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Flora Assessment

of

The proposed Road K109 on portions of the farm Olifantsfontein 410-JR

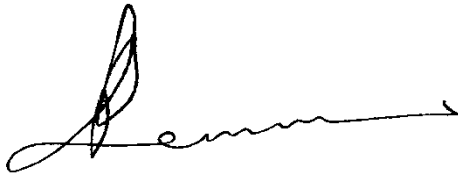
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DECLARATION OF INDEPENDENCE

I, Petro Lemmer (440129 0025 085) declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions
- act as an independent specialist consultant in the field of botany
- am subcontracted as specialist consultant by Galago Environmental CC for the proposed Road K109 project described in this report
- have no financial interest in the proposed development other than remuneration for work performed
- have or will not have any vested or conflicting interests in the proposed development
- undertake to disclose to Galago Environmental CC and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations, 2014.



Petro Lemmer

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1. INTRODUCTION

Galago Environmental was appointed to conduct a vegetation survey along the proposed Road K109, scheduled for construction on portions of the farm Olifantsfontein 410-JR. The objective was to determine which species occur in the vicinity of the proposed route. Special attention had to be given to possible habitats of all the Red List species that may occur in the area. This survey focuses on the current status of threatened plant species occurring, or which are likely to occur in the vicinity of the proposed route, and a description of the available and sensitive habitats in the vicinity of the proposed route.

2. OBJECTIVES OF THE STUDY

- To assess the current status of the habitat component and current general conservation status of the area;
- To list the perceptible flora in the vicinity of the proposed route and to recommend steps to be taken should threatened plant species, plant species of conservation concern and protected plant species be found;
- To highlight potential impacts of the proposed route on the flora in the vicinity of the route; and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed route be approved.

3. SCOPE OF STUDY

This report:

- Pertains to the study site as described in subsection 4.2 and is not meant as a report of the general vegetation of the area (subsection 4.1).
- Lists the more noticeable trees, shrubs, herbs, geophytes and grasses observed during the study and offers recommendations about the protection of the sensitive areas along the proposed route;
- Indicates medicinal plants recorded and lists alien species;
- Comments on connectivity with natural vegetation on adjacent sites;
- Comments on ecological sensitive areas;
- Evaluates the conservation importance and significance of the area along the proposed route with special emphasis on the current status of resident threatened species; and
- Offers recommendations to reduce or minimise impacts, should the proposed route be approved.

4. STUDY AREA

4.1 Regional vegetation

The proposed road K109 lies in the quarter degree square 2528CC (Centurion). Mucina & Rutherford (2006) classified the area as Egoli Granite Grassland, with archaean granite and gneiss of the Halfway House Granite at the core of the Johannesburg Dome supporting leached, shallow, coarsely grained, sandy soil poor in nutrients. This grassland falls within a strongly seasonal summer-rainfall region and very dry winters with frequent frosts.

This vegetation unit is considered endangered. Its conservation target is 24%. Only about 3% of this vegetation unit is conserved in statutory reserves and a few private conservation areas. More than two-thirds of the unit has already undergone transformation, mostly by urbanization, cultivation and by building of roads. Current rates of transformation threaten most of the remaining unconserved areas.

4.2 The study site

The study site comprises the 4,0947 km-long route for the proposed Road K109 situated east of, and parallel to, Van Riebeeck Road in Glen Austin Agricultural holdings. It runs from Road R562 southwards and passes close to the eastern bank of Glen Austin pan to merge with Dale Road in the south (Figure1). The study site includes the vegetation study units within 200 m from the road reserve. The proposed route passes through the Glen Austin Pan (GP 4) protected ecosystem. According to the GDARD C-Plan 3.3 the route runs along most of its length through a Critical Biodiversity area and the adjoining Ecological Support Area (Figure 2).

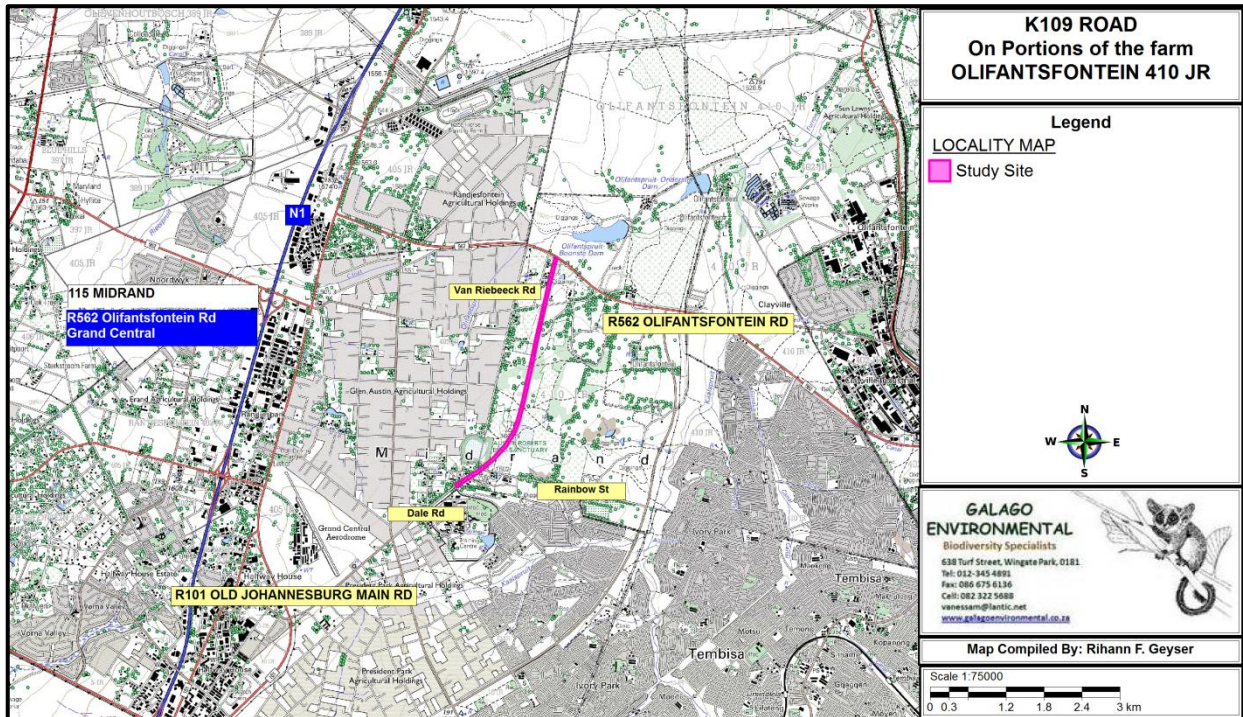


Figure 1: Locality map of the study area

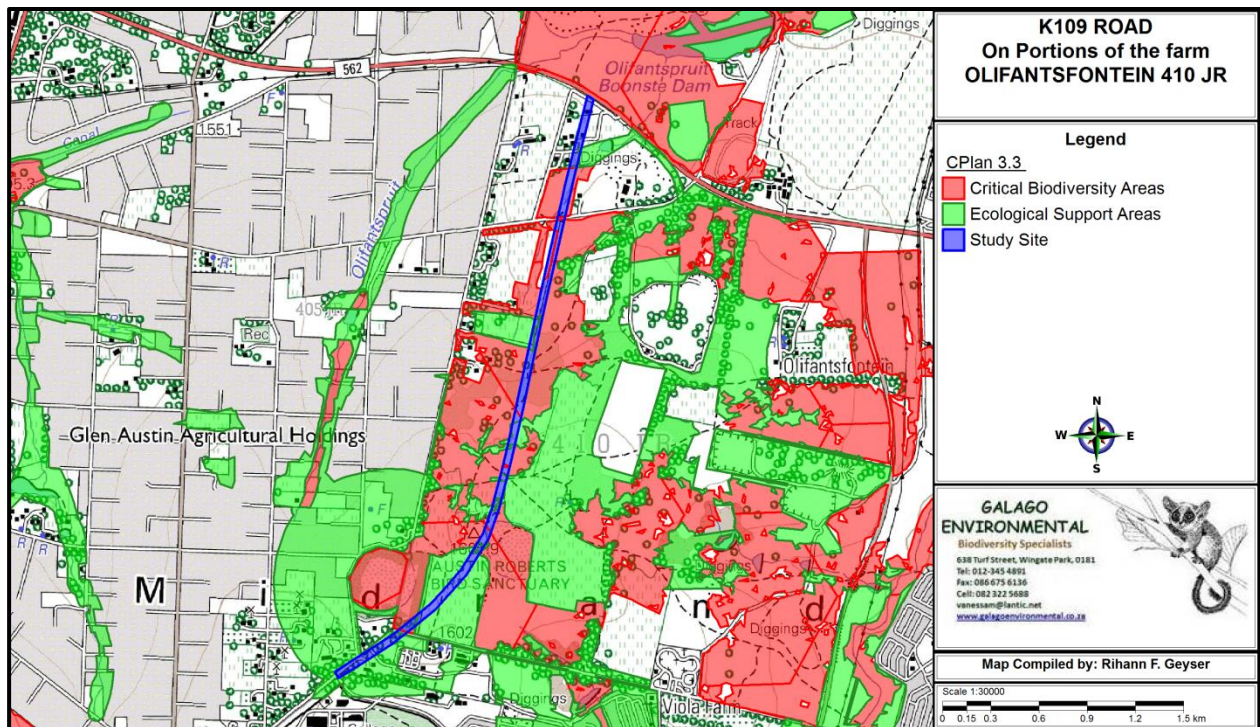


Figure 2: Critical Biodiversity Area and Ecological Support Area.

5. METHOD

A desktop study of the habitats of the Red List and Orange List species known to occur in the area was done before the site visit. Information about the Red List and Orange List plant species that occur in the area was obtained from GDARD. Various Acts and Ordinances were consulted about the protected plant species and species of special concern that might occur along the route (Section 11). The Guidelines issued by GDARD to plant specialists as well as various publications (Section 11) were consulted about the habitat preferences of the Red List and Orange List species concerned.

The list of plants recorded in the 2528CC quarter degree square was obtained from SANBI and consulted to verify the record of occurrence of the plant species seen along the proposed route. The important taxa listed by Mucina and Rutherford (2006) were also taken into account. Locality maps were obtained from Planet GIS and information about the Critical Biodiversity Areas and Ecological Support Areas were obtained from the GDARD C-Plan 3.3.

The proposed route was inspected on 12 November 2015 to determine whether the area along the route has suitable habitat for the Red List species known to occur in the quarter degree square and for those species for which GDARD requires biodiversity studies and to survey the flora present along the route.

The study units within 200 meters of the proposed route were identified (Figure 3) and the vegetation along the proposed route examined in a random zigzag fashion and the species recorded, paying particular attention to areas that at first sight appeared to be sensitive. These areas were meticulously searched for the presence of Red List species. The various study units along the proposed route were examined for the presence of protected tree species and other protected plants.

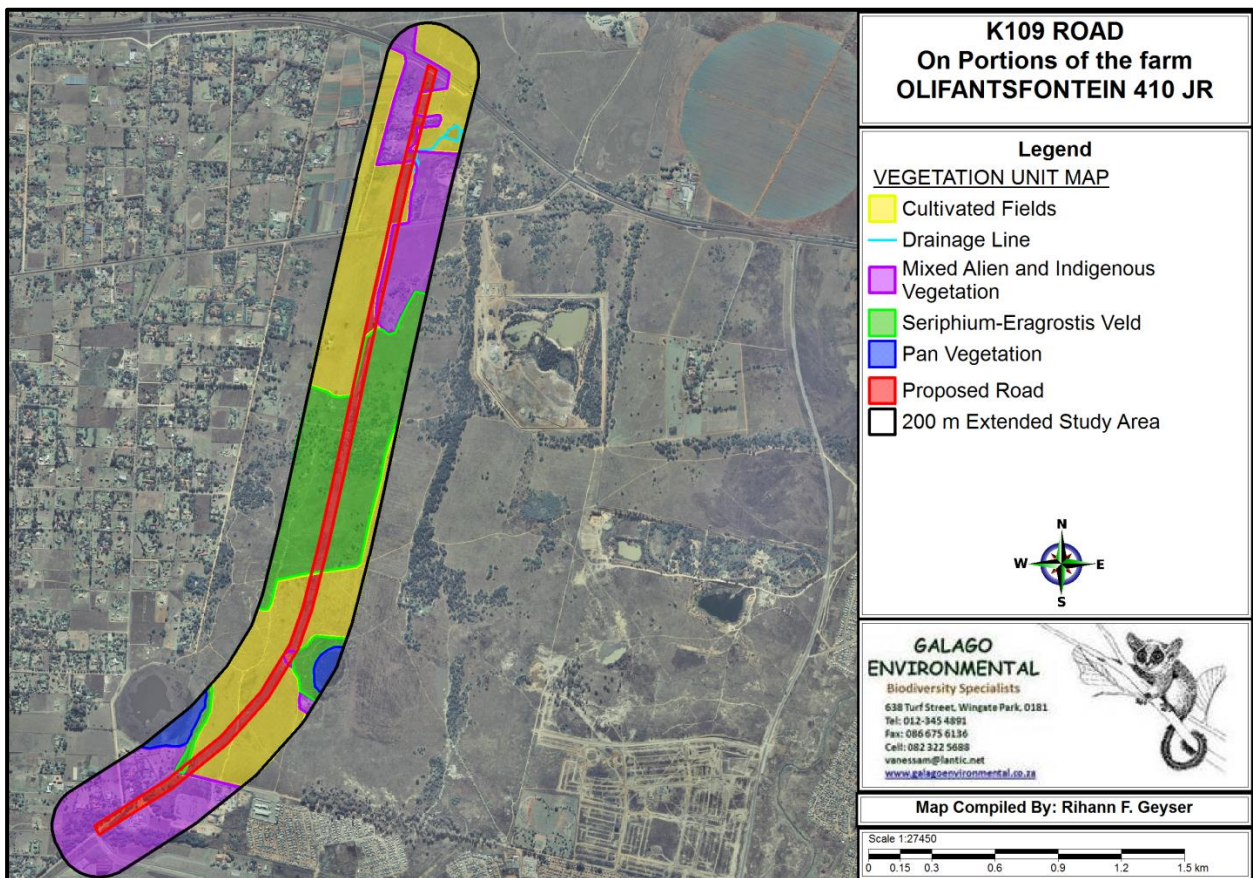


Figure 3: Vegetation study units identified within 200 m of the road reserve

6. RESULTS

6.1 Vegetation study units

Four vegetation study units were identified within 200 meters of the proposed route:

- Pan vegetation;
- Mixed alien and indigenous vegetation;
- *Seriphium – Eragrostis* veld; and
- Cultivated fields.

Tables 3 to 6 list the plants found in each study unit within the pipeline / road / powerline reserve.

6.2 Medicinal plants

The names of known medicinal plants are marked with numbers in Tables 3 to 6 and the numbers appear as footnotes at the end of the last table. Of the 101 plant species recorded within the boundaries of the road reserve, 10 species with medicinal properties were found. The distribution of the medicinal species in the study units is as follows:

Table 1: Number of medicinal species in the various study units

STUDY UNIT	TOTAL NO. OF SPECIES IN STUDY UNIT	NO. OF MEDICINAL SPECIES IN STUDY UNIT
Pan vegetation	38	2
Mixed alien and indigenous vegetation	34	2
<i>Seriphium – Eragrostis</i> veld	57	8
Cultivated fields	32	4

6.3 Alien plants

Alien plants are not listed separately, but are included in the lists as they form part of each particular study unit. Their names are marked with an asterisk in Tables 3 to 6. Thirty alien plant species, of which 10 species are Category 1b invasive species, one is a Category 2 invasive species and two are Category 3 invasive species, were recorded within the study site. The number of alien species in each study unit is reflected in table 2.

Table 2: Number of Alien species in each study unit

STUDY UNIT	NO. OF ALIEN SPECIES	CAT 1b	CAT 2	CAT 3	NOT LISTED
Pan vegetation	11	4	0	0	7
Mixed alien and indigenous vegetation	21	7	1	2	11
<i>Seriphium – Eragrostis</i> veld	12	5	0	0	7
Cultivated fields	13	5	0	0	8

Invasive species are controlled by the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014.

Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form of trade or planting is strictly prohibited.

Category 2: Invasive species, or species deemed to be potentially invasive, in that a permit is required to carry out a restricted activity. Category 2 species include commercially important species such as pine, wattle and gum trees. Plants in riparian areas become Category 1b invasive species.

Category 3: Invasive species which may remain in prescribed areas or provinces. Further planting, propagation or trade, is prohibited. Plants in riparian areas become Category 1b invasive species.

6.4 Orange List species along the proposed route

Seven Orange List plant species are known to occur in the 2528CC quarter degree square. The study site has suitable habitat for one species, but none was found during the present survey. (See Annexure A for a list of the Orange List and Red List species known to occur in the quarter degree square.)

6.5 Red List species along the proposed route

Fifteen Red List species are known to occur in the 2528CC q.d.s. However, the study site does not have suitable habitat for any of these species (see Annexure A for descriptions of suitable habitat for the species.)

GDARD requires biodiversity studies for *Brachycorythis conica* subsp. *transvaalensis*, *Gnaphalium nelsonii* and *Trachyandra erythrorrhiza* (Annexure B). The study site does not have suitable habitat for the first two species, but has suitable habitat for *Trachyandra erythrorrhiza*. However, this species was removed from the Red List some months ago.

6.6 Protected trees and other protected species along the proposed route

One Protected tree, listed in terms of the National Forests Act, 1998 (Act No. 84 of 1998) and one Protected plant species, listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) are known to occur in the 2528CC quarter degree square. However, the study site does not have suitable habitat for these two species (Annexures C and D).

6.7 Pan vegetation

6.7.1 Compositional aspects and Connectivity

The Pan vegetation study unit comprises a well-defined low-lying pan with a central water body and wetland plant species. A wide flood-plain with moisture-loving plants surrounded the water body. Connectivity with natural wetlands does not exist. Of the 101 plant species recorded along the proposed route 38 were recorded in the Pan vegetation study unit. Of these 27 are indigenous species. The following number of species in each growth form was noted:

GROWTH FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	19
Shrubs and dwarf shrubs	1
Grasses	10
Geophytes	3
Sedges	5
Total number of species	38

6.7.2 Red list and Orange List species in the study unit

The Pan vegetation study unit does not have suitable habitat for the Red List or Orange List plant species known to occur in the 2528CC quarter degree square.

The study unit has suitable habitat for *Trachyandra erythrorrhiza* for which GDARD requires biodiversity studies, but this species was not found during the study. This species was removed from the Red List some months ago.

6.7.3 Medicinal and alien species

Two medicinal species were recorded in this study unit. Eleven of the 30 alien species recorded along the proposed route were found in the Pan vegetation study unit. Of these, four are Category 1b invasive species.

6.7.4 Sensitivity

As wetlands form biological filters this study unit is considered sensitive and should be excluded from development. A wetland specialist should determine the extent of the wetland.



Figure 4: Pan vegetation and the surrounding flood plain

Table 3: Plants recorded in the Pan vegetation

SCIENTIFIC NAME	INV CAT	COMMON NAMES
<i>Agrostis lachnantha</i> var. <i>lachnantha</i>		Bent grass / Vink-agrostis
<i>Asparagus larycinus</i>		Wild asparagus / Katbos
<i>Calamagrostis epigeios</i> var. <i>capensis</i>		
<i>Centella asiatica</i> ^{1,2,3}		Pennywort / Varkoortjies
<i>Chenopodium album</i> *		White goosefoot / Wit hondebossie
<i>Ciclospermum leptophyllum</i> *		Wild celery / Wildeseldery
<i>Cirsium vulgare</i> *	1b	Scotch thistle / Skotse dissel
<i>Commelina africana</i> var. <i>africana</i>		
<i>Commelina subulata</i>		
<i>Conyza pinnata</i>		
<i>Cotula australis</i> *		
<i>Cynodon dactylon</i>		Couch grass / Kweek
<i>Cynodon transvaalensis</i>		
<i>Eleocharis dregeana</i>		Finger sedge
<i>Eragrostis capensis</i>		Heartseed love grass / Hartjiesgras
<i>Eragrostis gummiflua</i>		Gum grass / Gomgras
<i>Haplocarpha scaposa</i>		
<i>Hypoxis acuminata</i>		
<i>Hypoxis argentea</i> var. <i>sericea</i>		Small yellow star flower
<i>Imperata cylindrica</i>		Cottonwool grass / Donsgras
<i>Isolepis cernua</i> var. <i>cernua</i>		

SCIENTIFIC NAME	INV CAT	COMMON NAMES
<i>Kyllinga melanosperma</i>		
<i>Leersia hexandra</i>		
<i>Limosella longiflora</i>		
<i>Nidorella anomala</i>		
<i>Oenothera rosea</i> *		Pink evening primrose / Pienk aandblom
<i>Paspalum dilatatum</i> *		
<i>Persicaria attenuata</i> subsp. <i>africana</i>		Bristly snake root / Slangwortel
<i>Persicaria limbata</i> *		
<i>Polygala albida</i> var. <i>albida</i>		
<i>Rumex crispus</i> *		Curley dock / Krultongblaar
<i>Schoenoplectus brachyceras</i>		
<i>Scirpoides burkei</i>		
<i>Setaria sphacelata</i> var. <i>torta</i>		Creeping bristle grass / Kruipmannagras
<i>Typha capensis</i> ^{1,2}		Bulrush / Papkuil
<i>Verbena bonariensis</i> *	1b	Purple top / Blouwaterbossie
<i>Verbena brasiliensis</i> *	1b	
<i>Xanthium strumarium</i> *	1b	Large cocklebur / Boetebos

INV CAT = Invader category

6.8 Mixed alien and indigenous vegetation

6.8.1 Compositional aspects

This study unit consist of the ornamental garden vegetation at the southern end of the route as well as the alien species that invaded the old farm lands east of van Riebeeck Road from wind breaks and old boundary plantings of the alien species.

Of the 101 plant species recorded along the proposed route 34 were recorded in the Mixed alien and indigenous vegetation study unit. Of these 13 were indigenous species. The following number of species in each growth form was noted:

GROWTH FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	19
Tree species	6
Shrubs and dwarf shrubs	3
Grasses	5
Succulents	1
Total number of species	34

6.8.2 Red list and Orange List species in the study unit

The Mixed alien and indigenous vegetation study unit does not have suitable habitat for the Red List or Orange List plant species known to occur in the 2528CC quarter degree square.

6.8.3 Medicinal and alien species

Two medicinal species were recorded in this study unit. Twenty-one of the 30 alien species recorded along the proposed route were found in the Mixed alien and indigenous vegetation study unit. Of these, seven are Category 1b invasive species, one is a Category 2 invasive species and two are Category 3 invasive species.

6.8.4 Sensitivity

This study unit is not considered sensitive.



Figure 5: Mixed alien and indigenous vegetation

Table 4: Plants recorded in the Mixed alien and indigenous vegetation

SCIENTIFIC NAME	INV CAT	COMMON NAMES
<i>Acacia decurrens</i> *	2	Green wattle / Groenwattel
<i>Acacia karroo</i> ^{1,2}		Sweet thorn / Soetdoring
<i>Agave americana</i> *		Century plant / Garingboom
<i>Asparagus laricinus</i>		Wild asparagus / Katbos
<i>Chenopodium album</i> *		White goosefoot / Wit hondebossie
<i>Cirsium vulgare</i> *	1b	Scotch thistle / Skotse dissel
<i>Cynodon dactylon</i>		Couch grass / Kweek
<i>Datura stramonium</i> *	1b	Common thorn apple / Olieboom
<i>Eucalyptus sp</i> *	1b	
<i>Gomphocarpus fruticosus</i> subsp. <i>fruticosus</i> ^{1,2}		Milkweed / Melkbos
<i>Heliotropium amplexicaule</i> *		Blue heliotrope
<i>Hyparrhenia hirta</i>		Common thatching grass / Dekgras
<i>Hypochaeris radicata</i> *		Hairy wild lettuce / Harige skaapslaa
<i>Ipomoea purpurea</i> *	3	
<i>Leonotis intermedia</i>		Wild dagga / Wildedagga
<i>Melia azedarach</i> *	3	Syringa / Sering
<i>Melinis repens</i> subsp. <i>repens</i>		Red top grass
<i>Paspalum dilatatum</i> *		
<i>Pennisetum clandestinum</i> *		Kikuyu / Kikoejoe
<i>Pollichia campestris</i>		Waxberry / Teesuikerbossie
<i>Prunus persica</i> *		Peach / Perske
<i>Richardia brasiliensis</i> *		Tropical richardia / Tropiese richardia
<i>Schkuhria pinnata</i> *		Dwarf marigold / Klein kakiebos
<i>Seriphium plumosum</i>		Bankrupt bush / Bankrotbos
<i>Sida rhombifolia</i> subsp. <i>rhombifolia</i>		Arrow leaf Sida / Taaiman
<i>Solanum mauritianum</i> *	1b	Bugweed / Luisboom
<i>Solanum nigrum</i> *		
<i>Solanum sisymbriifolium</i> *	1b	Wild tomato / Doringbitterappel
<i>Sonchus dregeanus</i>		
<i>Tagetes minuta</i> *		Khaki weed / Kakiebos
<i>Tribulus terrestris</i>		Dubbeltjie
<i>Ursinia nana</i> subsp. <i>nana</i>		Magriet
<i>Verbena bonariensis</i> *	1b	Purple top / Blouwaterbossie
<i>Xanthium strumarium</i> *	1b	Large cocklebur / Boetebos

INV CAT = Invader Category

6.9 *Seriphium – Eragrostis veld*

6.9.1 Compositional aspects and Connectivity

This study unit comprises natural grassland seriously invaded by the indigenous shrub *Seriphium plumosum* and badly littered with dumped builders' rubble and garden refuse. Connectivity with natural grassland does not exist. Fifty-six percent of all species recorded along the proposed route were found in this study unit. Of the 101 plant species recorded along the proposed route 57 were recorded in the *Seriphium – Eragrostis veld* study unit. Of these 45 were indigenous species. The following number of species in each growth form was noted:

GROWTH FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	40
Tree species	1
Shrubs and dwarf shrubs	1
Grasses	10
Geophytes	4
Succulents	1
Total number of species	57

6.9.2 Red list and Orange List species in the study unit

The *Seriphium – Eragrostis veld* study unit does not have suitable habitat for the Red List plant species known to occur in the 2528CC quarter degree square. The study unit has suitable habitat for the Orange List *Hypoxis hemerocallidea*, but none was found during the survey.

6.9.3 Medicinal and alien species

Eight of the 10 medicinal species and 12 of the 30 alien species recorded along the proposed route were found in the *Seriphium – Eragrostis veld* study unit. Of the alien species five are Category 1b invasive species.

6.9.4 Sensitivity

The *Seriphium – Eragrostis veld* study unit is not considered sensitive.



Figure 6: *Seriphium – Eragrostis veld* littered with builders' rubble

Table 5: Plants recorded in the *Seriphium – Eragrostis* veld

SCIENTIFIC NAME	INV CAT	COMMON NAMES
<i>Acacia karroo</i> ^{1,2}		Sweet thorn / Soetdoring
<i>Acalypha angustata</i>		Copper leaf / Katpisbossie
<i>Anthospermum rigidum</i> subsp. <i>rigidum</i>		
<i>Campuloclinium macrocephalum</i> *	1b	Pom pom weed /Pompombossie
<i>Cheilanthes viridis</i> var. <i>glauca</i>		Blue cliff brake / Blou kransruigtevaring
<i>Cynodon dactylon</i>		Couch grass / Kweek
<i>Cynodon transvaalensis</i>		
<i>Dipcadi viride</i>		Slymuintjie
<i>Eragrostis chloromelas</i>		Curly leaf / Krulblaar
<i>Eragrostis gummiflua</i>		Gum grass / Gomgras
<i>Eragrostis racemosa</i>		Narrow heart love grass / Smalhartjiesgras
<i>Geigeria burkei</i> subsp. <i>burkei</i> var. <i>intermedia</i>		Vermeersiektebossie
<i>Gomphocarpus fruticosus</i> subsp. <i>fruticosus</i> ^{1,2}		Milkweed / Melkbos
<i>Haplocarpha scaposa</i>		
<i>Helichrysum rugulosum</i> ^{2,3}		
<i>Heliotropium amplexicaule</i> *		Blue heliotrope
<i>Hibiscus microcarpus</i>		
<i>Hilliardiella oligocephala</i> ^{1,2}		Cape vernonia / Blounaaldetee bossie
<i>Hyparrhenia hirta</i>		Common thatching grass / Dekgras
<i>Hypochaeris radicata</i> *		Hairy wild lettuce / Harige skaapslaa
<i>Ledebouria marginata</i>		
<i>Ledebouria ovatifolia</i>		
<i>Leonotis intermedia</i>		Wild dagga /Wildedagga
<i>Lotononis solitudinis</i>		Kluisenaarsertjie
<i>Melinis repens</i> subsp. <i>repens</i>		Red top grass
<i>Microchloa caffra</i>		Pincushion grass / Elsgras
<i>Nidorella anomala</i>		
<i>Nidorella hottentotica</i>		
<i>Ocimum obovatum</i> subsp. <i>obovatum</i> var. <i>obovatum</i> ^{2,3}		Cat's whiskers / Katsnor
<i>Opuntia microdasys</i> *	1b	Teddybear cactus
<i>Ornithogalum</i> sp		Bosui
<i>Oxalis corniculata</i> *		Steenboksuring
<i>Oxalis obliquifolia</i>		Sorrel / Suring
<i>Pelargonium luridum</i> ^{1,2}		Stalkflowered pelargonium / Wildemalva
<i>Plantago lanceolata</i>		Buckhorn plantain / Small weëblaar
<i>Pollichia campestris</i>		Waxberry / Teesuikerbossie
<i>Polygala albida</i> var. <i>albida</i>		
<i>Polygala amatymbica</i>		Dwarf polygala
<i>Polygala hottentotta</i> ^{2,3}		Small purple broom
<i>Polygala</i> sp.		
<i>Pseudognaphalium luteo-album</i>		
<i>Richardia brasiliensis</i> *		Tropical richardia / Tropiese richardia
<i>Selago densiflora</i>		Koningstapyt
<i>Senecio erubescens</i> var. <i>crepidifolius</i>		
<i>Senecio inaequidens</i>		Canary weed / Geelopslag
<i>Setaria sphacelata</i> var. <i>torta</i>		Creeping bristle grass / Kruipmannagras
<i>Sida rhombifolia</i> subsp. <i>rhombifolia</i>		Arrow leaf Sida / Taaiman
<i>Solanum lichtensteinii</i>		Giant bitter apple / Bitterappel
<i>Solanum nigrum</i> *		
<i>Solanum panduriforme</i>		Poison apple / Gifappel
<i>Tagetes minuta</i> *		Khaki weed / Kakiebos
<i>Tephrosia semiglabra</i>		
<i>Themeda triandra</i>		Red grass / Rooigras
<i>Verbena bonariensis</i> *	1b	Purple top / Blouwaterbossie
<i>Verbena brasiliensis</i> *	1b	
<i>Vigna vexillata</i> var. <i>vexillata</i> ³		Narrowleaved wild pea / Wildeertjie
<i>Xanthium strumarium</i> *	1b	Large cocklebur / Boetebos

INV CAT = Invader category

6.10 Cultivated fields

6.10.1 Compositional aspects

The Cultivated fields study unit comprises well-rehabilitated old fields along the proposed route and some newly cultivated and planted fields between the old Olifantsfontein Road and Road R562. The rehabilitated old fields were also seriously invaded by the indigenous shrub *Seriphium plumosum* and badly littered with dumped builders' rubble and garden refuse.

Of the 101 plant species recorded along the proposed route 32 were recorded in the Cultivated fields study unit. Of these 19 were indigenous species. The following number of species in each growth form was noted:

GROWTH FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	24
Shrubs and dwarf shrubs	3
Grasses	5
Total number of species	32

6.10.2 Red list and Orange List species in the study unit

The Cultivated fields study unit does not have suitable habitat for the Red List or Orange List plant species known to occur in the 2528CC quarter degree square.

6.10.3 Medicinal and alien species

Four of the 10 medicinal species and 13 of the 30 alien species recorded along the proposed route were found in the Cultivated fields study unit. Of the alien species five are Category 1b invasive species

6.10.4 Sensitivity

The Cultivated fields study unit is not considered sensitive.



Figure 7: Recently Cultivated fields between Olifantsfontein Road and Road R562



Figure 8: Old Cultivated fields invaded by *Seriphium plumosum*

Table 6: Plants recorded in the Cultivated fields

SCIENTIFIC NAME	INV CAT	COMMON NAMES
<i>Asparagus larycinus</i>		Wild asparagus / Katbos
<i>Chenopodium album</i> *		White goosefoot / Wit hondebossie
<i>Cirsium vulgare</i> *	1b	Scotch thistle / Skotse dissel
<i>Cynodon dactylon</i>		Couch grass / Kweek
<i>Datura stramonium</i> *	1b	Common thorn apple / Olieboom
<i>Eragrostis chloromelas</i>		Curly leaf / Krulblaar
<i>Gomphocarpus fruticosus</i> subsp. <i>fruticosus</i> ^{1,2}		Milkweed / Melkbos
<i>Helichrysum rugulosum</i> ^{2,3}		
<i>Heliotropium amplexicaule</i> *		Blue heliotrope
<i>Hilliardiella oligocephala</i> ^{1,2}		Cape vernonia / Blounaaldetee bossie
<i>Hyparrhenia hirta</i>		Common thatching grass / Dekgras
<i>Hypochaeris radicata</i> *		Hairy wild lettuce / Harige skaapslaai
<i>Leonotis intermedia</i>		Wild dagga / Wildedagga
<i>Melinis repens</i> subsp. <i>repens</i>		Red top grass
<i>Nidorella hottentotica</i>		
<i>Oxalis corniculata</i> *		Steenboksuring
<i>Paspalum dilatatum</i> *		
<i>Pollichia campestris</i>		Waxberry / Teesuikerbossie
<i>Polygala hottentotta</i> ^{2,3}		Small purple broom
<i>Pseudognaphalium luteo-album</i>		
<i>Richardia brasiliensis</i> *		Tropical richardia / Tropiese richardia
<i>Schkuhria pinnata</i> *		Dwarf marigold / Klein kakiebos
<i>Selago densiflora</i>		Koningstapyt
<i>Senecio inaequidens</i>		Canary weed / Geelopslag
<i>Seriphium plumosum</i>		Bankrupt bush / Bankrotbos
<i>Sida rhombifolia</i> subsp. <i>rhombifolia</i>		Arrow leaf Sida / Taaiman
<i>Solanum sisymbriifolium</i> *	1b	Wild tomato / Doringbitterappel
<i>Tagetes minuta</i> *		Khaki weed / Kakiebos
<i>Tribulus terrestris</i>		Dubbeltjie
<i>Ursinia nana</i> subsp. <i>nana</i>		Magriet
<i>Verbena bonariensis</i> *	1b	Purple top / Blouwaterbossie
<i>Verbena brasiliensis</i> *	1b	

INV CAT = Invader category

¹⁾ Van Wyk, B-E., Van Oudtshoorn, B. & Gericke, N. 2002.

²⁾ Watt, J.M. & Breyer-Brandwijk, M.G. 1962.

³⁾ Pooley, E. 1998.

7. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

The study area was visited during a dry early summer season during which very little rain had fallen and high temperatures were experienced.

8. FINDINGS AND POTENTIAL IMPLICATIONS

The proposed route is badly littered by dumped builders' rubble and garden waste and large areas of the grassland and rehabilitated cultivated fields are invaded by *Seriphium plumosum*. The proposed route passes very near the eastern banks of the Glen Austin pan that has been declared a protected ecosystem (Glen Austin Pan – GP 4) and that forms part of the Glen Austin Pan Conservancy. The edge effects from the road construction will impact upon the vegetation of the pan.

9. RECOMMENDED MITIGATION MEASURES

The following mitigation measures are proposed by the specialist:

- The *Seriphium plumosum* within the road reserve should be controlled.

The following mitigation measures were developed by GDARD 2014 (Department of Agriculture and Rural Development, Biodiversity Management Directorate) and are applicable to the study site:

- The appropriate agency should implement an ongoing monitoring and eradication programme for all invasive and weedy plant species growing within the servitude.
- Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.
- Any post-development re-vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred. As far as possible, indigenous plants naturally growing along the route, but would otherwise be destroyed during construction, should be used for re-vegetation / landscaping purposes.
- Prior to construction, fences should be erected in such a manner to prevent access and damage to any sensitive areas identified in a sensitivity mapping exercise (see Sensitivity Mapping Rules for Biodiversity Assessments).
- A comprehensive surface runoff and stormwater management plan should be compiled, indicating how all surface runoff generated as a result of the road development (during both the construction and operational phases) will be managed (e.g. artificial wetlands stormwater and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer flood zones and subsequently released to simulate natural hydrological conditions. This plan should form part of the EMP.

10. CONCLUSION

The flora study found the proposed route to be badly littered and large areas invaded by *Seriphium plumosum*. The study determined that the proposed route passes through the Glen Austin Pan protected ecosystem (Glen Austin Pan – GP 4) and through Critical Biodiversity areas and Ecological support areas. The area along the proposed route does not have suitable habitat for Red List plant species or for protected species. A wetland specialist should determine the extent of the wetland. The applicable buffer prescribed by GDARD should be maintained around the wetland.

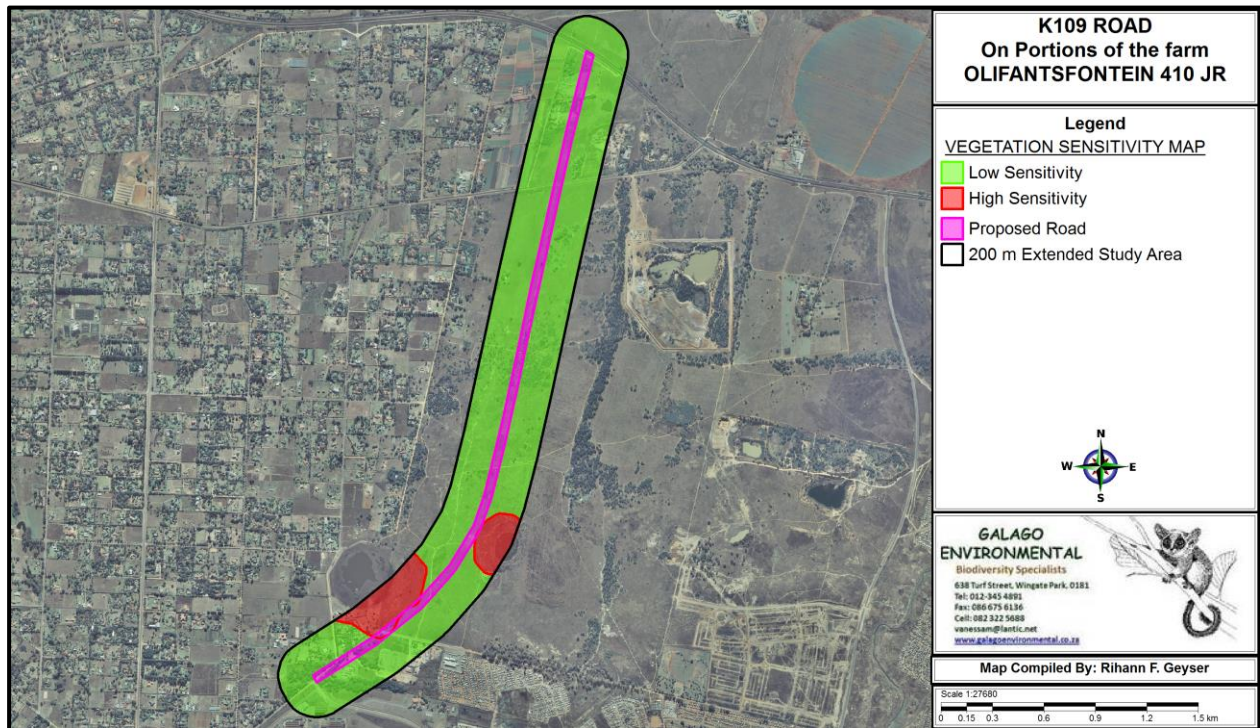


Figure 9: Vegetation sensitivity map

11. LITERATURE SOURCES

- Botha C. 2001. *Common weeds of crops and gardens in southern Africa*. ARC – Grain Crops Institute, Agricultural Research Council, Pretoria.
- Bothalia. 1962. Volume 7 part 4 (South African species of *Anthericum*, *Chlorophytum* and *Trachyandra*). Botanical Research Institute, Department of Agricultural Technical Services, Pretoria.
- Bromilow, C. 2001. *Problem plants of South Africa*. Briza Publications, Pretoria
- Crouch, N.R., Klopper, R.R., Burrows, J.E, & S.M., 2011. *Ferns of Southern Africa*. Struik Nature, Cape Town.
- Fabian, A. & Germishuizen, G. 1997. *Wild flowers of northern South Africa*. Fernwood Press, Cape Town.
- Flora of Southern Africa. 2000. Vol 28.1 (Convolvulaceae). National Botanical Institute, Pretoria
- Flora of Southern Africa. 1985. Vol. 28,4 (Lamiaceae). Botanical Research Institute, Department of Agriculture & Water Supply, Pretoria
- Gauteng Nature Conservation Act, 2013. Gauteng Provincial Legislature.
- GDARD, 2014. *Requirements for biodiversity assessments Version 3*. Biodiversity Management Directorate, Department of Agriculture and Rural development.
- GDARD, 2014. *Red List Plant Species Guidelines*. Compiled 26 June 2006 and updated in September 2014. Biodiversity Management Directorate, Department of Agriculture and Rural development.
- Gerber, A., Cilliers, C.J., Van Ginkel, C. & Glen, R., 2004. *Easy identification of aquatic plants*. Department of Water Affairs. Pretoria.
- Government Notice R151 Government Gazette No. 29657. 23 February 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of Lists of Critically Endangered, Endangered, Vulnerable and Protected Species.
- Government Notice No. 835, Government Gazette No. 33566, 23 September 2010. Notice of the List of protected tree species under the National Forests Act, 1998 (Act No. 84 Of 1998).
- Henderson, L. 2001. *Alien weeds and invasive plants*. Plant Protection Research Institute, Agricultural Research Council, Pretoria.
- Moteetee, A.N. 2003. *A taxonomic study of Melolobium and related African genera of the tribe Genisteae (Fabaceae)*. Faculty of Natural Sciences, Rand Afrikaans University, Johannesburg.

- Mucina, L. & Rutherford, M.C. 2006. *The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19*. South African National Biodiversity Institute, Pretoria.
- National Environmental Management Act, 1998 (Act 107 of 1998).
- National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004) – Alien and Invasive Species (AIS) Regulations
- National Environmental Management: Biodiversity Act, 2004 - National list of ecosystems that are threatened and in need of protection under Section 52(1)(a) of the Act (GG 34809, GN 1002). December 2011.
- Pfab, M.F. 2002. *Priority ranking scheme for Red Data plants in Gauteng, South Africa*. South African Journal of Botany, Vol 68: 299 – 303.
- Pfab, M.F. & Victor, J.E. 2002. Threatened plants of Gauteng, South Africa. South African Journal of Botany, Vol 68: 370 – 375.
- Pooley, E. 1998. *A field guide to the wild flowers of Kwazulu-Natal and the eastern region*. Natal Flora Publications Trust, Durban.
- Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner R.C., Kamundi, D.A. & Manyama, P.A. (eds) 2009. *Red list of South African Plants 2009*. Strelitzia 25. South African National Biodiversity Institute, Pretoria.
- Retief, E. & Herman, P.P.J. 1997. *Plants of the northern provinces of South Africa: keys and diagnostic characters. Strelitzia 6: 1-681*, National Botanical Institute, Pretoria.
- SANBI & DEAT. 2009. *Threatened Ecosystems in South Africa: Descriptions and Maps*. DRAFT for Comment. South African National Biodiversity Institute, Pretoria, South Africa.
- Smith, C.A. 1966. *Common names of South African plants*. Botanical Research Institute, Department of Agricultural Technical Services, Pretoria.
- Van Ginkel, C.E., Glen, R.P., Gordon-Gray, K.D., Cilliers, C.J., Muasya, M. & Van Deventer, P.P. 2011. *Easy identification of some South African wetland plants*. WRC Report No TT 479/10. Water Research Commission, Pretoria.
- Van Oudshoorn, F.P. 2002. *Guide to grasses of southern Africa*. Briza Publications, Pretoria.
- Van Wyk, B. & Malan, S. 1998. *Field guide to the wild flowers of the Highveld*. Struik, Cape Town.
- Van Wyk, B-E., Van Oudtshoorn, B. & Gericke, N. 2002. *Medicinal plants of South Africa*. Briza Publications, Pretoria.
- Watt, J.M. & Breyer-Brandwijk, M.G. 1962. *The medicinal and poisonous plants of southern and eastern Africa*. 2nd edition. Livingstone, London.

ANNEXURE A: Red List and Orange List* plants of the 2528CC q.d.s.

Species	Flower season	Suitable habitat	Priority group	Conserv status	PRESENT ON SITE
<i>Adromischus umbraticola</i> subsp <i>umbraticola</i>	Sep-Jan	Rock crevices on rocky ridges, usually south-facing.	A2	Near threatened ¹	Habitat not suitable
<i>Boophane disticha</i>	Oct-Jan	Dry grassland and rocky areas.	N/A	Declining ²	Habitat not suitable
<i>Bowiea volubilis</i> subsp <i>volubilis</i>	Sep-Apr	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	B	Vulnerable ²	Habitat not suitable
<i>Brachycorythis conica</i> subsp <i>transvaalensis</i>	Jan-Mrt	Short grassland, hillsides, on sandy gravel overlying dolomite, sometimes also on quartzites, occasionally open woodland, 1000 – 1705m	A3	Endangered ²	Habitat not suitable
<i>Callilepis leptophylla</i>	Aug-Jan & May	Grassland or open woodland, often on rocky outcrops or rocky hillslopes.	N/A	Declining ²	Habitat not suitable
<i>Ceropegia decidua</i> subsp. <i>pretoriensis</i>	Nov-Apr	Direct sunshine or shaded situations, rocky outcrops of the quartzitic Magaliesberg mountain series.	A1	Vulnerable ¹	Habitat not suitable
<i>Cheilanthes deltoidea</i> subsp <i>silicicola</i>	Nov-Jun	Southwest-facing soil pockets and rock crevices in chert rocks.	A2	Vulnerable ¹	Habitat not suitable
<i>Cleome conrathii</i>	Dec-Jan Mar-May	Stony quartzite slopes, usually in red sandy soil, grassland or open to closed deciduous woodland, all aspects.	A3	Near Threatened ¹	Habitat not suitable
<i>Crinum macowanii</i>	Oct-Jan	Grassland along rivers in gravelly soil or on sandy flats	N/A	Declining ²	Habitat not suitable
<i>Dicliptera magaliesbergensis</i>	Feb-Apr	Forest, savanna (Riverine forest and bush).	A1	Vulnerable ¹	Habitat not suitable
<i>Drimia sanguinea</i>	Aug-Dec	Open veld and scrubby woodland in a variety of soil types	B	Near threatened ²	Habitat not suitable
<i>Eucomis autumnalis</i>	Nov-Apr	Damp open grassland and sheltered places.	N/A	Declining ²	Habitat not suitable
<i>Gunnera perpensa</i>	Oct-Mar	In cold or cool continually moist localities, mainly along upland streambanks.	N/A	Declining ²	Habitat not suitable
<i>Habenaria barbertonii</i>	Feb-Mar	In grassland on rocky hillsides.	A2	Near threatened ¹	Habitat not suitable
<i>Habenaria kraenzliniana</i>	Feb-Apr	Terrestrial in stony, grassy hillsides, recorded from 1000 to 1400m.	A3	Near Threatened ¹	Habitat not suitable
<i>Habenaria mossii</i>	Mar-Apr	Open grassland on dolomite or in black sandy soil.	A1	Endangered ¹	Habitat not suitable
<i>Holothrix randii</i>	Sep-Jan	Grassy slopes & rock ledges, usually southern aspects.	B	Near Threatened ²	Habitat not suitable
<i>Hypoxis hemerocallidea</i>	Sep-Mar	Occurs in a wide range of habitats. Grassland and mixed woodland.	N/A	Declining ²	Habitat suitable
<i>Ilex mitis</i> var <i>mitis</i>	Oct-Dec	River banks, stream beds, evergreen forests.	N/A	Declining ²	Habitat not suitable
<i>Lithops lesliei</i> subsp. <i>lesliei</i>	Mar-Jun	Primary habitat the arid grasslands in the interior of SA where it usually occurs in rocky places.	B	Near threatened ²	Habitat not suitable
<i>Melolobium subspicatum</i>	Sep-May	Grassland.	A1	Vulnerable ¹	Habitat not suitable
<i>Pearsonia bracteata</i>	Dec-Apr	Gently sloping Highveld grassland.	A3	Near Threatened ¹	Habitat not suitable

¹) global status

²) national status

* Orange listed plants have no priority grouping and are designated 'N A'

ANNEXURE B: Red List plants for which biodiversity studies are required by GDARD

Species	Flower season	Suitable habitat	Priority group	Conserv status	PRESENT ON SITE
<i>Brachycorythis conica subsp transvaalensis</i>	Jan-Mrt	Short grassland, hillsides, on sandy gravel overlying dolomite, sometimes also on quartzites, occasionally open woodland, 1000 – 1705m	A3	Endangered ²	Habitat not suitable
<i>Gnaphalium nelsonii</i>	Oct-Dec	Seasonally wet grasslands	A2	Rare ¹	Habitat not suitable

ANNEXURE C: PROTECTED TREES

Trees of the 2528CC q.d.s. that are protected trees in terms of section 15(1) of the National Forests Act, 1998

Species	Presence on site
<i>Pittosporum viridiflorum</i>	Habitat not suitable

ANNEXURE D: OTHER PROTECTED SPECIES

Species of the 2528CC q.d.s. that are Protected species* in terms of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).

Species	Presence on site
<i>Harpagophytum zeyheri</i>	Habitat not suitable

* Indigenous species of high conservation value or national importance that require national protection