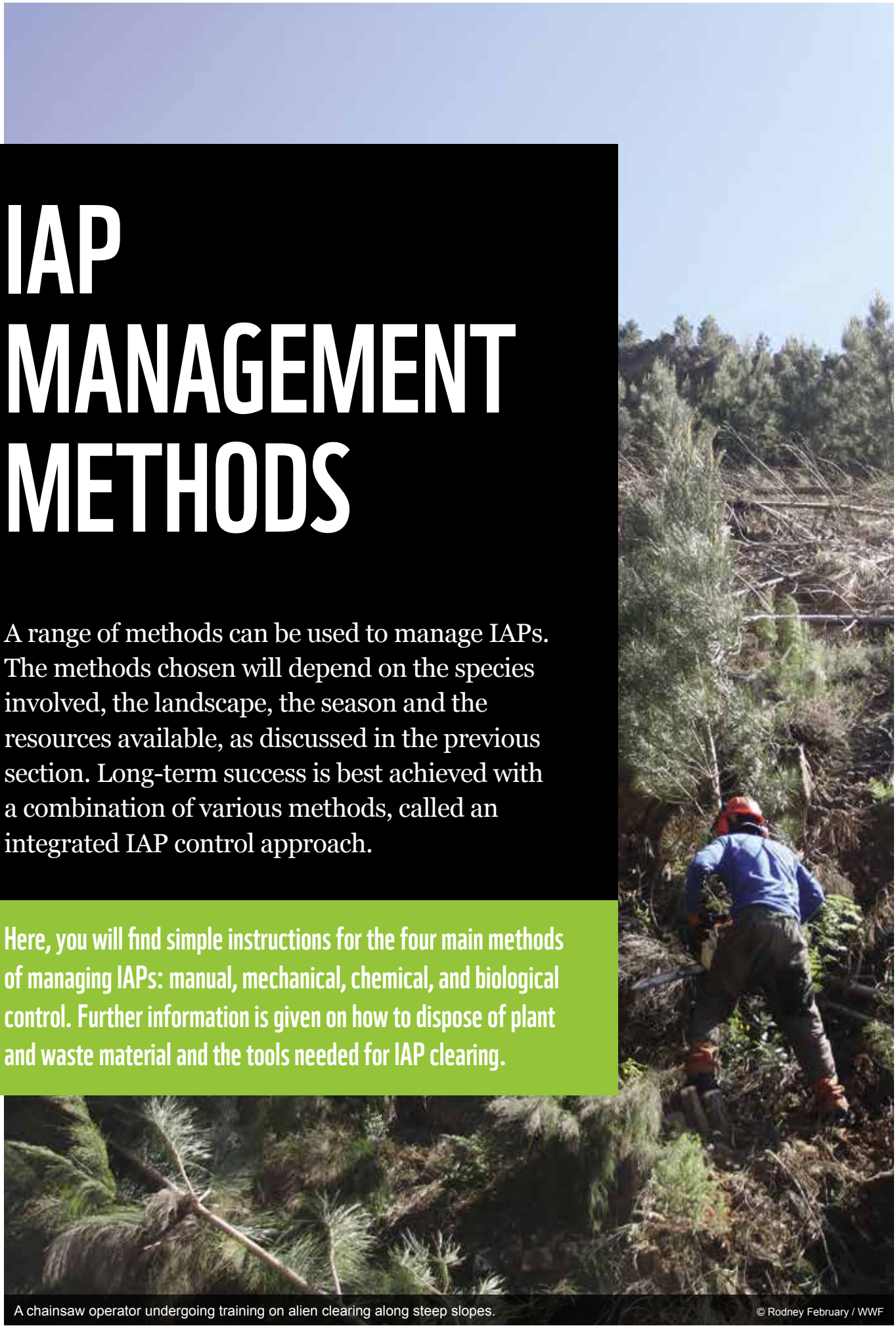
1. Always start at the highest point and work downwards, downhill or downstream.
2. Start from the edge of the infestation and work towards the centre.
3. Take care to prevent the spread of cuttings, which could take root further downstream.
4. Once plants have been removed, unstable slopes should be stabilised by erosion protection measures (such as geotextiles or other suitable material).
5. Keep accurate records of actions and costs to assist with future planning.
6. Control IAPs when the plants are young, rather than waiting until they are woody and difficult to remove by hand.
7. Manage IAPs before a wildfire burns the area, as the mechanical control thereafter is substantially more expensive (see Mapping – Why is it essential? page 22).
8. Set up an integrated fire and IAP management plan (see Integrated planning for fire and IAPs – Why is it important? page 24).
9. Take care to distinguish between young invasive species and Fynbos species (this could be difficult). Keurboom seedlings are remarkably similar to that of many acacia species seedlings.
10. Select the quickest and most effective way to efficiently kill a plant – time is money.

A Working for Water team untertaking slashing and stacking of the invasive weed lantana (*Lantana camara*). © LANDWORKS

IAP MANAGEMENT METHODS

A range of methods can be used to manage IAPs. The methods chosen will depend on the species involved, the landscape, the season and the resources available, as discussed in the previous section. Long-term success is best achieved with a combination of various methods, called an integrated IAP control approach.

Here, you will find simple instructions for the four main methods of managing IAPs: manual, mechanical, chemical, and biological control. Further information is given on how to dispose of plant and waste material and the tools needed for IAP clearing.



A chainsaw operator undergoing training on alien clearing along steep slopes.

MANUAL CONTROL OF IAPS – WHAT DOES IT ENTAIL?

Manual control is when a worker removes or kills each IAP through hand pulling, cutting, digging out, ring barking or bark stripping. Because it is so labour intensive, it is best used for lighter infestations, seedlings, single plants, plants that have shallow roots, or in very sensitive areas.

Hand pulling

Hand pulling is most effective when plants are small (30 cm), immature or shallow-rooted, and after rain.

- Use a pair of gloves and grip the plant firmly around the stem just above the root.
- Pull hard and remove the plant, roots and all.
- Kicking around the root area of the plant may help to loosen the root system, making it easier to pull out the plant.
- Shake the excess sandy material from the plant to ensure a higher mortality rate and make the plant easier to stockpile and lighter to transport.

Cutting

Chopping or slashing is most effective for young plants that are too large to pull out by hand, or for plants that have woody stems. It is best used on plants that are not resprouters. In the case of resprouters (coppicing), chopping must be combined with chemical treatment of the cut stumps.

- Use implements such as pangas (slashers/machetes), handsaws, bow-saws and axes to cut plants down as low as possible.
- Remember to wear protective clothing and keep team members at least two arm-lengths apart (see Health and safety, page 46).
- Stack removed material into piles of 2 m high and 3 m wide.

A team using the technique of cutting close to the ground combined with bark stripping, which eliminates the use of herbicide.

Digging out

Digging out IAPs involves the use of tools like hoes, sticks, tree poppers or spades. The entire plant and root must be removed.

- Dig around the plant, making sure the sand is loosened around the root system.
- Dig down under the roots, applying pressure, and wrench the entire plant out.
- Kicking the plant may help to dislodge it; however, care should be taken if the plant is seeding as dry seeds may be dislodged.
- Stack removed material into piles of 2 m high and 3 m wide.

Ring barking

Since this method means the tree is left standing, it is recommended only for single trees or very low-density invasions, not for stands. Ring barking on smaller diameter stems is ineffective and it would be quicker to just cut the tree down. Ring barking should be used on trees with stem diameters greater than 150 mm, where the time taken to fell, de-branch and stack would be excessive. Basal bark treatment could be considered as an alternative in some cases (see Chemical control of IAPs – What does it involve? page 36).

- Slashers or axes should be used for debarking.
- Remove the bark and cambium (outer rings where the trunk grows) in a continuous band around the trunk of the tree at least 25 cm wide, starting as low as possible.
- Where clean debarking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out.
- For better control of aggressively coppicing species, combine with bark stripping (right).

Bark stripping

Bark stripping is the removal of bark from the trunk between ground level and up to 1 m above ground. A suitable herbicide can be applied along with this method. Applications should be by means of a low-pressure, coarse-droplet spray from a narrow-angle solid-cone nozzle or by using a paint brush.

Bark stripping, ring barking and frilling should not be used as methods on any trees located next to rivers or infrastructure. Treated trees that are either dying or dead could fall into rivers and block the flow of water, or cause damage to infrastructure such as roads, fences, buildings and power lines.

Bark stripping removes the phloem layer of the plant, which will cause the tree to die over time. © Rodney February / WWF

Ring barking is used for larger trees. © Saskia Fourie / WWF

MECHANICAL CONTROL OF IAPS – WHAT ARE THE OPTIONS?

Mechanical control involves the use of machinery to clear IAPs and is often the most effective for larger individual plants. Cost effectiveness, personnel competency and safety remain important considerations.

Bulldozers

Although machines like bulldozers can bring additional strength to clearing more stubborn infestations, the use of heavy machinery has serious limitations:

- The disturbance to the soil and vegetation will lead to loss of natural biodiversity.
- Bulldozers create a fresh seedbed for germination of more invasive species.
- There are also unforeseen impacts caused by compacting the soil.

Because of these limitations, laws protecting natural veld, riparian areas and wetlands only allow heavy machinery to be used in areas that are already disturbed (e.g. cultivated lands, firebreaks and road verges).

Bulldozers have been used for IAP clearing with varied results.

- Use of machinery for IAP clearing must be compliant with the relevant legislation.
- The blade should be kept 15 to 20 cm above the ground to catch and push plants without gathering too much soil.
- The mix of soil and plants that is created makes disposal of plant material difficult and costly. Stacking into rows is the best option (see How can one responsibly manage plant material? page 45).

Felling equipment

Felling is appropriate where trees can be cut down and removed using chainsaws, bow-saws, brush cutters or slashers. Where trees cannot be removed (on steep slopes), it is better not to fell trees, but rather to control them where they stand. Where possible, large trees should be felled so that they fall uphill. Cut trees should be debranched.

Take wind direction into account when felling large trees with chainsaws. Always start downwind.

Heavy rollers

Heavy-duty forestry rollers are used to mulch plantation waste after clear-felling. They have been usefully applied to IAP clearing as part of a combined programme where fire is also used. The heavy roller can be used after fires on medium to dense stands of young saplings (saplings up to 2 m in height and < 30 cm in diameter). Fire can also be used to remove the flattened material.

Heavy machinery can be used in various ways to help dispose of plant waste from IAP clearing, such as by chipping or stacking (see How can one responsibly manage plant material? page 45).

A chainsaw operator felling a pine tree in the Vyeboom Wetland in the Theewaterskloof catchment. © Rodney February / WWF

CHEMICAL CONTROL OF IAPS – WHAT DOES IT INVOLVE?

Chemical control makes use of herbicides to kill target IAPs by foliar application, blanket spraying, aerial application or cut stump treatment. Other chemical methods are chemical frilling, basal bark treatment and stem injection.

A herbicide is a substance that is toxic to plants, either killing the plant or interfering with its growth. Several effective herbicides are available. Herbicides are usually applied to IAPs using special equipment such as knapsacks with spraying nozzles.

Chemical methods are a good choice when the IAPs are still seedlings or young. At this stage of a plant's life it is growing fast, so herbicides will be quickly translocated through the plant to reach the roots. The leaves and stem are young and green with a large surface area, allowing for good absorption of the herbicide.

Chemical control should not be applied when it is raining. It is important to note that herbicide can also harm many non-target species and must always be used with the greatest of care. Wetlands require special care and only herbicide appropriate for wetlands should be used.

Foliar application of herbcide using the correct PPE. © Peter Emsile

Foliar application of herbicide. © Peter Emsile

Foliar treatment

Foliar treatment is when herbicide is applied to the leaves of the plant, usually by spraying.

- Spray herbicide with a knapsack sprayer, mist-blower or high-pressure sprayer firefighting unit, e.g. a bakkie-sakkie.
- The correct choice of nozzle is important to achieve an even spray cover.
- The best results can be expected in the active growing season (but some species are more susceptible to chemical absorption when they are sprayed in summer).

Blanket spraying

Blanket spraying, or broadcast spraying, is when herbicide is sprayed across an entire area of over 70% infestation. While this method is recognised, it should be used with a high level of caution due to the significant environmental risk. It is the most cost-effective way to eradicate young, dense, uniform stands of IAPs. Some IAPs, like introduced acacias, germinate by the thousands after fire. The first line of attack to reduce these numbers is the use of broadcast spraying. Calibration is crucial to ensure even distribution of herbicide over the target area (see What you need to know when calibrating your equipment, page 40, and Herbicide safety, page 52).

For more information, see Appendix 11: Choice of nozzles for invader plant control (page 67).

Aerial application

Aerial application is spraying either large-scale infestations or targeted inaccessible plants from an aircraft. While aerial application is a recognised method of IAP control, it is still under development and should be used with a high level of caution due to the significant environmental risk. Aerial spraying can only be done by registered and certified operators according to strict regulations. The pilot must ensure that the spray mixture is distributed evenly over the target area and that the wastage of herbicide, as well as drift onto indigenous species, is kept to a minimum. It is essential that the following criteria be met:

- Inform your neighbours well in advance before spraying commences.
- Use only an aerial registered product. Port Jackson (*Acacia saligna*) and rooikrans (*Acacia cyclops)* have herbicides registered for aerial application.
- Adult Port Jackson and rooikrans must be sprayed in summer (i.e. November–March) for optimum results.

Applying herbicide from a helicopter using the wand method is the most targeted, although it is still under development. © Andrew Turner

Any aerial application of herbicide needs to be certified for in-field use. © Andrew Turner

Cut stump treatment

Applying herbicide to cut stumps is a highly effective method for larger woody IAPs.

- Fell the target tree horizontally and as low as possible to the ground.
- Ensure a smooth cut surface to expose the cambium (outer rings where the trunk grows).
- Clear around the cut stump to expose side branches that also need to be cut and treated.
- Spray the herbicide mixture at a very low pressure on the freshly cut surface.
- Treat only the outside cambium layer for stumps with a diameter larger than 10 cm.
- Apply the herbicide mixture as soon as possible after the tree has been felled.
- When using a product that is mixed with penetrant oil, the entire stump and exposed roots must be treated.

The correct application of herbicide for cut stump treatment. © Peter Emsile

The correct method for the chemical frilling of trees. © Peter Emsile

Application of herbicide once the frill has been completed. © Peter Emsile

Chemical frilling

The frill method can be used to kill standing trees where felling is too difficult. Frilling refers to a series of downward cuts made in the bark around the tree.

- Use an axe to frill trees smaller than 10 cm in diameter. A chainsaw can be used for larger diameter trees, but take care to ensure that the chain is sharp because cauterising the cambium layer can prevent absorption of the herbicide.
- The cut must penetrate the bark and must be deep enough to reach the cambium layer.
- The cuts must be made horizontally and as close to the ground as possible.
- Enough herbicide must be sprayed into the cut to ensure that it runs down to the cambium layer.
- The entire circumference of the tree must be treated.

Basal bark treatment

Basal bark application can only be carried out with an oil miscible product. Oil miscible products are formulated with penetrant oil, which acts as a carrier that moves the herbicide through the bark to the cambium and eventually to the roots. Young trees and shrubs with green bark can be treated while standing with no need for felling.

- Spray the herbicide onto the stem.
- Ensure wetting of the root crown, exposed roots and stem up to a height of 0,5 m.
- Low-pressure spraying or stem paint is required to minimise spillage onto the soil.
- The entire circumference of the trunk must be treated.

Basal bark application of herbicide. © Peter Emsile

Stem injection

This treatment, whereby the chemical is directly injected into the base of the plant, is only used for prickly pear (*Opuntia* species), but is still under development. Methods suitable for use on woody species are being investigated.

9 THINGS YOU NEED TO KNOW WHEN APPLYING HERBICIDES

1 Registration

Only herbicide products registered for the particular IAP species being treated must be used.

2 Safety

Appropriate protective clothing must be worn and should be changed and washed regularly. Clothing should be removed immediately if grossly contaminated. Hygiene aids – clean water, soap, towels and eyewash – must always be available to spray operators (see Herbicide safety, page 52).

3 Weather

Application should not be carried out during unfavourable weather such as rain, wind or hot, dry conditions. Weather conditions could affect the ability to control the spread of herbicide and endanger desirable vegetation, water bodies or personnel. Poor results may be achieved if the target plants are not in a suitable condition for treatment – this includes plants that are either water stressed or waterlogged.

4 Drift

Caution must be observed to limit wind drift when using minimum output nozzles.

5 Inspection

Equipment should be inspected regularly between and during applications. Ensure that the correct nozzles are fitted and that pressure settings are checked regularly.

6 Filling

Always ensure that knapsacks are filled to the desired level (generally only 95% of the tank volume). Ensure that there is a sufficient quantity of water on site to prevent operators from running out of spray water.

An example of a herbicide camp in the field. © Rodney February / WWF

7 Spillage

Spillage must be attended to immediately and appropriately disposed of. Where spillage occurs in a storage facility with a hard surface, the following steps should be followed:

- If available, an appropriate spill kit should be used to clear up the spill.
- Alternatively, contain the spillage with lime sand or a suitable material. Never use sawdust, as this could lead to spontaneous combustion.
- Bag and dispose of the material using a reputable hazardous waste disposal company.

If a spill occurs at a clearing site:

- Bag the spill material in thick plastic bags and take it off-site.
- Dispose of the bagged material in the same way as for a spill in the storage facility.

8 Repairs

Leaking sprayers or sprayers not applying correctly should be withdrawn until repairs have been carried out. Spare applicators and parts should always be available so as not to impede operations.

9 Cleaning

Equipment must be emptied and cleaned thoroughly after spraying. The spray mixture must not be left in the apparatus overnight.

Do not under any circumstances use metal objects to clean clogged spray nozzles, as this will cause damage, affecting the flow rate, spray pattern and droplet size. Use a soft bristled brush or compressed air to clean.

Spray water that is left over after cleaning the sprayers can be sprayed out on dense stands of IAPs, but remember to respray the area the next day with the correct concentration.

Important tips to remember

- Herbicide mixing and refuelling must be conducted on a spill blanket.
- A spade must be on-site to deal with any accidental spillage.
- Keep spill kits at hand when working with hydrocarbons.
- Do not decant or mix herbicide near water bodies.
- Do not rinse herbicide equipment in water courses.
- Do not use metal objects to clean clogged spray nozzles.

THE DOS AND DON'TS OF CHEMICAL CONTROL

WHAT TO DO

- ✔ Plan the use of herbicides before the operation starts.
- ✔ Wear the appropriate safety clothing (see Personal protective equipment – What does it include? page 50).
- ✔ Use only approved herbicides.
- ✔ Only use designated knapsacks or spray bottles.
- ✔ Follow the manufacturer's instructions.
- ✔ Mix herbicide according to the label.
- ✔ For some species, an adjuvant (wetter, spreader, sticker) will be added to the spray mixture to increase the efficacy of the herbicide.
- ✔ Spray when plants are actively growing.
- ✔ Spray when the leaves are dry.
- ✔ Apply spray mixture to the entire leaf surface including green stems and branches.
- ✔ Add dye to the spray mixture to prevent over-spraying.
- ✔ Keep herbicide in a demarcated area at the spraying site, out of direct sunlight.

WHAT NOT TO DO

- ✘ Do not spray without the appropriate personal protective clothing and the correct equipment.
- ✘ Do not spray during wind, or when there is a likelihood of spray drift.
- ✘ Do not apply herbicide in the rain or on wet, damp leaves.
- ✘ Do not spray when the temperature exceeds 30 ^{0}C.
- ✘ Do not spray plants that have signs of drought stress, frost damage or have not fully developed after winter dormancy.
- ✘ Do not spray plants that are above hip height.

Cut stump herbicide application using the correct PPE.
© Rodney February / WWF

The correct set-up of a herbicide storage camp in the field.
© Guy Deacon

WHAT YOU NEED TO KNOW WHEN CALIBRATING YOUR EQUIPMENT

Calibration is the adjustment of spray equipment in order to deliver the recommended volumes of water and herbicide, taking into account the operator or machine speed across the terrain to be treated. All spraying equipment must be correctly calibrated to obtain best results and prevent wastage. Calibration is needed for every knapsack since equipment and nozzles differ. The calibration results from one knapsack cannot be used for other knapsacks.

Calibration should be carried out on site and checked frequently during application. The following should be checked:

- Correct spray pressure
- Correct nozzle size and spray pattern
- Correct nozzle output (delivery rate in litres per hectare, suggested in the herbicide label)
- Volume of application over a specific area.

WHAT IS BIOCONTROL?

Biological control, or biocontrol, is bringing in natural enemies of an IAP from their country of origin. The natural enemies will feed on and damage the IAPs, making them easier to manage and reduce the rate of spread.

Biocontrol is a good management option for several reasons:

- It is environmentally responsible as it does not cause pollution and only affects the target plant.
- It does not disturb the soil or create large empty areas where other IAPs could invade.
- Biocontrol can be self-sustaining without the need for ongoing management.
- It is a cost-effective option that is often a key part of an integrated control plan.

BIOCONTROL AGENTS

The natural enemies used in biocontrol are called biocontrol agents. They are usually plant-feeding insects, mites or plant diseases. Biocontrol agents may control an IAP in different ways, e.g. by damaging vegetative growth, or by lowering the number of seeds produced.

More than 700 biocontrol agents have been tested and released around the world. Biocontrol agents are host specific. This means they only feed on the target IAP, and cannot survive by switching to indigenous plants or crops.

If the target IAP population eventually dies out, the introduced biocontrol agents will die out with it. It is sometimes necessary to establish small reserves of healthy, mature IAPs on which the agents can survive and spread to IAPs that may have escaped the clearing process.

Galls formed as a result of *Dasineura rubiformis*, the biological control agent for black wattle (*Acacia mearnsii*). Female midges lay their eggs in the flowers and the flowers become galled rather than going on to produce bunches of seed pods.

SAFETY REGARDING THE USE OF BIOCONTROL

The use of living organisms is never entirely risk free, but modern methods of biocontrol are very safe. Biocontrol has been used for over 100 years in South Africa. It has become an accepted and common practice in many countries. There are safety measures in place to ensure that biocontrol does not harm natural ecosystems.

Scientific research

There is a lot of scientific research on biocontrol. Biocontrol scientists are constantly working to expand and build on the current knowledge. They publish their research in reputable scientific journals and share their results at international conferences. Biocontrol scientists are careful to maintain their excellent safety record.

Choice of agents

Biocontrol agents are very carefully selected before release. They are usually chosen to be specific to the target IAP, so they cannot harm any other plants. There have been advances in molecular techniques that have made host-specificity testing more accurate and less time consuming.

Testing

Before any biocontrol is carried out, rigorous scientific safety tests are conducted under strict quarantine. It may take several years to test a single biocontrol agent before it is released.

Regulation

Different countries have different regulatory processes for biocontrol. Regulations are used to decide whether or not a biocontrol agent is safe for release in a particular country. Scientists and regulators are getting better at weighing up the risks and benefits. Usually, approval from the relevant authority is required before biocontrol agents are released.

THE BENEFITS OF BIOCONTROL

Around the world, the benefits of biocontrol are impressive. Biocontrol has been responsible for ending some very damaging IAP invasions. It is also more cost effective than many other IAP control methods. It was estimated in 1998 that biocontrol programmes had already saved South Africa R1,38 billion in IAP control costs. However, biocontrol agents can have varying degrees of effectiveness.

Complete control

Some biocontrol agents have been very successful at suppressing the target IAPs. When biocontrol is successful, it can sustain this benefit for decades, without any further investment or management.

Management aid

Biocontrol agents can help to reduce the density or spread of IAPs to a more easily managed level. These invasions can then be addressed using other control methods. The land user must then consider how best to integrate the use of the biocontrol agents with other control methods.

Limited effect

There are some instances where a biocontrol agent does inflict damage on the IAPs, but it is not enough to bring the invasion under control. In a few cases, biocontrol agents fail to become established in the introduced environment. A suitable biocontrol agent may not be available for some IAPs.

Long term

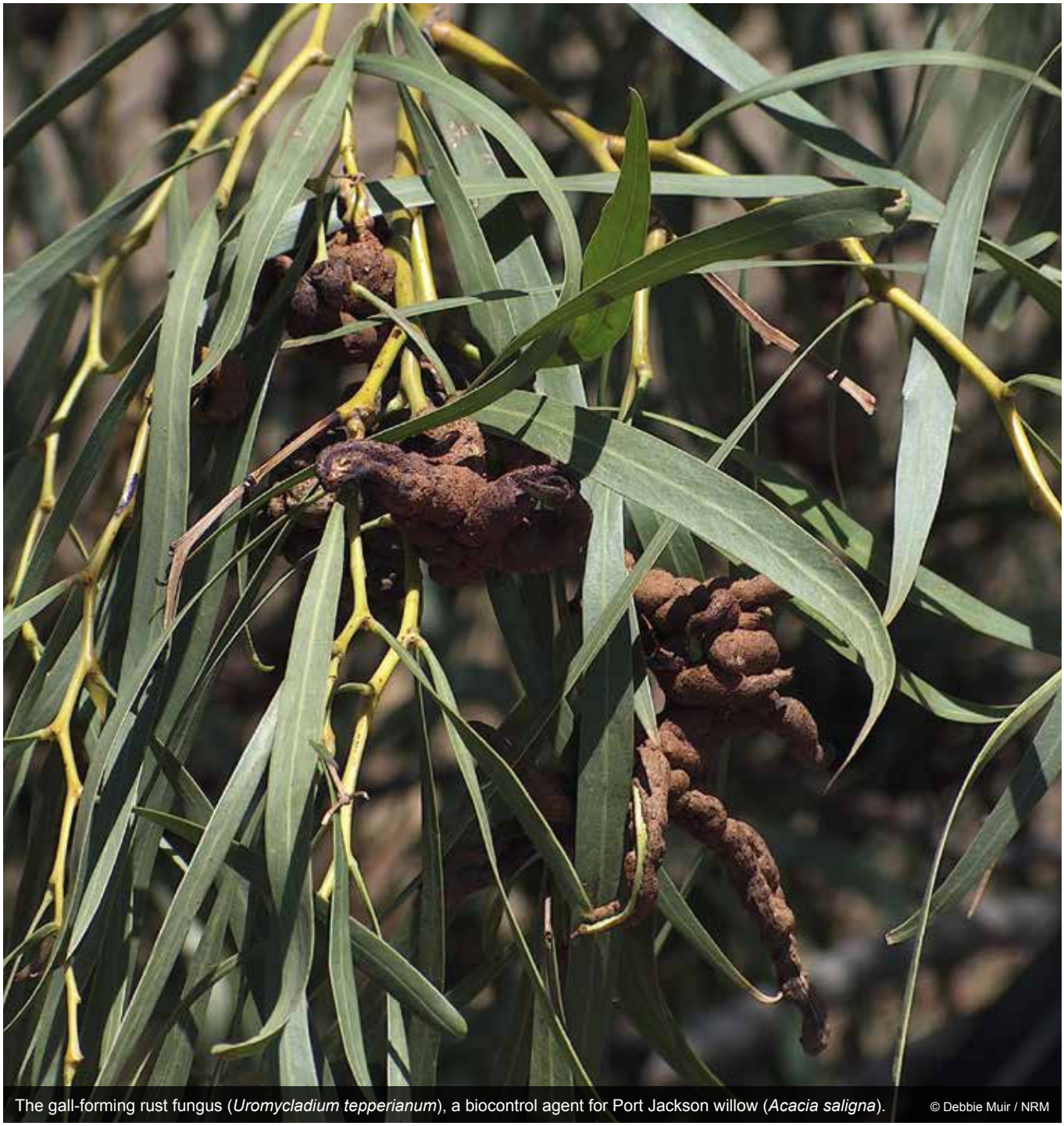
It is important to understand that biocontrol is often a long-term strategy. It is usual for biocontrol agents to take 10 to 20 years to build up large enough numbers to control the target IAPs. Often, biocontrol has been discounted too early because the IAP problem is not solved within a few months or years.

Dr Alan Wood of the Agricultural Research Council applying the biocontrol stink bean fungus spores to stink bean plants in the field.

EXAMPLES OF BIOCONTROL AGENTS IN SOUTH AFRICA

Over the years, several biocontrol agents have been approved and released for IAPs in South Africa (Table 4 on the next page). Some invasive alien plants are at present under effective biological control. In these instances, further time and money need not be wasted on additional clearing methods. Examples are:

- Silky hakea (*Hakea sericea*) in areas where the climate enhances gummosis disease and other agents;
- Sesbania (*Sesbania punicea*) after the introduction of all three insect agents;
- Red water fern (*Azolla filiculoides*) which has been brought under control by a frond-feeding weevil;
- Harrisia cactus (*Harrisia martinii*) after the establishment of the mealy bug;
- Australian pest pear (*Opuntia stricta*) after the establishment of cochineal.



The gall-forming rust fungus (*Uromycladium tepperianum*), a biocontrol agent for Port Jackson willow (*Acacia saligna*). © Debbie Muir / NRM

Table 4: Biocontrol agents and their effectiveness

Biocontrol agent	Year introduced	Damage to plant	Comments
Silky hakea (*Hakea sericea*)			
Erytenna consputa (seed-feeding weevil)	1970	Extensive	
Carposina autologa (seed-feeding moth)	1970	Moderate	
Cydmaea binotata (leaf/shoot-boring weevil)	1979	Trivial	
Aphanasium australe (stem-boring beetle)	2001	Moderate	Limited in distribution and destroyed in areas prone to wildfires
Dicomada rufa (flower bud-feeding weevil)	2006	Moderate	Established only in the southern Cape to date
Colletotrichum acutatum (gummosis fungus)	Indigenous	Considerable	Performs best in wet cold conditions
Rock hakea (*Hakea gibbosa*)			
Erytenna consputa (seed-feeding weevil)	1979	Trivial	Negligible, but priority species for future biocontrol
Carposina autologa (seed-feeding moth)	1979	Trivial	
Port Jackson willow (*Acacia saligna*)			
Uromycladium morrisii (gall rust fungus)	1987	Extensive	Control almost complete; around 85% of adult plants killed
Melanterius castanaeus (seed-feeding weevil)	2001	Considerable	Seedling regrowth problems
Long-leaved wattle (*Acacia longifolia*)			
Trichilogaster acaciaelongifoliae (bud-galling wasp)	1982	Extensive	Almost complete control achieved
Melanterius ventralis (seed-feeding weevil)	1985	Extensive	
Golden wattle (*Acacia pycnantha*)			
Trichilogaster signiventris (bud-galling wasp)	1987	Extensive	Almost complete control achieved
Melanterius maculatus (seed feeding weevil)	2005	Moderate	
Baileys wattle (*Acacia baileyana*)			
Melanterius maculatus (seed-feeding weevil)	2006	Trivial	*D. pilifera* first released and established in 2016
Dasineura pilifera (bud-galling midge fly)	2016	Too early to tell	Site destroyed by fire; new releases in 2019
Pearl acacia (*Acacia podalyriifolia*)			
Melanterius maculatus (seed-feeding weevil)	2008	Trivial	
Black wattle (*Acacia mearnsii*)			
Melanterius maculatus (seed-feeding weevil)	1995	Moderate	Both agents have most impact in winter rainfall regions
Dasineura rubiformis (flower-galling fly)	2001–06	Extensive	Establishment and impact far less successful in summer rainfall regions
Silver wattle (*Acacia dealbata*)			
Melanterius maculatus (seed-feeding weevil)	2001	Moderate	Moderate in the Western Cape, trivial elsewhere
Dasineura pilifera (flower-galling fly)	2018	Unknown	The fly is a new introduction
Green wattle (*Acacia decurrens*)			
Melanterius maculatus (seed-feeding weevil)	2001	Moderate	Moderate in the Western Cape, trivial elsewhere
Australian black wood (*Acacia melanoxylon*)			
Melanterius maculatus (seed-feeding weevil)	1986	Extensive	Majority of seeds destroyed
Rooikrans (*Acacia cyclops*)			
Melanterius servulus (seed-feeding weevil)	1994	Extensive	High proportion of seeds destroyed (96% or more at many sites)
Dasineura dielsi (podlet-galling midge fly)	2002	Considerable	
Australian myrtle (*Leptospermum laevigatum*)			
Aristaea thalassias (leaf-mining moth)	1996	Trivial	Both agents are abundant but control is negligible
Dasineura strobila (bud-galling midge fly)	1994	Trivial	
Red sesbania (*Sesbania punicea*)			
Trichapion lativentre (bud-feeding weevil)	1970	Extensive	Complete control in most areas
Rhyssomatus marginatus (seed-feeding weevil)	1984	Extensive	Some isolated patches need weevils introduced
Neodiplogrammus quadrivittatus (stem-boring weevil)	1984	Extensive	
Stink bean (*Paraserianthes lophantha*)			
Melanterius servulus (seed-feeding weevil)	1989	Considerable	High levels of seeds destroyed at many sites
Uromycladium woodii (gall-forming rust fungus)	2016	Unknown	
Mesquite (various hybrids of *Prosopis* species)			
Algarobius prosopis (seed-feeding weevil)	1987	Considerable	High levels of seeds destroyed by *A. prosopis* but control is negligible
Neltumius arizonensis (seed-feeding weevil)	1993	Unknown	

HOW CAN ONE RESPONSIBLY MANAGE PLANT MATERIAL?

Invasive alien plant clearing produces large amounts of dead and dying plant material. An excessive amount of plant material can present a fire hazard and, if washed down rivers, can damage infrastructure and riverbanks. This plant waste needs to be responsibly disposed of.

Make use of the waste

Plant material should be used beneficially wherever possible. This includes a wide range of options like charcoal, timber, or even using the cut material to generate electricity where facilities are available. It may be possible to use some material for basket making or animal feed. Wood can be made available to the local community for firewood. This use can offset the costs of IAP management or create a local economic opportunity. However, care must be taken not to distribute seeds or vegetatively growing material (e.g. *Cactus cladodes*) as it could give rise to new infestations.

Chipping and composting

Woody and dry material can be chipped and used as mulch, but beware of the risks of using chips that may contain IAP seed. Wet material and aquatic weeds should be combined with other organic matter and composted. Composting is not appropriate if the material contains seeds. Chipping can also be used to make a range of products, such as pellets for animal feed or fertiliser.

Burning on site

Burning the material on site presents risks that need to be managed appropriately. Burning should only be attempted by suitably (in terms of the relevant legislation) equipped and competent personnel. Material can be stacked in several ways before being burnt (see Integrated planning for fires and IAPs – Why is it important? page 24).

Landfill

Material that cannot be used, stacked or burnt must be disposed of at a registered and approved disposal site. Plant material can take up valuable space in a landfill, so other disposal options are preferable first. When removing material, take care to remove all debris, including shoots and seeds.

Stacking

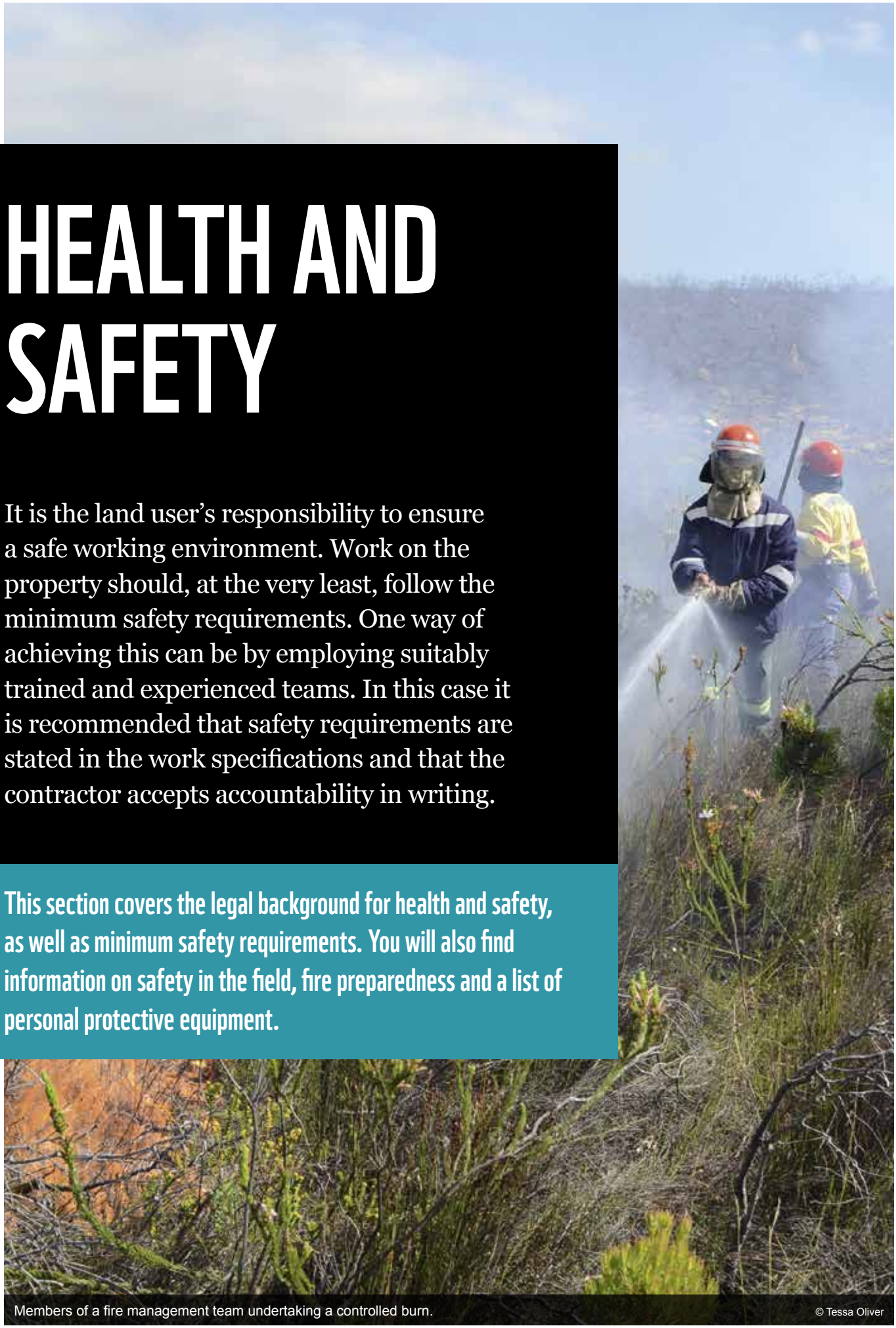
Stacking the cut material in heaps or windrows along mountain contours can help to reduce erosion. This also facilitates easy access for follow-up, and assists in containing the fuel load and reducing the risk of uncontrolled wildfires. The stacking method will depend on the IAP species, the clearing methods used, the habitat and the fire history of the invaded area.

- Stack removed material into piles of 2 m high and 3 m wide.
- Keep stacks well apart to prevent fires from crossing, not less than 10 m apart – this is naturally dependent on the size of the stack and the resulting fire intensity when the stacks burn.
- Stack light branches separately from heavy timber (diameter of 150 mm and more) – this helps if communities are dismantling stacks for firewood.
- Preferably remove heavy branches to reduce long-burning fuel loads that can result in soil scars from intensely hot fire, and the need for increased fire surveillance after burning.
- Stack brushwood rows along the contour if on a slope.
- Do not make stacks under trees, power and telephone lines, within 30 m of a firebreak or near water courses, houses and other infrastructure.
- Distribute the team along natural open areas for stacking as productivity will be improved if workers are not working too close to one another. In this way they will not get in one another's way and will be able to stack more freely and safely.

HEALTH AND SAFETY

It is the land user's responsibility to ensure a safe working environment. Work on the property should, at the very least, follow the minimum safety requirements. One way of achieving this can be by employing suitably trained and experienced teams. In this case it is recommended that safety requirements are stated in the work specifications and that the contractor accepts accountability in writing.

This section covers the legal background for health and safety, as well as minimum safety requirements. You will also find information on safety in the field, fire preparedness and a list of personal protective equipment.



Members of a fire management team undertaking a controlled burn. © Tessa Oliver

WHAT ARE THE MAIN PILLARS OF HEALTH AND SAFETY LEGISLATION?

IAP management involves manual labour with dangerous machinery and hazardous chemicals. It is important that everyone understands the risks and responsibilities. Taking the necessary measures to ensure health and safety makes the difference between a high-risk and a risk-free work environment.

In South Africa, the most important legislation for health and safety is the Occupational Health and Safety Act 85 of 1993 (OHSA). The two main pillars of this Act are:

1 Employer duties and responsibilities

Employers are responsible for making sure that all employees understand the risks and hazards in the workplace. Communication is critical under the OHSA, so workers must be informed of dangers at the workplace. Health and safety information must be communicated to all employees.

2 Employee duties and responsibilities

Employees are responsible for their own health and safety. They should also take reasonable care of those around them. Employees must cooperate with any health and safety rules by obeying all lawful instructions.

A Working for Water clearing team in the field, using the correct PPE. © Rodney February / WWF

WHAT ARE THE MINIMUM SAFETY REQUIREMENTS?

The landowner should check with the contractor or the contractor's staff to make sure the minimum health and safety requirements are met.

Safety representatives

Due to the risks (or the nature of the work) involved in IAP clearing, the employer should appoint a safety representative. The employer must explain to the workers' organisation what responsibilities the safety representatives will have. The safety representative should be available on site.

Safety committees

In every workplace where there are two or more safety representatives, there must also be a safety committee. This committee must meet at least every three months. The committee must deal with all health and safety issues that affect workers. Safety committees have certain functions and powers. You can find out more about these by contacting the Department of Labour.

Emergency contacts

All teams should be aware of the correct emergency contact details for the ambulance service, South African Police Service, Poisons Information Helpline, COVID-19 public helpline, as well as directions to the nearest hospital, clinic or doctor. Detailed procedures should be drawn up for dealing with emergencies, including fuel, oil and herbicide spills.

Water

Clean water must be available in suitable, clearly marked containers for drinking and mixing herbicides.

Toilet facilities

The contractor or land user should provide a mobile toilet on site for the duration of the work.

Training

Only correctly trained staff can perform quality work. If the land user or contractor is unaware of what training is required, they should consult the local Department of Labour office. It is the employer's duty to give training to workers who use dangerous machinery and materials, and to make sure they know the safety precautions.

Team skills

Chainsaw operators should have valid certificates and members of the team who apply the herbicide should be certified.

Work methods and equipment

Equipment must be suitable for the work and in good working order. All work methods set out in the project specifications should be followed. Dangerous machinery must carry warnings and notices. Workers should be prevented from using dangerous machinery and materials unless all safety rules have been followed.

Compensation for Occupational Injuries and Diseases (COID)

The contractor must have a valid certificate of good standing from the Compensation Commissioner. An indemnity form must be signed stating that the contractor accepts full liability for any COID-related matters and that the land user will not be held liable should the contractor not comply with the minimum health and safety standards.

Accident and incident register

Any incident must be reported to the land user. A register of near misses, incidents and accidents must be kept. If an accident occurs, evidence must not be moved until a Department of Labour inspector has given permission, unless someone has been badly injured and needs treatment.

Insurance

The contractor must be insured for vehicles and equipment, and must provide proof of third-party and liability insurance.

It is important to:

- Ensure that all Covid-19 safety protocols are adhered to.
- Sign an agreement whereby the contractor accepts liability for damages in case of negligence.

HOW CAN A LAND USER ENSURE SAFETY IN THE FIELD?

Safety is all important in the field. There are two areas of safety that the land user must be aware of: staff safety and environmental safety.

Staff safety is only possible if the team has the correct mental attitude and have had appropriate training. Only then is personal protective equipment (see Personal protective equipment – What does it include?, page 50) and first aid effective. Supervision by someone who knows the work will help to ensure the safety of workers.

Environmental safety is achieved through correct choice of IAP control methods and herbicides, proper field storage and waste disposal (in a waste bin or a refuse bag on site for the collection of waste material and to prevent littering), and good team training. It is important to keep the workplace open so that workers can escape from danger if necessary, and to have adequate field-safety measures in place.

Toolbox talks

A "toolbox talk" is a safety meeting that focuses on safety topics related to the specific job. Meetings are short and conducted at the job site before a job or work shift begins. They are an effective way to refresh workers' knowledge, cover last-minute safety checks, and exchange information with workers. Toolbox talks help to open up discussions about safety at the job site and to promote a culture of safety.

First aid

The regulations state that an employer should take reasonable steps to make sure that someone who is injured at work gets prompt first-aid treatment. If there are more than 10 employees at a workplace, the employer needs to appoint a first aider. This is a compulsory legal appointment, and the first aider should be readily available during normal working hours. The first aider should have a valid first-aid certificate, issued by a person or organisation approved by the chief inspector. Where pesticides, hazardous chemical substances or hazardous activities are involved, the first-aid worker should also be trained to treat the types of injuries that may result. A fully stocked first-aid kit must be available on site.

Camps

Camps and equipment should not be placed in environmentally sensitive areas, but in a shady spot that has been demarcated before activities commence on site. All rubbish should be collected and disposed of off site. Waste bins should have lids that shut firmly. No waste should be burnt.

Storage of herbicides and fuel

Fuel and herbicides must be left in a shady area, away from the resting/eating area. The area must be clearly marked with danger tape, which must be removed on completion of the job. Herbicide mixing must be conducted on a spill blanket. A spade must be on site to deal with any accidental spillage. Keep spill kits at hand when working with hydrocarbons. Do not decant or mix herbicide near water bodies and do not rinse herbicide equipment in water courses.

Herbicide equipment can be cleaned back at the herbicide store (shed) where there is running water. It should not be cleaned in the field, especially not near water courses. Collect the water still containing herbicide and apply it to dense stands of IAPs, which can be resprayed with the correct concentration later.

No oil, petrol or diesel should be allowed to spill onto the ground or into a stream or river. Drip trays should be used when refuelling, parking overnight or carrying out repairs to machinery. When refuelling on site (e.g. using 200 litre drums), the proper dispensing equipment must be used and the drum should not be tipped in order to dispense fuel.

Transport

The National Road Traffic Act 93 of 1996 is very clear on what is required for safe transport. It is the employer's responsibility to see that all transport meets these requirements. Some of the basic requirements include the following:

- Vehicles must be roadworthy
- Drivers must be in possession of a valid professional driving permit (PrDP)
- Passengers must be seated and have safety belts
- No hazardous substances should be carried in the same compartments as passengers or food and water
- Tools must be transported in a trailer, separately from the workers.

Preventing fires

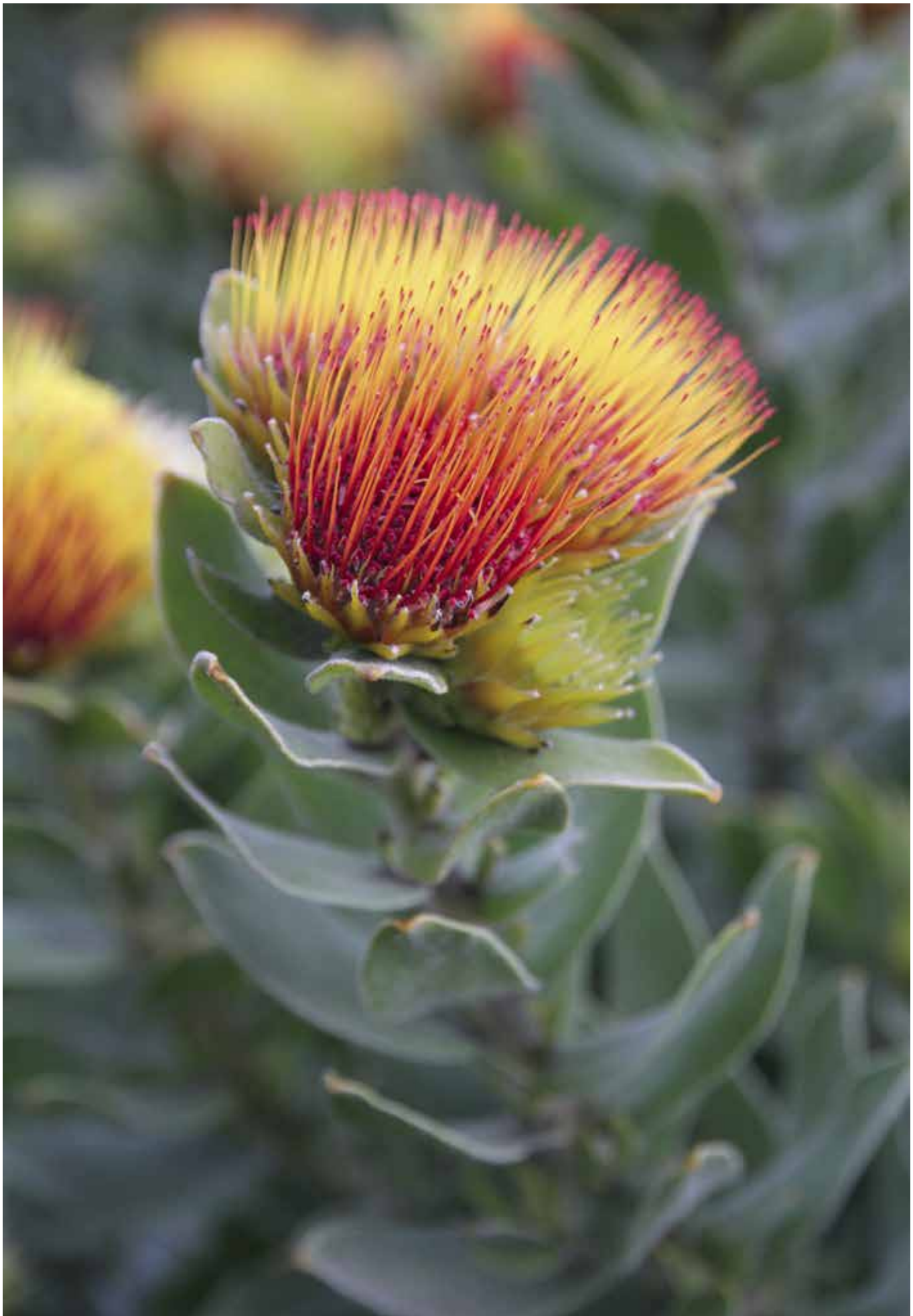
No smoking should be allowed while working. Assign a designated smoking area, remove cigarette butts, and prohibit smoking during windy conditions. No chainsaw work should be done during Code Orange and Red days (Fire Danger Indices are obtainable from the Fire Protection Association). Keep one fire beater for every team member within reach of the workers. A serviced and functional fire extinguisher must be kept at the fuel refilling area (see How to prepare for and manage wildfires, page 25).

PERSONAL PROTECTIVE EQUIPMENT – WHAT DOES IT INCLUDE?

Personal protective equipment (PPE) or personal protective clothing, such as chemical resistant plastic aprons, gloves and eye protection, is worn to protect workers from injury or harm when conducting IAP control. PPE should be of the correct standard (approved by the South African Bureau of Standards) for the task.

Table 5: Examples of personal protective equipment worn during IAP clearing operations

Item	Supervisor	Machine operator	General workers	Herbicide applicator
Conti suit (overall)	✔	✔	✔	✔
Gloves	✔	✔	✔	✔
Gumboots (when working in wet areas)	✔	✔	✔	✔
Rain suit (during rainy conditions)	✔	✔	✔	✔
Safety boots	✔	✔	✔	✔
Safety goggles	✔	✔	✔	✔
Sunhat	✔	✔	✔	✔
T-shirt	✔	✔	✔	✔
Hard hat	✔		✔	✔
Whistle	✔	✔		
Chainsaw operators' gloves		✔		
Chainsaw safety boots		✔		
Chainsaw safety pants (11 layers) with broad belt or braces		✔		
Safety helmet (EU standard)		✔		
Shin-guards for brush cutters		✔		
Cape (when using a knapsack)				✔
Mask (when applying herbicides)				✔
Rubber apron (for mixing herbicides)				✔
Rubber gloves (for mixing herbicides)				✔



Indigenous Overberg pincushion (*Leucospermum oleifolium*) in Kirstenbosch National Botanical Garden. © Helen Stuart / WWF

HERBICIDE SAFETY

Herbicides are chemicals used to kill unwanted plants. Herbicides can be very effective for controlling some types of IAPs. However, they can be hazardous or toxic, and cause harm to people, animals, other plants and the environment.

In this section, information is given on herbicide labels and the safe storage, mixing and disposal of herbicides. Following these precautions will help to reduce the risks associated with these chemicals.

A blue dye mixed with herbicide (which is often colourless) clearly identifies stumps that had been treated.

WHAT IS ON THE HERBICIDE LABEL?

The herbicide label will give details about how the herbicide should be prepared and applied. The Material Safety Data Sheet (MSDS) gives information on the hazardous ingredients, health risks, fire risk, emergency procedures, and more. MSDSs can be found on the Internet or from the dealer.

Concentration

The concentration gives the amount of herbicide that should be diluted in water for use in foliar spray. It is expressed as a percentage (%) or as a volume per volume (v/v). For example: 0,75% in 100 litres of water means you need 75 ml in 10 ℓ of water, or 7,5 ml in 1 ℓ.

Dosage

Dosage tells you the volume of herbicide that needs to be used per area for blanket spraying, e.g. 1,5 ℓ per hectare.

Rate of application

The rate of application gives the volume of mixture that needs to be used per area for blanket spraying, e.g. 1,5 ℓ of product to be applied in 400 ℓ of water per hectare.

For more information, see Appendix 12: Example of a herbicide mixing rate table (page 67).

An in-field herbicide mixing station with the correct safety precautions in place. © Carlo de Kock / SANParks

HOW TO STORE HERBICIDES

Herbicides should be stored correctly to prevent leakage and contamination.

Isolation

The herbicide store (shed) should be a separate building, more than 5 m from the dwelling house, livestock buildings or where fodder, fuel or flammable materials are stored. The store must be totally sealed off, with no free movement of air between the storage area and other areas. The location of the store must minimise possible pollution risk from spilt chemicals. It should be situated away from water sources, rivers, dams, boreholes and areas likely to be flooded. It should be in a location that can be supervised.

Accessibility

The store should have easy access for delivery and dispatch. In an emergency, it should be possible to approach the building from all sides.

Floor

Smooth, screeded concrete is the ideal flooring. Sealed steel-container floors are also acceptable. Earth, timber, bitumen, PVC, linoleum and coarse unscreeded or disintegrating concrete is not acceptable. The floor surrounding the doorway should be bunded (a ridge to contain spillage) to a height of 200 mm. The bunded area should be able to store 110% of the liquids kept in the store. All floor joints and doorways should be watertight.

Walls

Walls should be made of bricks or concrete blocks with vents 200 mm from the floor and near roof level. Repurposed shipping containers are acceptable if there is adequate ventilation. The container should be placed in a shaded area.

Roof

The roof should be leak-free and insulated to keep temperatures at a reasonable level. A vent in the roof will allow hot air to escape during the summer months. If possible, an extractor fan should be installed.

Doors

Steel doors with an effective locking system are preferred. Wooden doors should have security gates to reduce the risk of forced entry. Containers with fitted security gates can be left open to cool the contents during the heat of the day. Only authorised personnel should have access to keys and be allowed in the store.

Windows

Windows should allow enough light into the store to be able to read product labels. All windows should be weather proof, burglar barred and preferably at head height for security reasons.

Lighting

There should be sufficient lighting to allow for the reading of product labels. If electric lighting is required, it must be secure to reduce the risk of fire. The mains control should be outside the store itself.

Sanitation

Staff should have immediate access to washing facilities with running water, soap and towels. They should be encouraged to use these facilities frequently. An eyewash bottle or similar must always be available for the flushing of contamination from the eyes, should it occur. A shower facility is also recommended.

Equipment

The room should be equipped with a suitable table for the reading of labels and decanting and measuring of herbicides. Measuring jugs, funnels, pumps and buckets must be kept on hand. These items must be kept specifically for use with herbicides – do not use household items. Have on hand a broom, spade and a supply of dry, fine soil or spill-absorbing material (not sawdust) that is fire resistant to contain and absorb spills.

Fire extinguisher

A fire extinguisher should be mounted on the outside of the storage facility.

Emergency numbers

The store should have well-displayed emergency contact numbers, e.g. ambulance, medical doctor, Poisons Information Helpline, fire brigade, etc.

Labels

All containers should be labelled accordingly. The Material Safety Data Sheets should be placed on the wall behind the product.

For more information, see Appendix 13: AVCASA's Storing agrochemicals and stock remedies (page 67).

HOW TO MIX HERBICIDES

Many herbicides require mixing with water to dilute them, or with other additives to improve their effectiveness. Products should be mixed according to instructions on the label.

Water

Only clean water should be used for spray mixtures. The product label should be consulted regarding the quality of water suitable for a particular herbicide. Where particulate matter occurs in water (e.g. water from rivers), the water must be filtered to avoid nozzle blockages. When large volumes of water are transported over rough or uneven terrain, which causes the water to move from side to side, tanks should be fitted with tank baffles because the vehicle can be easily overturned by the pure weight of the water.

Adjuvants

There are several types of surfactants[4] that may need to be added to spray mixtures to increase the efficacy of the herbicide. Each product label will specify which adjuvant/surfactant is recommended with the product to optimise its performance. Contact the manufacturer or distributor for advice on the use of these agents. The contact numbers will be printed on the product label.

- Wetting and spreading agents should be mixed in accordance with label recommendations.
- Dye must be added where the product has no built-in dye. Dye helps to show where target species may have been missed or herbicide spilled.
- In areas where water is alkaline, a buffering agent may be necessary. Buffers should be added to water before the herbicide.
- In sensitive areas where drift must be controlled, the use of drift-control agents may be necessary.

Containers

All containers into which herbicides are decanted must be clearly marked with the contents and the dilution. A copy of the original label must be secured to the container. Mixtures should never be decanted into drinking bottles or food containers, as this is a serious safety risk. Suitable equipment must be available to prepare spray mixtures. These include plastic measuring cylinders and beakers, mixing containers (buckets) and funnels.

See What is on the herbicide label? (page 53) for more information.

Safety

The person responsible for mixing must take extra precaution since they are working with an undiluted product that can burn or irritate the skin and eyes.

- Wear suitable protective clothing when handling concentrates (see Personal protective equipment – What does it include? page 50).
- Mix the herbicide according to the label instructions, on a spill blanket.
- Add liquid concentrates to a half-full tank, and then top up the tank.
- Do not mix concentrates together before adding them to the tank.
- Follow the label instruction about when to add adjuvants – before or after mixing the herbicide.
- When a buffer is needed to stabilise the water at the desired pH, first add the buffer, measure the pH of the water to ensure that the correct pH has been reached, and only then add the herbicide to the spray water.
- Proper mixing in knapsacks and hand-held applicators is difficult; mix spray mixtures in bulk containers before pouring into the knapsacks or applicators.
- Agitate spray mixtures continuously, especially after they have been standing for a while.
- Do not wash or rinse spray equipment or containers in or near natural water systems, but take them back to the herbicide store (shed) where wash water can be safely stored in drums for future use as mixing water, without the risk of contaminating the natural environment.

[4] Surfactants lower the surface tension between substances and may act as wetting agents, emulsifiers, foaming agents or dispersants.

PRECAUTIONARY MEASURES WHEN HANDLING HERBICIDES

The handling of herbicides requires strict precautions to protect people, animals, non-target plants and the environment.

Clothing

Suitable protective clothing should be worn. These include chemical resistant plastic aprons, gloves and eye protection (see Personal protective equipment – What does it include? page 50).

In the field

Special care must be taken when handling herbicides in the field.

- Herbicides should only be kept on site in appropriate, clearly demarcated storage areas (see How can a land user ensure safety in the field? page 49).
- Care must be taken to prevent damage to desirable vegetation.
- Application equipment and containers should not be cleaned on site.
- Spray mixtures and equipment must not be left unattended where there is a danger of theft or misuse.
- Products should not be left uncovered in the sun.
- Plans must be in place to prevent spillage, and clean up and dispose of any spilled material.

Spillage

In the case of accidental spillage, the spill must be contained immediately. Suitable absorbent material, such as fine, dry soil, must be available to clean up spillage. Contaminated material should then be disposed of at an approved hazardous waste site. Adequate hygiene aids such as plentiful clean water, soap, towels and eyewash must be readily available.

Transporting

Herbicides and application equipment must be transported separately from people, food and clothing. Herbicides and equipment must be secured to prevent spillage and damage. Vehicles should carry absorbent material to absorb any spillage (see How can a land user ensure safety in the field? page 49).

For more information, see Appendix 14: CropLife International's Responsible Use Manual (page 67).

Since herbicides are hazardous to people and the environment, precautions must be taken to limit risks.

Public safety

Bystanders in the vicinity of herbicide storage and application areas must be well informed and protected from harm.

- The public should be kept out of operational areas where hazards exist.
- The public should be informed of control operations in their area by means of verbal communication, notices, pamphlets, the press, etc.
- Warning notices should be displayed where necessary.
- Product and spray mixtures should be stored so that they are inaccessible to the public.
- Treatment of areas within 50 m of homes and public areas (e.g. parks) should be avoided or only carried out in consultation with the parties affected.

Environmental safety

Steps must be taken to minimise the impact of herbicide use in IAP clearing operations on the natural environment.

- Area contamination must be minimised by careful, accurate application with the lowest amount of herbicide to achieve control of IAPs.
- To avoid damage to indigenous or other desirable vegetation (like crops), herbicides should be selected that will have the least effect on non-target vegetation.
- Coarse-droplet nozzles should be fitted to avoid drift onto neighbouring vegetation and crops.
- All care must be taken to prevent contamination of water bodies. This includes due care in storage, application, cleaning of equipment and disposal of containers, products and spray mixtures (see Safely disposing of empty containers and leftover spray mixtures, page 57).

SAFELY DISPOSING OF EMPTY CONTAINERS AND LEFTOVER SPRAY MIXTURES

In addition to taking care that the cleaning of equipment does not contaminate the environment, used containers and leftover spray mixtures should be disposed of with great care.

Used containers

Used herbicide containers must not be used for any other purpose and must be destroyed after use.

- A designated person should be responsible for safely disposing of used containers.
- Under no circumstances should containers be taken home for personal use.
- Empty herbicide containers will not be accepted back by the supplier. It is the purchaser of the product's responsibility to deal with empty herbicide containers according to the CropLife regulations.
- All empty containers must be returned to the herbicide store (shed) from where they were issued. The designated storeman will then triple rinse the containers, puncture and flatten them and send them away for recycling or destruction by an authorised organisation.

Leftover spray mixture

Only sufficient herbicide spray mixture that can be used in a day should be prepared. However, if it starts to rain and spraying cannot continue, leftover spray mixtures must be handled appropriately.

- Leftover mixed herbicide should be returned to the herbicide store (shed) for safe storage and reuse, if appropriate. Containers must be clearly labelled with the herbicide name and dilution.
- The spray mixture (or washings) can be kept in drums and used for 'spray water' when the same herbicide is required for the same species. In this case, the herbicide needs to be added to the spray mix again to compensate for chemical breakdown.
- Certain spray mixtures should not be left standing overnight and should be safely disposed of. Consult the product label.

Refilling herbicide spray bottles at a herbicide camp.

For more information, see Appendix 15: CropLife's Resources on Container Management (page 67).

LONG-TERM REHABILITATION

Clearing IAPs is an important part of rehabilitating infested land, and often a first step in any rehabilitation project. Rehabilitation work needs to be carried out by people with adequate skills to avoid damage to the remaining natural ecosystems.

Here, you will find an overview of the reasons for rehabilitating cleared land, the types of rehabilitation and the phases in a rehabilitation project. Useful resources with more detailed information on rehabilitation are suggested.

Regrowth of indigenous vegetation at an active restoration site in the Kouga catchment in the Eastern Cape. © Saskia Fourie / WWF

WHY REHABILITATE?

The need to tackle the threat of IAPs has been recognised for many years. But it is only more recently that we have started to realise what an important role rehabilitation can and should play in the process.

The removal of IAPs is the first step in addressing their negative impacts, but in some situations the natural area, such as rivers, have degraded to such a degree that they are not able to self-restore and their ability to deliver basic functions, e.g. flow and filtration, has been compromised. In these cases, additional interventions in the form of active restoration, such as seeding or planting, are required to return the area's natural functions and prevent further degradation. The establishment of an indigenous vegetation cover also suppresses alien regrowth and is a prerequisite for the long-term control of IAPs.

Intact, functioning natural ecosystems, which are called our "natural infrastructure", provide society with a number of goods and services (Figure 3).

Figure 3: Ecosystem services

CLEAN AIR	Ecosystems produce oxygen and also purify and detoxify the air
CLEAN WATER	Ecosystems provide us with clean water and store and cycle fresh water
CLIMATE	Ecosystems regulate the climate and provide resilience against the impacts of climate change
HEALTHY SOIL	Ecosystems form topsoil and prevent erosion and flood damage
RAW MATERIALS	Ecosystems produce raw materials, foods and medicines

Rehabilitating the cleared land will ensure that natural infrastructure can keep producing the benefits that people derive from nature. By planting back lost or endangered species, we can prevent extinction, maintain biodiversity, reverse the loss of species and help restore the way the natural environment functions.

WHAT ARE THE BASIC PRINCIPLES OF REHABILITATION?

Although one should always strive to avoid degradation in the first place, this is not always possible and rehabilitation might be necessary. Rehabilitation can differ from area to area, depending on the situation. However, all rehabilitation projects follow the same four basic principles.

4 BASIC PRINCIPLES OF REHABILITATION

1 Halt degradation

Identify what is causing degradation to the natural ecosystem and take measures to stop it. IAPs can be very damaging to natural ecosystems, so managing IAPs can help to prevent further destruction. Be careful not to inadvertently increase degradation through rehabilitation actions, either on or off site.

2 Address missing ecosystem processes

Ecosystem processes are processes that link organisms to their environment. These processes include things like nutrient cycles and food webs. Often, degraded systems are missing key ecosystem processes. Identifying and addressing these missing processes can help with rehabilitation. Local conservation offices or rehabilitation specialists could be consulted in this regard.

3 Conserve what remains

It is important to prevent the loss of remaining natural ecosystems, including seedbanks and soils. In this way, rehabilitation costs may be kept to a minimum.

4 Prioritise

Resources are usually limited, so it is important to carefully prioritise which areas should be rehabilitated. Studies in Brazil have shown that a well-prioritised approach is five times more effective than an unplanned approach. After clearing IAPs, areas most prone to further degradation should be prioritised for rehabilitation.

Cleared material at a restoration site that has been stacked along the contours to pervent erosion. © Saskia Fourie / WWF

WHAT METHODS CAN BE USED FOR REHABILITATION?

The type of rehabilitation will depend on the setting and the IAP management methods that were used. The extent, density, age and species of IAPs cleared will affect what type of rehabilitation – passive, active or manipulated succession – should be implemented.

Passive rehabilitation

After IAPs have been cleared or activities damaging the ecosystem stopped, the area is left to recover naturally. The causes of degradation are removed from the system and the system can repair itself over time. If the IAP infestation was minimal or if plenty of indigenous vegetation still exists around the IAP infestation and was not damaged during the clearing process, then one may rely on passive rehabilitation taking place. This will provide adequate ground cover to supress the regrowth of IAPs and prevent erosion.

Active rehabilitation

When IAP clearing has resulted in large exposed areas, active rehabilitation activities may be required. These may include activities that stabilise the soil, the planting of seedlings or the sowing of seeds to reintroduce natural species. Obtain indigenous seed and seedlings from as nearby as possible to ensure correctly adapted plant populations. If IAP management is implemented properly, it can reduce the need for any active rehabilitation, thus reducing the long-term costs involved.

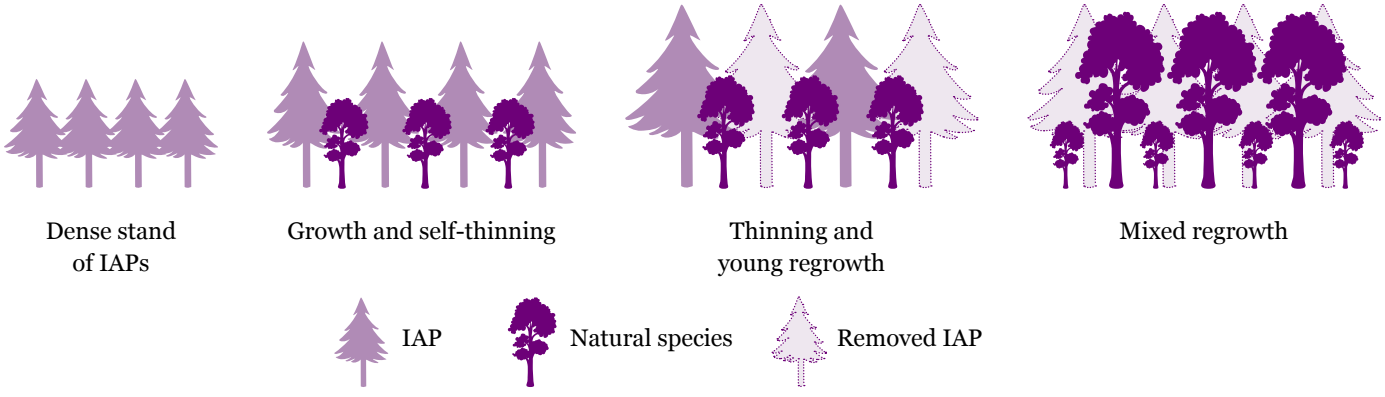
Manipulated succession

Complete clearing of an area can cause the growth of secondary IAPs (weedy species). Many IAPs fall into this category and will take advantage of newly cleared ground. To prevent this, IAPs can be thinned in stages to support the gradual regrowth of natural vegetation (Figure 4).

It is useful to plan IAP clearing and rehabilitation at the same time. There may be different rehabilitation methodologies for riparian or terrestrial areas. It should be noted that full restoration cannot always be achieved. This is often due to the severity of the degradation, or a lack of resources.

For more information, see:
Appendix 16: WWF: A practical guide for community-run nurseries (page 67).
Appendix 17: WWF: Restoration of alien-invaded riparian systems (page 67).
Appendix 18: Alien weeds and invasive plants (page 67).

Figure 4: Removing selected IAPs over time can support natural forest succession for rehabilitation [5]



[5] Geldenhuys, C.J. 2011. Most invasive plants facilitate natural forest recovery – how is that possible? *SAPIA News* 18: 2–5.

WHAT ARE THE PHASES OF A REHABILITATION PROJECT?

Rehabilitation projects invariably follow four distinct phases – a site assessment (getting an understanding of the site); planning (drawing up a detailed and cost-effective plan for the necessary interventions); executing the planned interventions; and monitoring the work (surveillance of the site and indicators of recovery, and identifying further interventions, as appropriate).

4 PHASES OF A REHABILITATION PROJECT

1 Site assessment

Before rehabilitation is even planned, a good background understanding of the site is needed. One should record the history of the site, look at its existing condition, and find out what has caused the degradation. They should collect baseline information over a period of time. Physical conditions such as slope, water quality, local climate and soils should be noted. A nearby natural ecosystem should be identified to understand what comprises the natural system, thus determining what rehabilitation efforts may be required. Information on plants and animals that make up the natural ecosystem should be gathered, including information about the reproduction and life cycles of key species. It may be necessary for a land user to consult experts on the above if they require additional assistance.

2 Planning

A rehabilitation management plan should be drawn up, building on the background information collected during the site assessment. Planning is essential to decide how feasible it is to carry out rehabilitation. The plan should clearly state the goal of the rehabilitation project. It should specify what rehabilitation activities will need to be undertaken over the course of the project. If necessary, trials should be carried out to test the rehabilitation methods. The plan should also identify the physical, human and financial resources that will be needed. It is also mandatory to get all the necessary approvals or permits, and to liaise with relevant organisations or government departments.

3 Implementation

Once planning is completed, staff can be hired to supervise and carry out the rehabilitation. Rehabilitation methods will vary depending on the situation. They will probably include the reintroduction of plants or animals, e.g. through collecting flower heads and mulch from surrounding areas to spread over the site. Beware of commercially available seed as it may contain other undesirable seed (especially alien species), which may compete with Fynbos seedlings or threaten the genetics of local plants. Other rehabilitation activities may include putting in place landscape restrictions, such as stopping land uses that reduce water quality.

4 Monitoring

Once active rehabilitation is complete, there are several follow-up tasks that should be done. These include protecting the site from vandals, pests or livestock, and performing ongoing maintenance, such as erosion repair and continued IAP control. Records should be kept of all rehabilitation sites. These records should include IAP management methods, dates, the results of IAP clearing and rehabilitation actions. Regular site inspections should be undertaken to address any threats to the recovering area.

For more information, see the resources listed under Rehabilitation and restoration (page 67).

Indigenous daisy (*S. elegans*) in Kirstenbosch National Botanical Garden. © Helen Stuart / WWF

FUNDING OPPORTUNITIES

Managing IAPs can be costly, but failing to manage IAPs before they get out of control can be even more costly. Land users do not need to wait until they have enough funds before starting with IAP management activities. There are many resources available to help them with their IAP management efforts.

This section contains information about government and other funding opportunities for IAP management. Options include accessing government programmes, working cost effectively with neighbours, and finding resourceful ways to recoup funds from IAPs.

An indigenous pincushion protea (*Leucospermum spp*).

AVAILABLE RESOURCES FOR IAP MANAGEMENT

To make the most of funding opportunities, it is vital that land users show that they are taking responsibility for the IAP problem that exists on their land. Funders often want to see what efforts the land user is already making towards IAP control.

Even if only limited funds are available, the management of IAPs still needs to be well planned (see Planning IAP management operations, page 18), with careful consideration of how activities can be sustained with the resources available.

The best way of finding potential co-funders is to think about where the property is situated in the landscape. Understanding who stands to gain from IAP clearing will help to determine who might be willing to provide funds. Is the area important for conservation, water production, or of high agricultural value? Linking up with other initiatives in the landscape can help to access funds from a variety of sources.

Neighbourhood initiatives and conservation stewardships

Often, extra resources can be found when IAP management is combined across neighbouring properties. It is best for land users to work together and develop a landscape or catchment approach to IAP management. This can be achieved by working through a Farmers' Association, Fire Protection Association or Water User Association, or by creating a new initiative like a conservancy, or by signing up with a conservation stewardship (see capenature.co.za/care-for-nature/stewardship). Conducting IAP management in this way is more cost effective because resources such as herbicide can be shared. A collaborative approach is also more likely to attract funding from outside sources.

LandCare Programme

Provincial departments of Agriculture sometimes fund IAP management through their LandCare Programme. If LandCare is active in an area, they may be willing to assist private land users by co-funding IAP clearing. However, in most instances they prefer to tackle large projects with many land users in priority areas.

Natural Resource Management (NRM) Programme

The Department of Environment, Forestry and Fisheries is another potential source of resources through its NRM provincial offices. Through the NRM Programme, a land user can get access to herbicide and IAP eradication assistance. Assistance will depend on various factors, including budget, the IAP management strategy in the catchment, and existing IAP control efforts. The land user and provincial office will negotiate contributions (financial and non-financial), and the land user will have to display a willingness to do their part. Due to the necessary checks and balances for disbursement of government funds, applying for and managing these resources may require a lot of administration.

Beneficiation

Additional funds can be gained by making use of the IAP biomass that is cut down (see What other factors should one consider for IAP management? page 28 and How can one responsibly manage plant material? page 45). The land user can get financial benefit if wood is processed into saleable products like charcoal, activated carbon, pellets, pallets, poles and many other wood products. The investment in these production processes can help to offset the costs of IAP management. However, this approach should always follow best practice for IAP management, as clearing only some IAPs may have no environmental benefit and could make the IAP problem worse.

Several green economy initiatives are emerging across the landscape, so it is wise to approach the government programmes mentioned above, local non-government organisations or local businesses to get involved.

FOR MORE INFORMATION

Supporting documentation and additional information have been compiled into a set of appendices, which are available at www.wwf.org.za/invasive_plants_appendices. All the documents are in PDF format, but the templates can be converted to MS Word using free PDF to MS Word conversion programs available on the internet.

LEGAL REQUIREMENTS

APPENDIX 1: LEGISLATION GUIDELINE FOR INVASIVE ALIEN SPECIES

A detailed guideline on the legislation relevant to landowners with invasive alien species on their land.

PLANNING IAP MANAGEMENT OPERATIONS

APPENDIX 2: GUIDELINES FOR THE PREPARATION OF AN IAP CONTROL PLAN

Guidelines for drawing up an IAP control plan for a farm, giving basic pointers on drawing up a plan, completing a field verification and determining working days for costing. A field verification worksheet (Appendix 3) and guidelines for clearing times (Appendix 4) are also included.

APPENDIX 3: WORK SHEET FOR FIELD VERIFICATION

A blank worksheet to fill in the species, age and density classes of IAPs and then calculate person days. The work sheet can be converted to MS Word using free PDF to Word conversion programs available on the internet. It is also available from the Department of Environment, Forestry and Fisheries Natural Resource Management (NRM) offices.

APPENDIX 4: GUIDELINES FOR CLEARING TIME (person days/ha NORMS)

The "norms" for person days required for different IAP types, ages and density classes. It is also available from Department of Environment, Forestry and Fisheries Natural Resource Management (NRM) offices.

APPENDIX 5: TEMPLATE FOR A FARM-LEVEL ALIEN CONTROL PLAN

A template to record listed alien species, distribution, objectives and actions, monitoring actions, planning and budget and a clearing schedule. It also provides a herbicide control sheet and useful checklists for landowners. The template can be converted to MS Word using free PDF to Word conversion programs available on the internet.

APPENDIX 6: BASIC MAPPING SKILLS

Some basics of map reading and mapping aids necessary to understand maps.

APPENDIX 7: FIRE PROTECTION ASSOCIATIONS IN THE WESTERN CAPE

Information about Fire Protection Associations are specific to the reader's location and can be found online. An example for the Western Cape is included here.

APPENDIX 8: CAPENATURE'S FACT FILE: A LANDOWNER'S GUIDE TO PLANNING ALIEN CONTROL

This two-page information sheet giving brief information on prioritisation, budget, clearing methods and common invasive alien species, in English and Afrikaans, is also available on CapeNature's website at www.capenature.co.za.

APPENDIX 9: NATIONAL GEOSPATIAL INFORMATION (NGI)

Topographical maps and aerial photos are available from the NGI at www.ngi.gov.za.

APPENDIX 10: CAPENATURE'S FACT SHEET: WHAT A LANDOWNER NEEDS TO KNOW ABOUT FIRE MANAGEMENT

A two-page information sheet on fire management for landowners, including principles of burning (frequency, intensity, season) and dos and don'ts, available in English at https://www.capenature.co.za/wp-content/uploads/2013/09/Landowners-Guide-to-Fire-Management-Fact-Sheet-English.pdf, and in Afrikaans at https://www.capenature.co.za/wp-content/uploads/2013/09/Landowners-Guide-to-Fire-Management-Fact-Sheet-Afrikaans.pdf.

IAP MANAGEMENT METHODS

APPENDIX 11: CHOICE OF NOZZLES FOR INVADER PLANT CONTROL

An introduction to the types of nozzles available and their uses. This information can be sourced from your herbicide provider.

HERBICIDE SAFETY

APPENDIX 12: EXAMPLE OF A HERBICIDE MIXING RATE TABLE

Most herbicide manufacturers supply a table of quantities for mixing common herbicides online. Additional information can be found on CropLife's website: https://croplife.co.za.

APPENDIX 13: AVCASA'S STORING AGROCHEMICALS AND STOCK REMEDIES

Guidance on the proper storage of chemicals to prevent the risk of agrochemicals being used to poison livestock, people and even to destroy crops is available at www.nda.agric.za/docs/peststore/storing.htm.

APPENDIX 14: CROPLIFE INTERNATIONAL'S RESPONSIBLE USE MANUAL

Comprehensive course material on the concepts and principles of the responsible use of pesticides is available at https://croplife.org/wp-content/uploads/2016/04/Responsible-Use-Manual.pdf.

APPENDIX 15: CROPLIFE'S RESOURCES ON CONTAINER MANAGEMENT

A set of resources on proper disposal of used herbicide containers is available at https://croplife.co.za/container-management.

REHABILITATION AND RESTORATION

APPENDIX 16: WWF: A PRACTICAL GUIDE FOR COMMUNITY-RUN NURSERIES

Wilman, V. 2019. *A Practical Guide for Community-run Nurseries: Growing Indigenous Plants for Restoration*. WWF South Africa, Cape Town, South Africa. This practical guide is available at https://www.wwf.org.za/our_research/publications/?29601/a-practical-guide-for-community-run-nurseries.

APPENDIX 17: WWF: RESTORATION OF ALIEN-INVADED RIPARIAN SYSTEMS

Fourie, S. and Wilman, V. n.d. *Restoration of Alien Invaded Riparian Systems*. Report ISBN 978-2-940443-06-2, WWF, Cape Town, South Africa.

APPENDIX 18: ALIEN WEEDS AND INVASIVE PLANTS

Henderson, L. 2001. *Alien weeds and invasive plants*. Plant Protection Research Institute Handbook No. 12. Plant Protection Research Institute, Agricultural Research Council, Pretoria, South Africa.

A complete guide to declared weeds and invaders in South Africa, including another 36 species invasive in that region, compiled by the Agricultural Research Council. This guide is available at www.wfw.org.za.

REFERENCES

Conservation of Agricultural Resources Act 43 of 1983

National Environmental Management: Biodiversity Act 10 of 2004

National Forest Act 84 of 1998

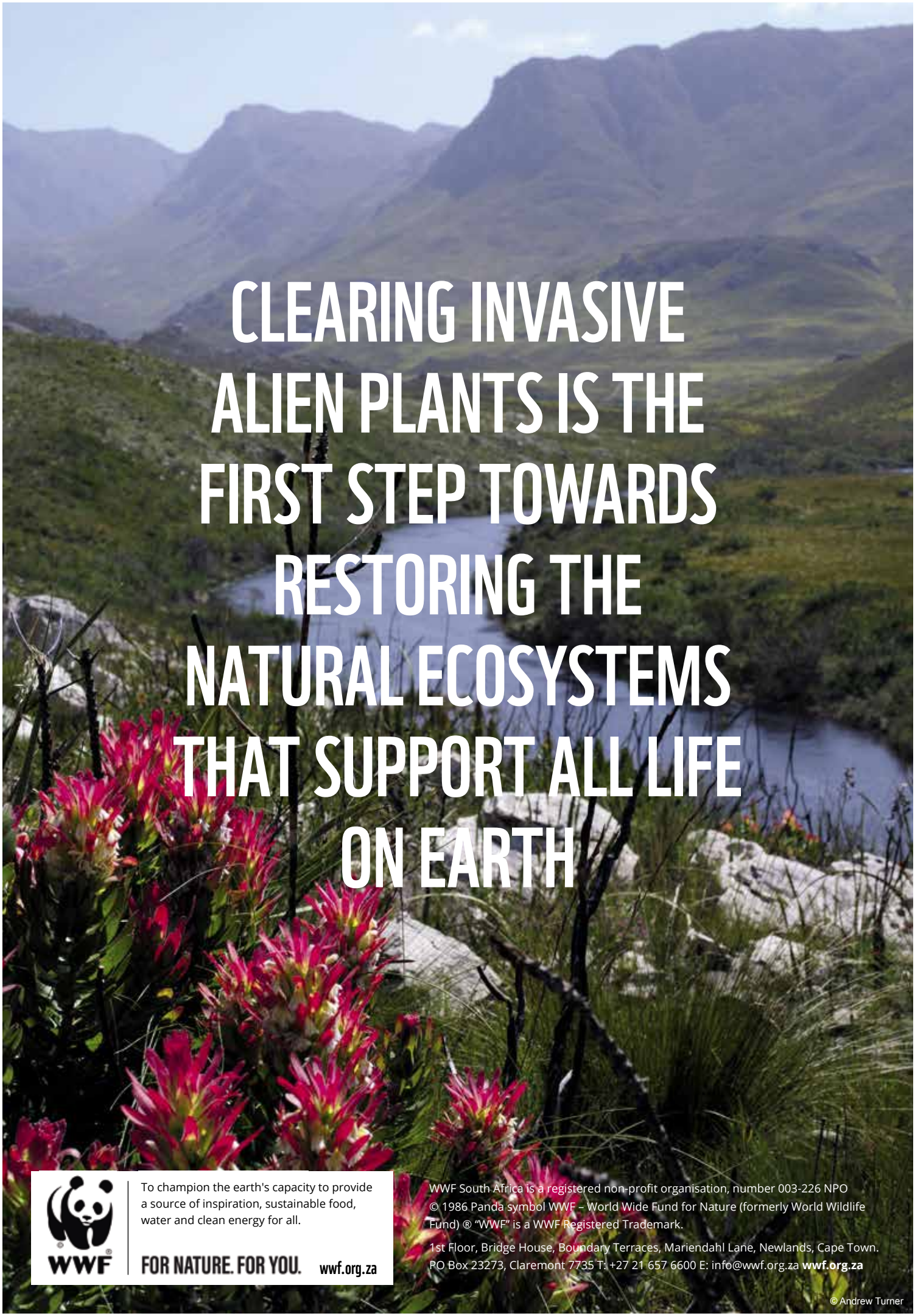
National Heritage Resources Act 25 of 1999

National Road Traffic Act 93 of 1996

National Veld and Forest Fire Act 101 of 1998

National Water Act 36 of 1998

Occupational Health and Safety Act 85 of 1993



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ENVIRONMENTAL AWARENESS TRAINING BOOKLET

Environmental Monitor's Forward

SES is here to ensure that everyone complies with the conditions of "Duty to Care". If these conditions are not complied with the project can be stopped and fines can be issued.

We hope that with your co-operation the project won't be stopped and fines won't be issued, and a successful project can be finished on time.

Notes:

- Workers working on this project must undergo environmental training.

- The information contained in this document should be used during day-to-day activities.

HOW IS THIS PROJECT IMPLEMENTING ENVIRONMENTAL MANAGEMENT?

This project is implementing Environmental Management on an ongoing basis throughout the duration of the project. The following aspects would be implemented to achieve the above stated:

- A dedicated Environmental Manager or Environmental Control Officer appointment to the project to implement and monitor Environmental Management.
- Regular environmental inspection on the site.
- Regular environmental training for workers
- Environmental audits on a regular basis.

WASTE TREATMENT

Refuse:

- Refuse waste includes: waste food, food containers, packaging materials, cans, bottles, newspapers and magazines.
- Day to day household waste should always be disposed of in the containers provided on site by the company.
- No dumping of waste anywhere other than in the bins provided.
- No burning of refuse.
- If there are not enough refuse containers on site, the ECO or supervisor needs to be informed.

Construction Waste:

- Construction waste includes: concrete, steel, cement, rock, pre-coated chips, wood, plastic, empty bags and rubble.
- Construction waste must be discarded in skips located in strategic areas for removal.
- Construction waste must not be discarded in holes or burned on site.

- Small amounts of construction waste should be collected and not discarded into vegetation or down fill slopes.
- Material should only be spoiled if a rehabilitation plan has been designed for the area.

Liquid waste:

- Liquid waste includes: concrete, paint, thinners, diesel, hydraulic fluids, cooking oil, chemicals, other fuel and sewage.
- Use facilities provided for waste.
- The liquid waste should be recycled as far as possible.
- Use chemical toilets and ablution facilities.

INFORM THE ENVIRONMENTAL CONTROL OFFICER (ECO) IMMEDIATELY OF ANY IMMEDIATE OR POTENTIAL ENVIRONMENTAL INCIDENT.

SPECIFIC ENVIRONMENTAL ISSUES

SPESIFIEKE OMGEWINGSKWESSIES
IMIBA ETHILE YEZOBUME BEMEKO YENDALO

The basic Do's and Don'ts towards environmental awareness are as follows:

Die basiese Moets en Moenies van omgewingsbesinning is as volg:

Oondoqo bo mawukwenze no mawungakwenzi kwilinge lezobume be meko yendalo bume ngoluhlobo:

Toilet Facilities:
Toilet Fasiliteite:
Izindlu Zangasese:

DO:

USE THE TOILET FACILITIES PROVIDED - REPORT FULL FACILITIES
MOET:
GEBRUIK MAAK VAN TOILET FASILITEITE WAT VOORSIEN WORD – RAPPORTEER AS FASILITEITE VOL IS
OMAWUKWENZE: SEBENZISA IZINDLU ZANGASESE EZIBONELELWEYO- NIKA INGXELO NGAMALUNGISELELO AGCWELEYO.

DO NOT:
USE THE BUSH
MOENIE:
DIE BOS GEBRUIK NIE
OMAWUNGAKWENZI: UKUSEBENZISA ITYHOLO.

Vehicles operation and maintenance:
Voertuig werking en onderhoud:
Ulawulo nophatho lezithuthi:

DO:
ENSURE THAT VEHICLES AND MACHINERY DO NOT LEAK FUEL OR OILS. REFUELLING, MAINTENANCE, SERVICING OR WASHING MUST BE DONE WITHIN THE DESIGNATED AREA IN THE CONSTRUCTION CAMP AREA ONLY.
MOET:
VERSEKER DAT VOERTUIE EN MASJINERIE NIE OLIES OF BRANDSTOF LEK NIE. VOLMAAK, ONDERHOUD, DIENS OF SKOONMAAK VAN VOERTUIE MOET SLEGS IN AANGEWYSTE AREAS IN DIE KONSTRUKSIE KAMP GESKIED.
OMAWUKWENZE: QINISEKISA IZITHUTHI NOMATSHINI ABAVUZI MAFUTHA OKANYE I OYILE, UKUGALELA, UKUPHATHA, UKULUNGISA OKANYE UKUHLAMBA KUFUNEKA KWENZIWE KUMMANDLA OTYUNJIWEYO KWINKAMPI YOLWAKHIWO KUPHELA NGOKUKHAWULEZILEYO.

DO:
REPORT ALL FUEL OR OIL SPILLS IMMEDIATELY & STOP THE SPILL CONTINUING.
MOET:
RAPPORTEER ENIGE BRANDSTOF OF OLIE STORTE & VERHOED DAT DIE STORT AANHOU.
OMAWUKWENZE: NIKA INGXELO NGE OLI NAMAFUTHA ACHITHEKILEYO, UZE UNQANDE UCHITHEKO LUNGAQHUBEKI.

DO:
PREVENT CONTAMINATION OR POLLUTION OF STREAMS AND WATER CHANNELS.
MOET:
VERHOED DIE KONTAMINASIE EN BESOEDELING VAN STROME & WATERKANALE.
OMAWUKWENZE : NQANDA USULELEKO OKANYE UNGCOLISEKO LWEMILAMBO NEMISELE YAMANZI.

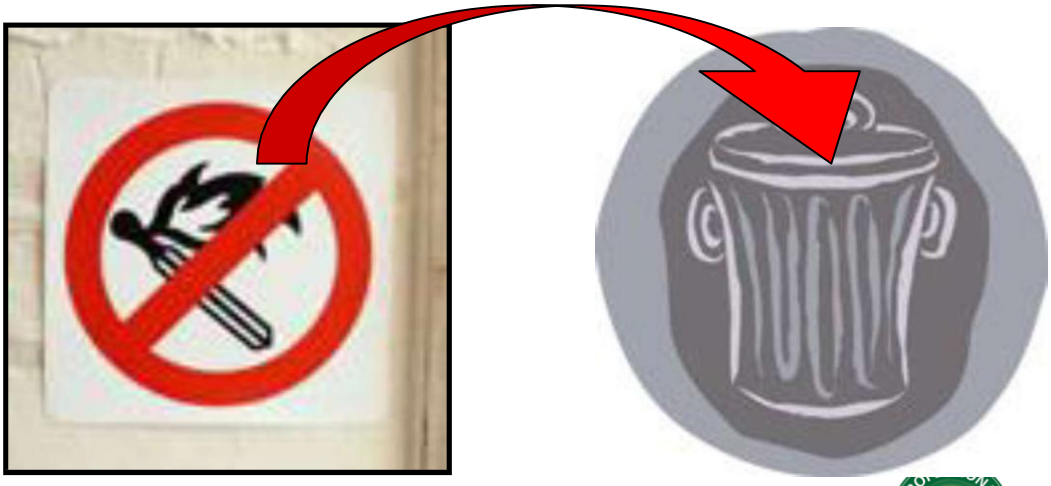
DO NOT:
ALLOW WASTE, LITTER, OILS OR FOREIGN MATERIALS INTO THE STREAM
MOENIE:
TOELAAT DAT AFVALPRODUKTE, GEMORS, OLIES OF VREEMDE MATERIALE IN STROME BELAND NIE.
OMAWUNGAKWENZI: MUSA UKUVUMELA INCITHO, ULAHLO, IOYILE OKANYE EZINYE IZINTO EMILANJENI.

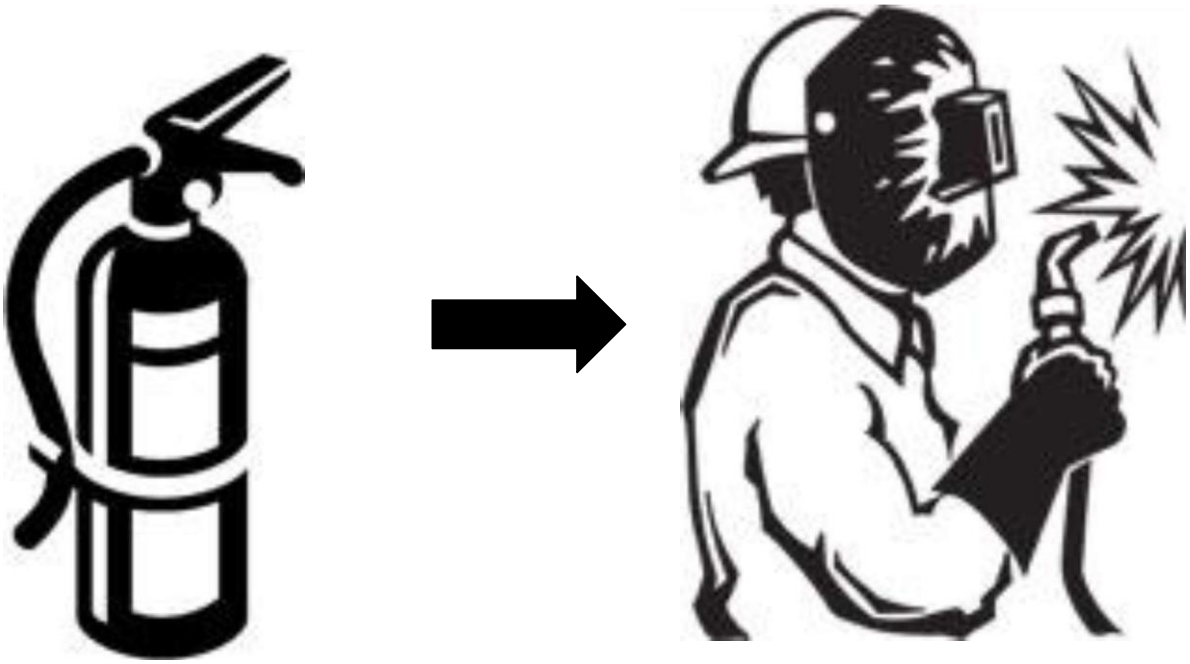
Fire Control:
Vuur Beheer:
Ulawulo Lemililo:

DO:
DISPOSE OF CIGARETTES AND MATCHES CAREFULLY. (Littering is an offence.)
MOET:
GOOI SIGARETTE & VUURHOUTJIES OP GEPASTE MANIER WEG WEG (rommelstrooi is 'n oortreding)
OMAWUKWENZE: LAHLA ISIGARETE NOOMATSHISI NGONONOPHELO (ukulahla lityala).

DO:
ENSURE A WORKING FIRE EXTINGUISHER IS IMMEDIATELY AT HAND IF ANY "HOT WORK" IS UNDERTAKEN e.g. welding, grinding, gas cutting etc.
MOET:
VERSEKER DAT 'N WERKENDE BRANDBLUSSER BYDERHAND IS INDIEN "WARM WERK" GEDOEN WORD bv. Sweiswerk.
OMAWUKWENZE: QINISEKISA ISICIMA-MLILO ESISEBENZAYO SISESANDLENI UKUBA KUKHO UMSEBENZI "OTSHISAYO" OWENZIWAYO, umz. ukuwelda, ugubo, ukuqhawula ugesi, njl.

DO NOT:
MAKE ANY FIRES
MOENIE:
ENIGE VURE MAAK OF ENIGEIETS VERBRAND NIE
OMAWUNGAKWENZI: UKWENZA IMILILO OKANYE UTSHISE NOKUBA YINTONI.





Fencing and Restricted Areas:
Omheining en Beperkte Areas:
Ubiyelo Nemimanndla Engavumelekanga:

DO:

CONFINE WORK AND STORAGE OF EQUIPMENT TO WITHIN THE IMMEDIATE WORK AREA.

MOET:

BEPERK ALLE WERK EN STOOR VAN GEREEDSKAP TOT IN DIE GEGEWE WERKAREA.

OMAWUKWENZE:GCINA UMSEBENZI NEZIXHOBO ZOKUSEBENZA NGAKUMMANDLA OKUSETYENZELWA KUWO.

DO NOT:

ENTER ANY FENCED OFF OR MARKED AREA. SUCH AREAS HAVE BEEN MARKED WITH "NO-GO AREA" SIGNS AND SHOULD BE ADHERED TO.

MOENIE:

ENIGE OMHEINDE OF GEMERKTE AREAS BINNEGAAN NIE. SULKE AREAS IS MET "NO-GO AREA" TEKENS GEMERK EN MOET GEHOORSAAM WORD.

OMAWUNGAKWENZI: MUSA UKUNGENA KWI NDAWO EBIYIWEYO OKANYE EPHAWULWEYO. IMIMANDLA ENJALO IPHAWULWE NGAMAGAMA ATHI "**NO-GO AREA** "

NO-GO AREA

Safety:
Veiligheid:
Ukhuseleko:

DO:
USE ALL SAFETY EQUIPMENT AND COMPLY WITH ALL SAFETY PROCEDURES.
MOET:
GEBRUIK ALLE VEILIGHEIDSGEREEDSKAP EN VOLDOEN AAN ALLE VEILIGHEIDS PROSEDURES.
OMAWUKWENZE: SEBENZISA ZONKE IZIXHOBO ZOKHUSELEKO, UZE UTHOBELE YONKE IMIGAQO YOKHUSELO.

Driving and Dust:
Bestuur en Stof:
Uqhubo Nothuli:

DO:
DRIVE ON DESIGNATED ROUTES ONLY.
MOET:
NET OP AANGEWYSTE ROETES BESTUUR.
OMAWUKWENZE: QHUBA KWIMIMANDLA EPHAWULWEYO KUPHELA.

DO NOT:
SPEED OR DRIVE RECKLESSLY
MOENIE:
JAAG OF ROEKELOOS BESTUUR NIE.
OMAWUNGAKWENZI: SUKUQHUBA NGESANTYA ESIPHEZULU OKANYE NGOKUNGAKHATHALI.

DO NOT:
ALLOW CEMENT TO BLOW AROUND.
MOENIE;
TOELAAT DAT SEMENT WEGWAAI NIE.
OMAWUNGAKWENZI: MUSUKUVUMELA ISAMENTE ISASAZWE.

DO NOT:
CAUSE EXCESSIVE DUST
MOENIE:
OORDREWE STOF VEROORSAAK NIE.


SLOW


PPC

Vegetation protection:
Plantegroei Beskerming:
Ukhuselo Lwezityalo:

DO NOT:
DAMAGE OR REMOVE ANY VEGETATION WITHOUT DIRECT INSTRUCTION.
MOENIE:
ENIGE PLANTEGROEI SONDER DIREKTE INSTRUKSIE BESKADIG OF VERWYDER NIE.
OMAWUNGAKWENZI: MUSA UKUTSHABALALISA OKANYE USUSE NASIPHINA ISITYALO NGAPHANDLE KOMYALELO.

Animals:
Diere:
Izilwanyana:

DO NOT:
INJURE, CAPTURE/SNARE, FEED OR CHASE ANIMALS – this includes birds, frogs, snakes, lizards, tortoises, etc.
MOENIE:
ENIGE DIERE BESEER, VANG, VOER OF JAAG NIE – dit sluit in: voëls, paddas, slange akkedisse, skilpaaie ens.
OMAWUNGAKWENZI: MUSA UKWENZAKALISA, UKUBAMBA, UKONDLA OKANYE UKULEQA IZILWANYANA- okuquka iintaka, amasele, iinyoka, amacilikishe, izikolopati.

DO:
REPORT ANY INJURY OF AN ANIMAL.
MOET:
DIE BESERING VAN 'N DIER RAPPORTEER.
OMAWUKWENZE: XELA NASIPHI ISENZAKALO SESILWANYANA.

Preventing Pollution:
Voorkoming van Besoedeling:
Ukhuselo Longcoliseko:

DO:
CLEAR YOUR WORK AREAS OF LITTER AND BUILDING RUBBLE AT THE END OF EACH DAY **–** use the waste bins provided and ensure that litter will not blow away.
MOET:
RUIM NA ELKE DAG DIE WERK AREA OP EN GOOI ENIGE ROMMEL WEG IN DIE GEGEWE HOUERS – maak seker dat rommel nie kan wegwaai nie.
OMAWUKWENZE: COCA INDAWO OSEBENZA KUYO, IZINTO EZILAHLIWEYO NENKUNKUMA YOKWAKHA QHO EKUPHELENI KWEMINI-sebenzisa imigqomo yenkunkuma uze uqiniseke ukuba inkunkuma ayivuthuzwa ngumoya.

DO NOT:
ALLOW WASTE BINS TO OVERFLOW OR WASTE TO BLOWAROUND.
MOENIE:
TOELAAT DAT ROMMELHOUERS OORVLOEI OF DAT ROMMEL ROND WAAI NIE.
OMAWUNGAKWENZI: MUSA UKUVUMELA IMIGQOMO YENKUNKUMA IGCWALE KAKHULU OKANYE INKUNKUMA ISASAZEKE.

DO NOT:
LITTER OR LEAVE FOOD LAYING AROUND
MOENIE:
ROMMEL OF KOS LAAT RONDLÊ NIE.
OMAWUNGAKWENZI: MUSA UKUNGCOLISA OKANYE USHIYE UKUTYA KULELE INDAWO YONKE.

DO NOT:
BURY ANY LITTER OR WASTE IN THE GROUND.
MOENIE:
ENIGE ROMMEL OF GEMORS IN DIE GROND BEGRAWE NIE.
OMAWUNGAKWENZI: MUSA UKUNGCWABA INKUNKUMA EMHLABENI.


GLASS
CARDBOARD
PAPER

SCREENING REPORT FOR AN ENVIRONMENTAL AUTHORIZATION AS REQUIRED BY THE 2014 EIA REGULATIONS – PROPOSED SITE ENVIRONMENTAL SENSITIVITY

EIA Reference number: 16/3/3/1/A1/41/3042/25

Project name: The proposed N7 Weighbridge

Project title: .

Date screening report generated: 28/08/2025 09:35:22

Applicant: Western Cape Government: Department of Infrastructure

Compiler: SEScc

Compiler signature: .....

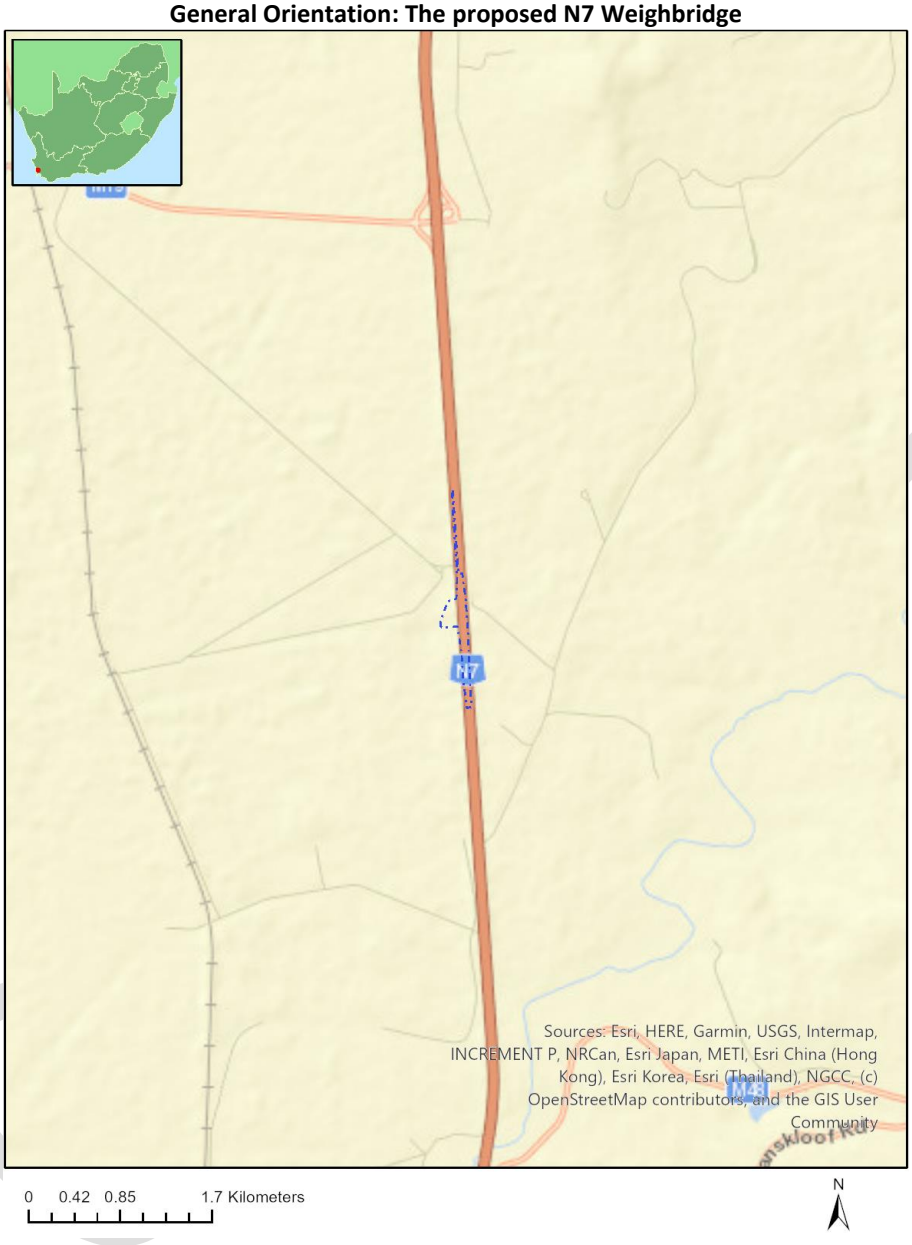
Application Category: Infrastructure|Transport Services|Roads|Public

Table of Contents

Proposed Project Location

Orientation map 1: General location

General Orientation: The proposed N7 Weighbridge



Map of proposed site and relevant area(s)

Cadastral details of the proposed site

Property details:

No	Farm Name	Farm/ Erf No	Portion	Latitude	Longitude	Property Type
1	VISSERSHOK OUTSPAN	153	0	33°45'57.84S	18°32'46.61E	Farm
2	MORNING STAR	141	0	33°44'31.35S	18°32'16.54E	Farm
3	MORNING STAR	141	0	33°44'11.59S	18°32'28.25E	Farm Portion
4	MORNING STAR	141	25	33°45'4.79S	18°32'41.49E	Farm Portion
5	MORNING STAR	141	0	33°44'13.12S	18°32'27.62E	Farm Portion
6	VISSERSHOK OUTSPAN	153	0	33°45'57.84S	18°32'46.61E	Farm Portion

Development footprint[1] vertices:
No development footprint(s) specified.

Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

No	EIA Reference	Classification	Status of	Distance from proposed

[1] "development footprint", means the area within the site on which the development will take place and incudes all ancillary developments for example roads, power lines, boundary walls, paving etc. which require vegetation clearance or which will be disturbed and for which the application has been submitted.

	No		application	area (km)
1	12/12/20/2109/AM2	Solar PV	Approved	21.5
2	12/12/20/2109	Solar PV	Approved	21.5
3	12/12/20/2638/AM2	Wind	Approved	26.5
4	12/12/20/2109/AM3	Solar PV	Approved	21.5
5	12/12/20/2638	Wind	Approved	26.5
6	12/12/20/2638/AM3	Wind	Approved	26.5
7	12/12/20/2109/AM1	Solar PV	Approved	21.5

Environmental Management Frameworks relevant to the application

No intersections with EMF areas found.

Environmental screening results and assessment outcomes

The following sections contain a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development site as well as the most environmental sensitive features on the site based on the site sensitivity screening results for the application classification that was selected. The application classification selected for this report is: **Infrastructure|Transport Services|Roads|Public**.

Relevant development incentives, restrictions, exclusions or prohibitions

The following development incentives, restrictions, exclusions or prohibitions and their implications that apply to this site are indicated below.

Incentive, restriction or prohibition	Implication
Strategic Transmission Corridor-Central corridor	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/Combined_EGI.pdf
Strategic Gas Pipeline Corridors-Phase 1a & 1b: Saldanha to Ankerlig and Saldanha to Mossel Bay	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/Combined_GAS.pdf
South African Conservation Areas	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/SACAD_OR_2025_Q1_Metadata.pdf

Proposed Development Area Environmental Sensitivity

The following summary of the development site environmental sensitivities is identified. Only the highest environmental sensitivity is indicated. The footprint environmental sensitivities for the proposed development footprint as identified, are indicative only and must be verified on site by a suitably qualified person before the specialist assessments identified below can be confirmed.

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme		X		
Animal Species Theme		X		
Aquatic Biodiversity Theme				X

Archaeological and Cultural Heritage Theme				X
Civil Aviation Theme		X		
Defence Theme			X	
Paleontology Theme				X
Plant Species Theme		X		
Terrestrial Biodiversity Theme	X			

Specialist assessments identified

Based on the selected classification, and the known impacts associated with the proposed development, the following list of specialist assessments have been identified for inclusion in the assessment report. It is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the site situation.

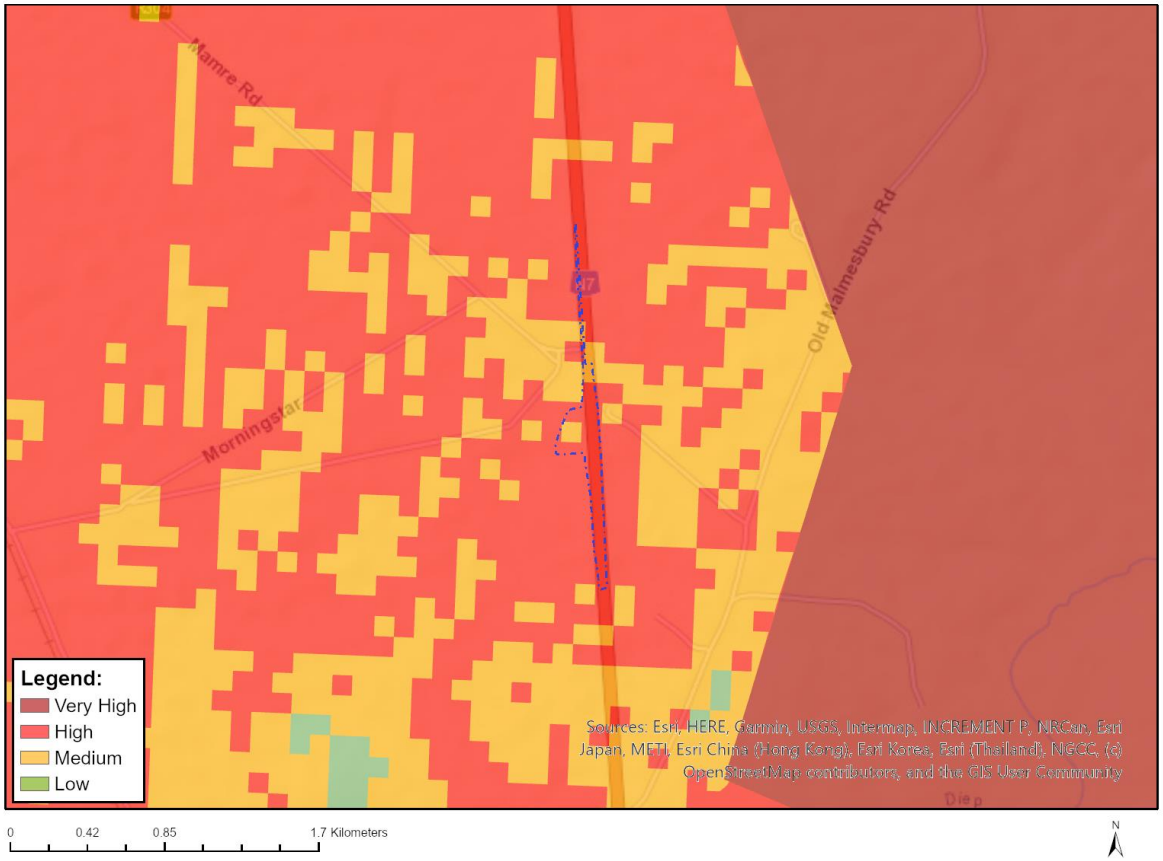
No	Specialist assessment	Assessment Protocol
1	Agricultural Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Agriculture_Assessment_Protocols.pdf
2	Landscape/Visual Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
3	Archaeological and Cultural Heritage Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/GuidanceforHIA.pdf
4	Palaeontology Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/GuidanceforPIA.pdf
5	Terrestrial Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Terrestrial_Biodiversity_Assessment_Protocols.pdf
6	Aquatic Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Aquatic_Biodiversity_Assessment_Protocols.pdf
7	Noise Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Noise_Impacts_Assessment_Protocol.pdf
8	Traffic Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
9	Geotechnical Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
10	Socio-Economic Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
11	Ambient Air Quality Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
12	Plant Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Plant_Species_Assessment_Protocols.

		pdf
13	Animal Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Animal_Species_Assessment_Protocols.pdf

Results of the environmental sensitivity of the proposed area.

The following section represents the results of the screening for environmental sensitivity of the proposed site for relevant environmental themes associated with the project classification. It is the duty of the EAP to ensure that the environmental themes provided by the screening tool are comprehensive and complete for the project. Refer to the disclaimer.

MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY

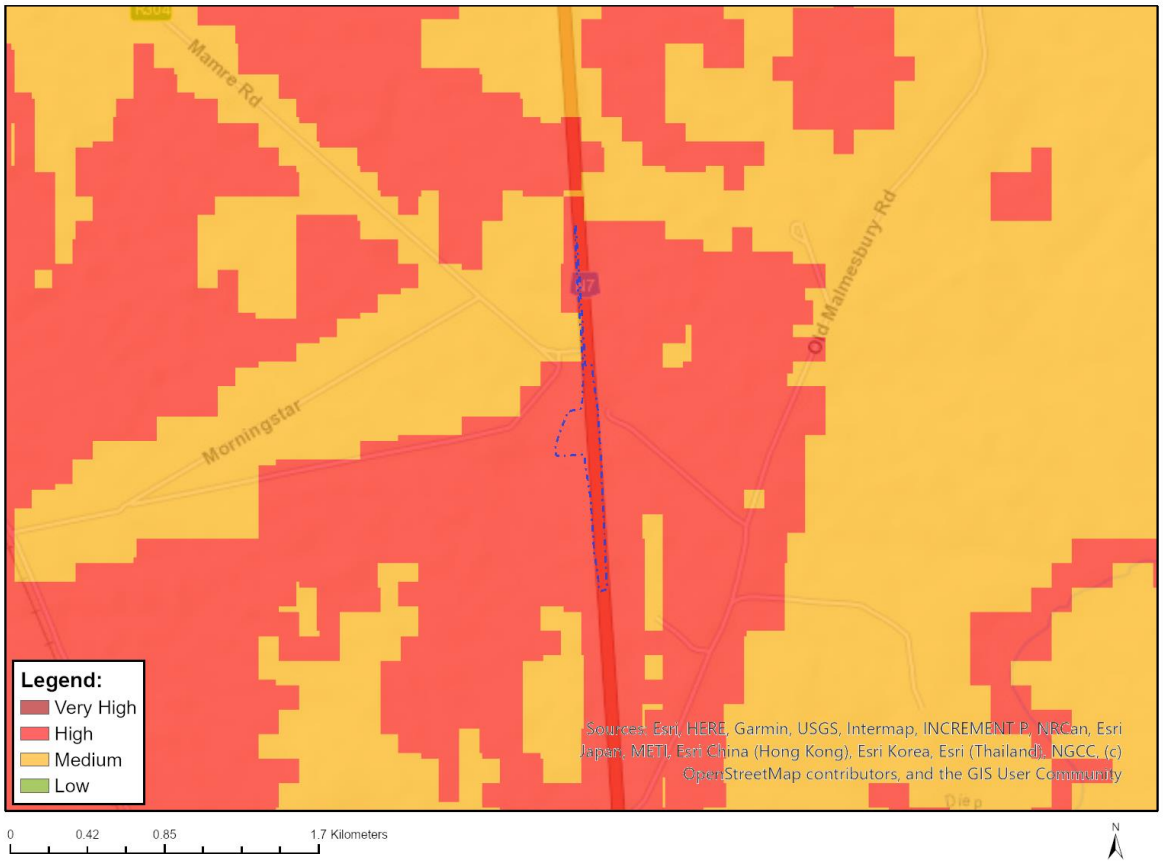


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	08. Moderate
High	09. Moderate-High
Medium	07. Low-Moderate

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Circus ranivorus
High	Aves-Circus maurus
High	Aves-Polemaetus bellicosus
Medium	Aves-Afrotis afra
Medium	Invertebrate-Pachysoma aesculapius
Medium	Invertebrate-Bullacris obliqua

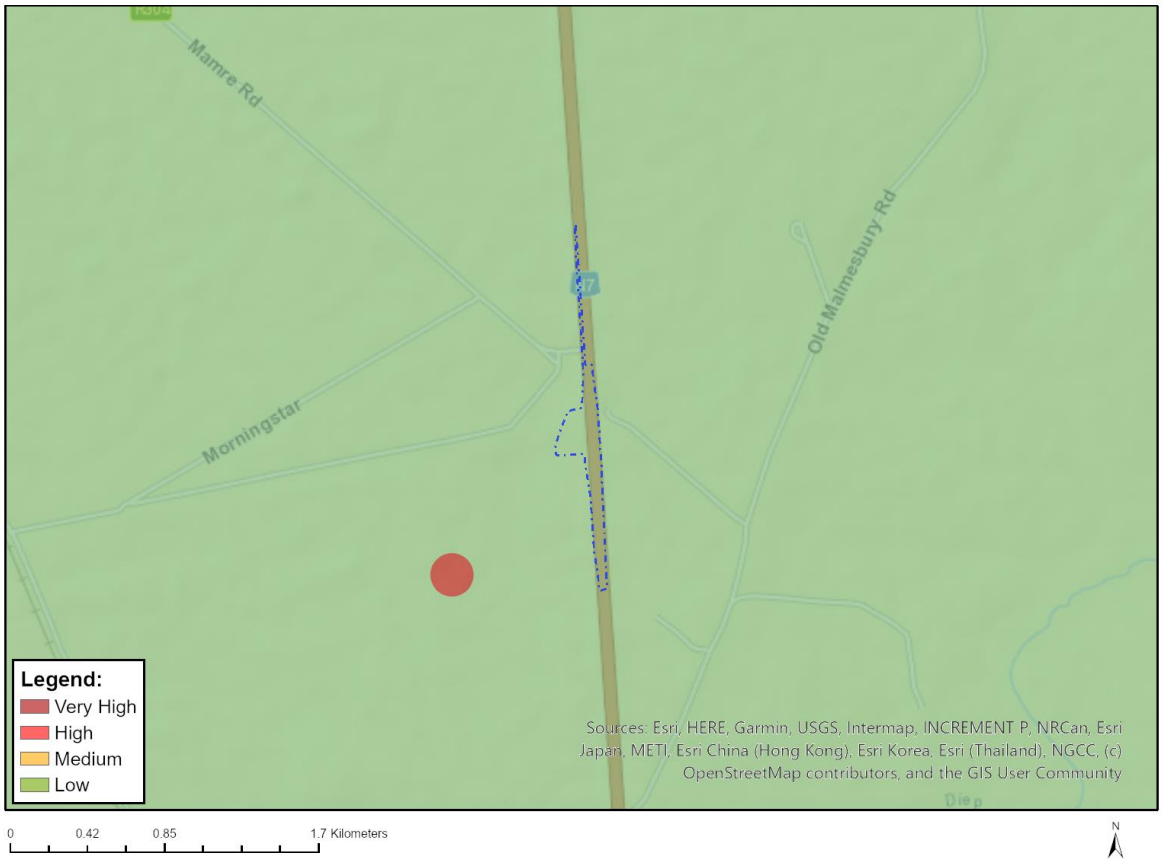
MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity

MAP OF RELATIVE ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME SENSITIVITY

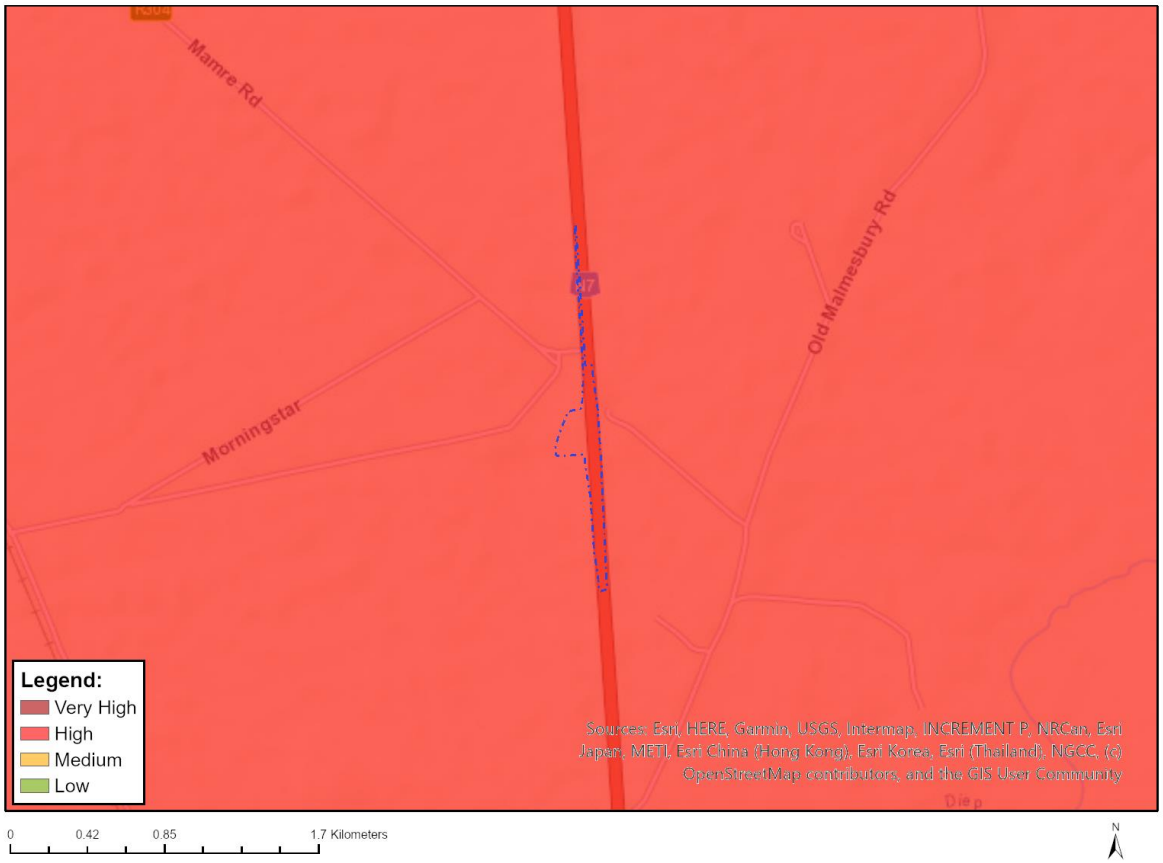


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity

MAP OF RELATIVE CIVIL AVIATION THEME SENSITIVITY

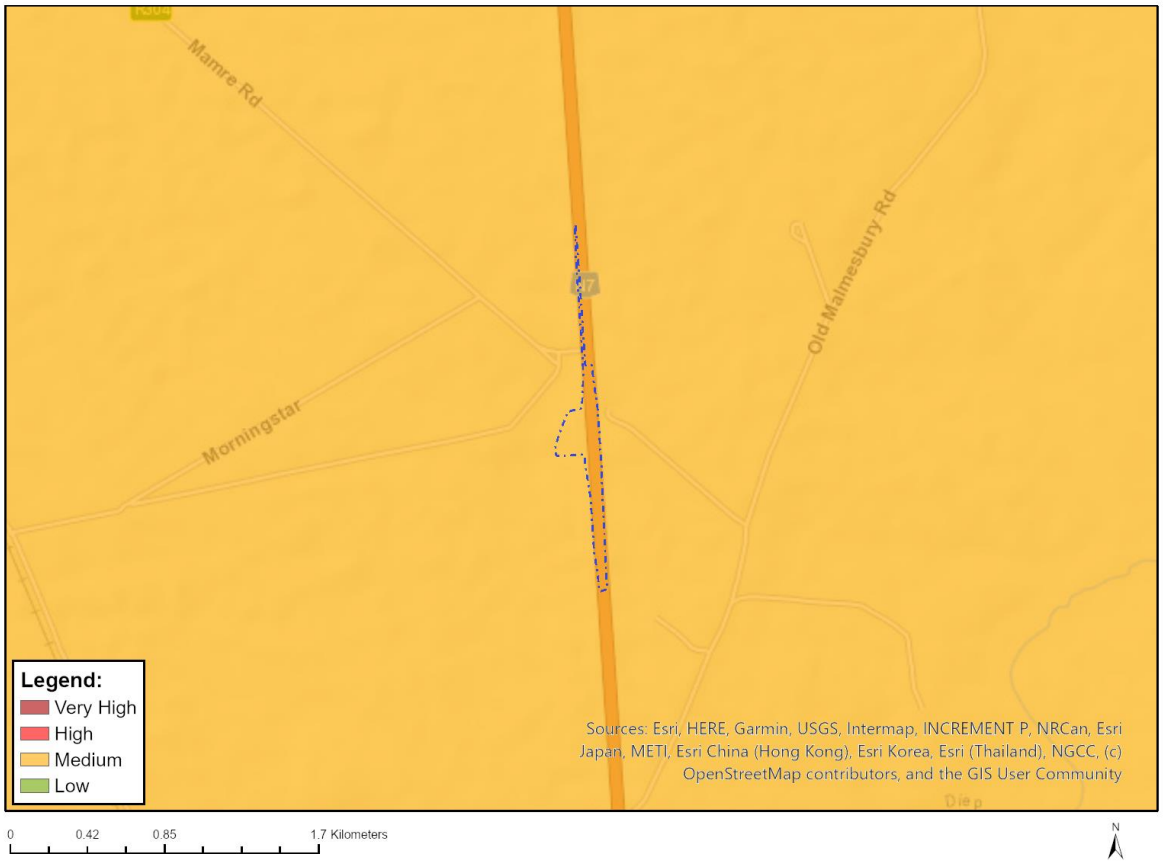


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Within 8 km of other civil aviation aerodrome
Medium	Between 15 and 35 km from a civil aviation radar
Medium	Between 15 and 35 km from a major civil aviation aerodrome

MAP OF RELATIVE DEFENCE THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Military and Defence Site

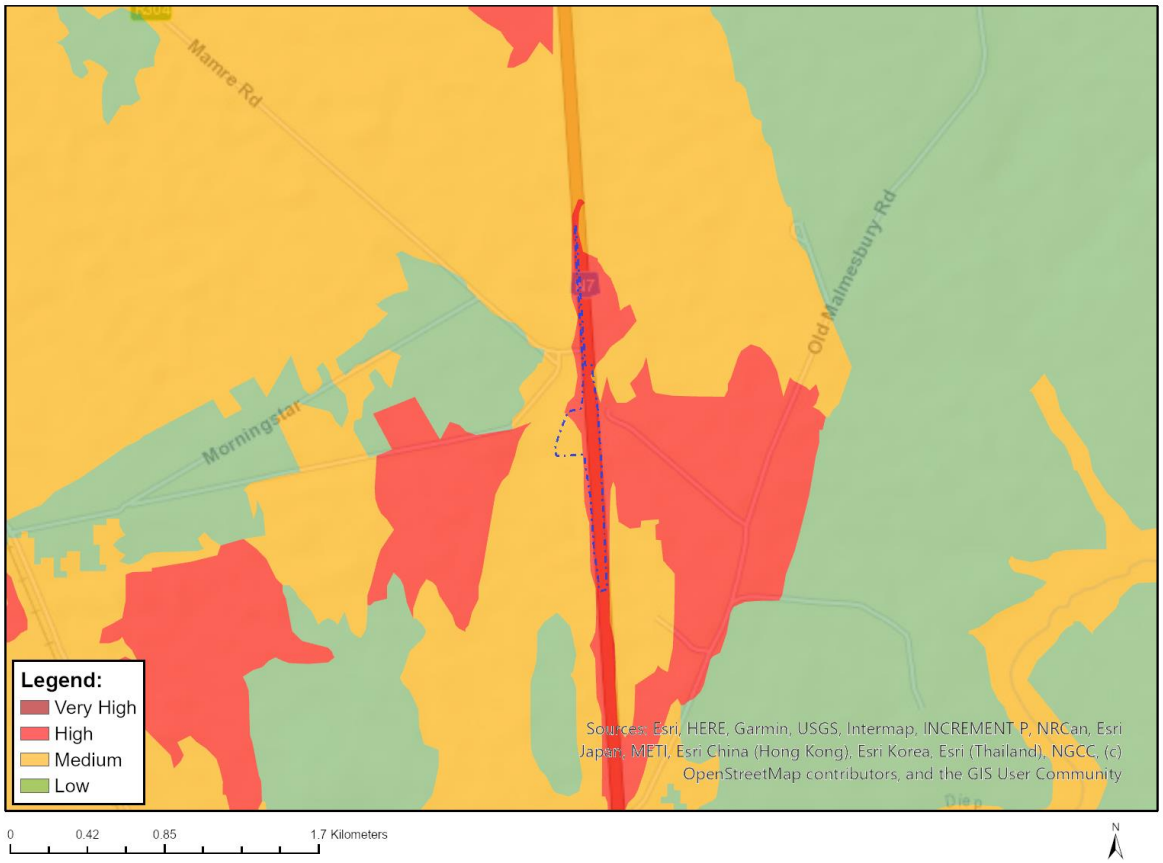
MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Features with a Low paleontological sensitivity

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Leucadendron thymifolium
Medium	Lampranthus amoenus
Medium	Lampranthus dilutus
Medium	Lampranthus filicaulis
Medium	Lampranthus leptaleon
Medium	Lampranthus peacockiae
Medium	Lampranthus scaber
Medium	Lampranthus sociorum
Medium	Lampranthus spiniformis
Medium	Lampranthus stenopetalus
Medium	Lampranthus stenus
Medium	Lampranthus tenuifolius
Medium	Antimima mucronata

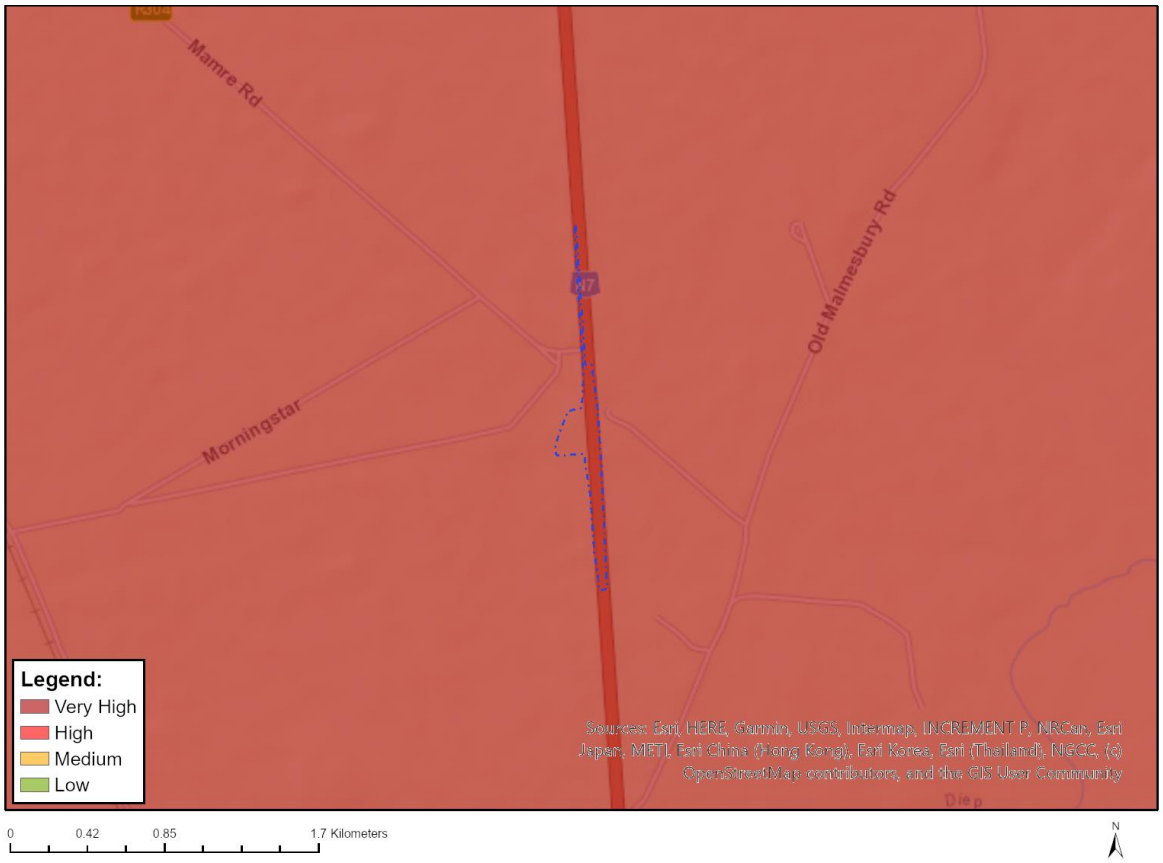
Medium	Antimima aristulata
Medium	Erepsia patula
Medium	Erepsia ramosa
Medium	Cleretum clavatum
Medium	Ruschia diversifolia
Medium	Ruschia geminiflora
Medium	Ruschia tecta
Medium	Drosanthemum hispifolium
Medium	Cephalophyllum parviflorum
Medium	Lessertia argentea
Medium	Amphithalea ericifolia subsp. erecta
Medium	Xiphotheca lanceolata
Medium	Psoralea glaucina
Medium	Indigofera psoraloides
Medium	Aspalathus acanthophylla
Medium	Aspalathus aculeata
Medium	Aspalathus araneosa
Medium	Aspalathus lotoides subsp. lotoides
Medium	Aspalathus muraltioides
Medium	Aspalathus retroflexa subsp. bicolor
Medium	Aspalathus varians
Medium	Rafnia lancea
Medium	Rafnia angulata subsp. humilis
Medium	Rafnia angulata subsp. ericifolia
Medium	Lebeckia plukenetiana
Medium	Podalyria argentea
Medium	Podalyria microphylla
Medium	Podalyria sericea
Medium	Thesium ecklonianum
Medium	Leucadendron cinereum
Medium	Leucadendron lanigerum var. lanigerum
Medium	Leucadendron levisanus
Medium	Leucadendron stellare
Medium	Leucadendron thymifolium
Medium	Leucospermum hypophyllocarpodendron subsp. canaliculatum
Medium	Leucospermum hypophyllocarpodendron subsp. hypophyllocarpodendron
Medium	Protea burchellii
Medium	Diastella proteoides
Medium	Serruria aemula
Medium	Serruria brownii
Medium	Serruria trilopha
Medium	Microdon capitatus
Medium	Manulea corymbosa
Medium	Pentameris bachmannii
Medium	Pentameris pholiuroides
Medium	Anthospermum ericifolium
Medium	Lobostemon capitatus
Medium	Echiostachys incanus
Medium	Echiostachys spicatus
Medium	Hesperantha spicata subsp. spicata
Medium	Sensitive species 14
Medium	Sensitive species 267
Medium	Sensitive species 631
Medium	Sensitive species 533
Medium	Sensitive species 878
Medium	Geissorhiza brehmii
Medium	Geissorhiza furva
Medium	Geissorhiza humilis
Medium	Geissorhiza monanthos
Medium	Geissorhiza radians

Medium	Geissorhiza setacea
Medium	Geissorhiza erosa
Medium	Ixia monadelpha
Medium	Sensitive species 881
Medium	Sensitive species 683
Medium	Sensitive species 560
Medium	Sensitive species 816
Medium	Sensitive species 1
Medium	Sensitive species 830
Medium	Sensitive species 1140
Medium	Sensitive species 995
Medium	Sensitive species 863
Medium	Pauridia alba
Medium	Pauridia canaliculata
Medium	Pauridia pygmaea
Medium	Pseudalthenia aschersoniana
Medium	Oxalis falcatula
Medium	Oxalis natans
Medium	Erica bolusiae var. bolusiae
Medium	Stylapterus fruticulosus
Medium	Hermannia procumbens subsp. procumbens
Medium	Hermannia rugosa
Medium	Sensitive species 769
Medium	Sensitive species 222
Medium	Sebaea rara
Medium	Sensitive species 444
Medium	Sensitive species 493
Medium	Sensitive species 478
Medium	Sensitive species 756
Medium	Adenogramma rigida
Medium	Wachendorfia brachyandra
Medium	Hessea cinnamomea
Medium	Sensitive species 133
Medium	Isolepis inconspicua
Medium	Isolepis venustula
Medium	Trianoptiles solitaria
Medium	Cannomois arenicola
Medium	Elegia prominens
Medium	Hypodiscus rugosus
Medium	Restio duthieae
Medium	Restio micans
Medium	Restio impolitus
Medium	Restio papillosus
Medium	Anisodontea biflora
Medium	Cynanchum zeyheri
Medium	Sensitive species 985
Medium	Sensitive species 120
Medium	Sensitive species 266
Medium	Pterygodium cruciferum
Medium	Pterygodium inversum
Medium	Pterygodium microglossum
Medium	Gnidia spicata
Medium	Passerina paludosa
Medium	Lachnaea uniflora
Medium	Metalasia capitata
Medium	Metalasia octoflora
Medium	Marasmodes fasciculata
Medium	Steirodiscus tagetes
Medium	Senecio foeniculoides
Medium	Senecio cadiscus

Medium	Cotula eckloniana
Medium	Athanasia capitata
Medium	Athanasia rugulosa
Medium	Arctotis angustifolia
Medium	Sensitive species 1042
Medium	Arctotheca forbesiana
Medium	Heterorhachis aculeata
Medium	Diosma dichotoma
Medium	Agathosma corymbosa
Medium	Agathosma glabrata
Medium	Adenandra villosa subsp. biseriata
Medium	Macrostylis cassiopoides subsp. dregeana
Medium	Macrostylis villosa subsp. villosa
Medium	Cliffortia ericifolia
Medium	Cliffortia hirta
Medium	Limonium depauperatum
Medium	Limonium purpuratum
Medium	Muraltia brevicornu
Medium	Muraltia decipiens
Medium	Muraltia macropetala
Medium	Muraltia mitior
Medium	Sensitive species 262
Medium	Sensitive species 1135
Medium	Sensitive species 158
Medium	Sensitive species 1265
Medium	Sensitive species 616
Medium	Wurmbea hiemalis
Medium	Wurmbea inusta
Medium	Phylica harveyi
Medium	Phylica plumosa var. squarrosa
Medium	Phylica stenopetala var. stenopetala
Medium	Phylica strigulosa
Medium	Phylica thunbergiana
Medium	Ezoloba macrocarpa
Medium	Codonorhiza azurea
Medium	Skiatophytum skiatophytoides
Medium	Lampranthus debilis
Medium	Lampranthus glaucus
Medium	Drosanthemum striatum
Medium	Argyrolobium velutinum
Medium	Xiphotheca reflexa
Medium	Psoralea alata
Medium	Aspalathus lebeckioides
Medium	Aspalathus recurva
Medium	Aspalathus tylodes
Medium	Aponogeton fugax
Medium	Leucospermum rodolentum
Medium	Protea scolymocephala
Medium	Sensitive species 593
Medium	Sensitive species 335
Medium	Sensitive species 599
Medium	Elegia squamosa
Medium	Elegia verreauxii
Medium	Restio paludosus
Medium	Restio rigoratus
Medium	Sensitive species 500
Medium	Sensitive species 654
Medium	Lachnaea capitata
Medium	Lachnaea grandiflora
Medium	Cotula pusilla

Medium	Sensitive species 1225
Medium	Caesia sabulosa

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	CBA 1a
Very High	CBA 1c
Very High	ESA 2
Very High	CR_Cape Flats Sand Fynbos