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Ridge and Flora Assessment

ERASMUSKLOOF RETAIL CENTRE ON THE REMAINING EXTENT OF THE FARM WATERKLOOF 378 JT

May 2018

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DECLARATION OF INDEPENDENCE

I, Marli Burger (820903 0245 087) declare that I:

- am subcontracted as specialist consultant by Galago Environmental CC for the proposed project described in this report
- 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
- 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.

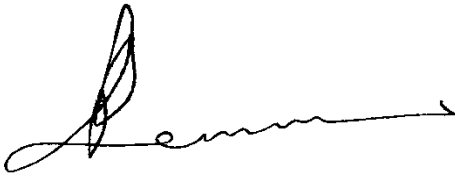
A handwritten signature in black ink, appearing to read 'Marli Burger', is written in a cursive style.

Marli Burger

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 Erasmuskloof Retail Centre development 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 - Pr.Sci.Nat. (400567/15)

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1 Environmental conditions: *Status Quo*

1.1 Study site

Galago Environmental was appointed to evaluate the sensitivity of a rocky outcrop on the corner of Solomon Mahlangu Drive and Van Ryneveld Avenue on the farm Waterkloof 378-JT, to be known as Erasmuskloof Retail Centre, scheduled for commercial development.

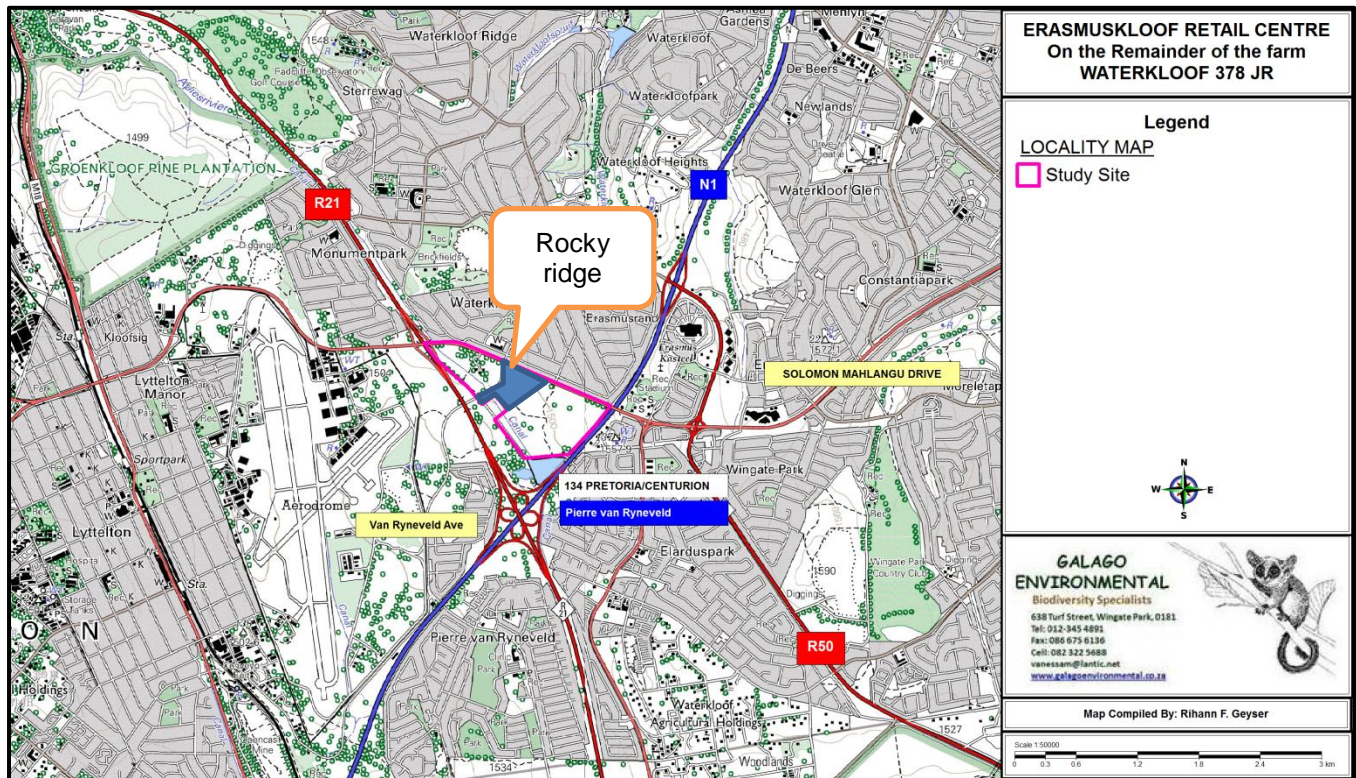


FIGURE 1: LOCALITY OF STUDY SITE

1.2 Method of assessment

Rocky outcrop ecology:

The main aim of this assessment is to determine the sensitivity, ecological function and importance of a section of the proposed development where an access road is proposed to cross a sensitive area just below a rocky ridge on site (Figure 2).

Specialist studies (by Exigo, October 2016) for the proposed development on the study site were consulted for background information, as well as relevant literature, legislations and geographical information systems.

A site visit was conducted on 3 May 2018 by both specialists and recommendations were made based on the proposed road alignment through the sensitive area and the building and parking area cutting off a portion of the rocky ridge (Figure 2).

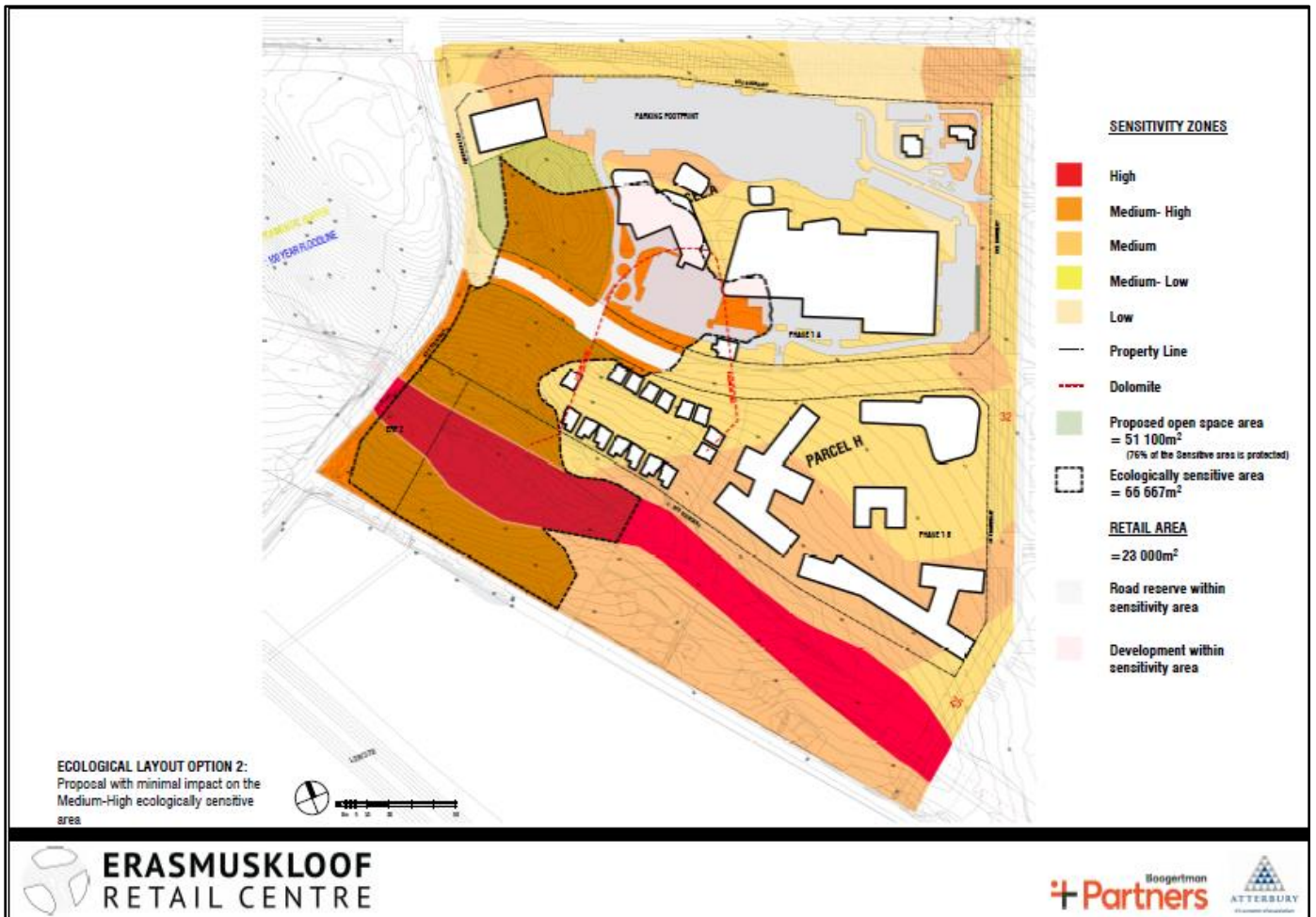


FIGURE 2: PROPOSED LAYOUT INDICATING IMPACTS TO THE SENSITIVE AREA

The study site was evaluated in terms of the compositional aspects including Red data species, geology and substrate heterogeneity, topography and habitat availability. Factors such as cover of exotic vegetation species and plant utilization (trade or collection) of specific species were also considered. The functional aspects of the ridge habitat were assessed by considering the connectivity of the ridge to other ridge areas, as well as to adjacent areas of natural vegetation. Impacts on the ridge ecology were considered and mitigation measures are proposed.

Recommendations are based on the principles of Section 28 of NEMA, which refers to the minimisation of environmental impacts and duty of care, as well as the GDARD minimum requirements (Version 3, 2014) and GDACE Ridge Policy Guidelines (2001).

Vegetation assessment:

The objectives were to determine which species occur on the rocky outcrop, to assess the current status of the habitat component, to highlight potential impacts and to provide management recommendations. 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 on the rocky outcrop, and a description of the available and sensitive habitats on the rocky outcrop and within 200 meters of the boundary of the rocky outcrop.

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 on the rocky outcrop. The Guidelines issued by GDARD to plant specialists as well as various publications (Section 11) and the local herbaria were consulted about the habitat preferences of the Red and Orange List species concerned and to verify identification of some plant species.

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 on the rocky outcrop. The important taxa listed by Mucina and Rutherford (2006) were also considered. 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 rocky outcrop was visited on 3 May 2018 to determine whether the rocky outcrop has suitable habitat for the Red List species known to occur in the quarter degree square, to survey the flora present on the rocky outcrop and to evaluate the sensitivity of the ridge on the site.

Three plots of size about 10m x 10m were selected at random on the ridge for detailed study. Each plot was surveyed in a random crisscross fashion and the plants recorded. Areas where there is suitable habitat for the Red List species known to occur in the quarter degree square were examined in detail. The rocky outcrop was examined to determine whether it has suitable habitat for protected trees and other protected species.

The vegetation assessment includes the following information about the rocky outcrop:

- Lists the more noticeable trees, shrubs, herbs, geophytes and grasses observed during the study and offers recommendations about the protection of the sensitive areas / protected species on the rocky outcrop;
- 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 site with special emphasis on the current status of resident threatened species; and
- Offers recommendations to reduce or minimise impacts, should the proposed development be approved.

2 Results

2.1 Flora Assessment

The rocky outcrop lies in the quarter degree square 2528CC (Centurion). Mucina & Rutherford (2006) classified the area as Carltonville Dolomite Grassland, a species-rich grassland with shallow soil and slightly undulating plains on dolomite dissected by prominent rocky chert ridges.

According to the GDARD C-Plan 3.3 the entire site is situated within a Critical Biodiversity Area.

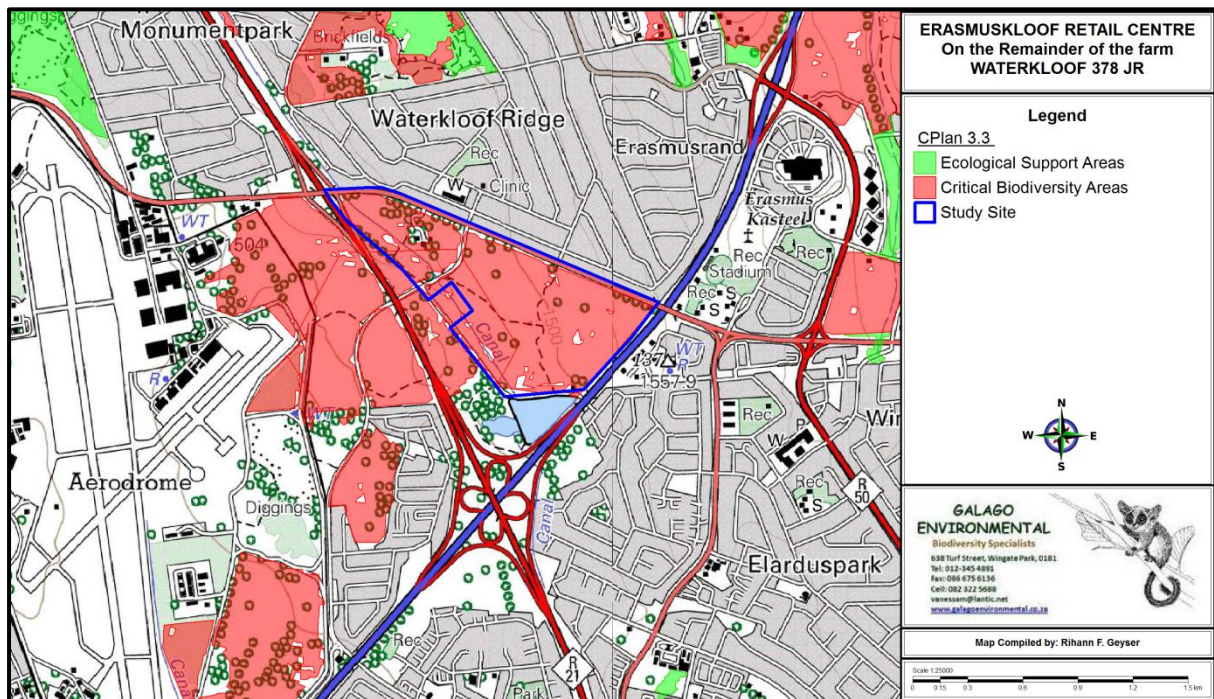


FIGURE 3: CRITICAL BIODIVERSITY AREA AND ECOLOGICAL SUPPORT AREA.

2.1.1 Compositional aspects and Connectivity

This study unit comprises natural grassland on an outcrop of shale. No plants typical of dolomitic soil and dolomite outcrops were recorded and few geophytes and succulents were observed. Only one of each was recorded on the surveyed plots. Connectivity exists with the natural grassland around the Waterkloof airbase west of the site but is limited by roads and the boundary wall of the airbase. Table 1 lists the plants found on the rocky outcrop of the site. Of the 65 plant species recorded on the rocky outcrop 51 are indigenous species. The following number of species in each growth form was noted:

GROWTH FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	30
Tree species	7
Shrubs and dwarf shrubs	9
Grasses	16
Geophytes	1
Sedges	0
Succulents	2
Total number of species	65

2.1.2 Red List and Orange List species in the study unit

Seventeen Red List plant species are known to occur in the 2528CC quarter degree square, eight of these within 5 km of the site. The Rocky outcrop grassland has suitable habitat for the Red List species *Drimia sanguinea*, *Habenaria kraenzliniana* and especially for the mesemb *Lithops lesliei* subsp. *lesliei*. This study unit also has suitable habitat for the Orange List plant species *Callilepis leptophylla*. None of these species were found during the survey. Because the habitat was specifically suitable for *Lithops lesliei* subsp. *lesliei*, it is highly possible that this species occurs on the rocky outcrop in areas not covered during the survey. Annexure A lists the Orange List and Red List species known to occur in the quarter degree square and indicates the eight Red List species previously found with 5 km of the site.

2.1.3 Medicinal species

The names of known medicinal plants are marked with numbers in Table 1 and the numbers appear as footnotes at the end of the table. Of the 65 plant species recorded on the rocky outcrop, seven species with medicinal properties were found.

2.1.4 Alien plants

Alien plants are not listed separately but are included in the list as they form part of the study unit. Their names are marked with an asterisk in Table 1. Fourteen alien plant species, of which four species are Category 1b invasive species, two are Category 2 invasive species and three are Category 3 invasive species, were recorded on the rocky outcrop.

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.

2.1.5 Protected trees and other protected species

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 No. 10 of 2004) are known to occur in the 2528CC quarter degree square. However, the Rocky outcrop does not have suitable habitat for these two species (Annexures B and C).

2.1.6 Sensitivity

The Rocky outcrop vegetation study unit comprises natural grassland and is situated in a Critical Biodiversity area (GDARD C-Plan 3.3), but it is threatened by alien invasive species and other alien species, especially along the many footpaths criss-crossing the outcrop. Because connectivity with natural grassland to the west is very limited, its continued existence as a healthy vegetation unit is doubtful. The sensitivity status of the rocky outcrop is severely challenged by the alien species, the species composition and the pedestrian access to the site, and although the rocky outcrop is considered sensitive, it is deemed to be of medium sensitivity only. Most of the rocky outcrop shall be excluded from development.



FIGURE 4: ROCKY OUTCROP WITH ALIEN GUAVA TREE ON THE RIGHT



FIGURE 5: SUITABLE HABITAT FOR *LITHOP LESLIEI* SUBSP. *LESLIEI*



FIGURE 6: GRASSLAND OF THE ROCKY OUTCROP WITH ENCROACHING ALIENS ON ITS PERIMETER

TABLE 1: PLANTS RECORDED IN THE ROCKY OUTCROP

SCIENTIFIC NAME	INV CAT	COMMON NAMES
<i>Acacia decurrens</i> *	2	Green wattle / Groenwattel
<i>Acacia karroo</i> ^{1,2}		Sweet thorn / Soetdoring
<i>Albuca setosa</i>		Slymuintjie
<i>Aloe zebrina</i>		
<i>Alternanthera pungens</i> *		Paper thorns / Kakie dubbeltjie
<i>Andropogon chinensis</i>		Hairy blue grass / Harige blougras
<i>Andropogon schirensis</i>		Stab grass / Tweevingergras
<i>Anthospermum rigidum</i> subsp. <i>rigidum</i>		
<i>Aristida congesta</i> subsp. <i>barbicollis</i>		Spreading three-awn grass / Witsteekgras
<i>Acanthospermum australe</i> *		Prostrate starbur / Kruipsterklits
<i>Asparagus suaveolens</i>		Wild asparagus / Katdoring
<i>Bidens pilosa</i> *		Blackjack / Knapsekêrel
<i>Brachiaria serrata</i>		Velvet grass / Fluweelgras
<i>Campuloclinium macrocephalum</i> *	1b	Pom pom weed /Pompombossie
<i>Chaetacanthus costatus</i>		
<i>Conyza podocephala</i>		
<i>Crabbea angustifolia</i> ²		
<i>Crassula capitella</i> subsp. <i>nodulosa</i>		
<i>Crotalaria agatiflora</i> subsp. <i>agatiflora</i> *	1b	Bird flower / Voëltjebos
<i>Cymbopogon pospischilii</i> *		Turpentine grass / Terpentyngras
<i>Diheteropogon amplexens</i> var. <i>amplexens</i>		Broadleaved bluestem / Breëblaar blougras
<i>Diospyros lycioides</i> subsp. <i>guerkei</i>		Bushveld bluebush / Bosveldbloubos
<i>Eragrostis chloromelas</i>		Curly leaf / Krulblaar
<i>Eragrostis racemosa</i>		Narrow heart love grass / Smalhartjiesgras
<i>Eucalyptus</i> sp*	2	
<i>Felicia muricata</i> subsp. <i>muricata</i> ^{1,2,3}		White felicia
<i>Helichrysum nudifolium</i> var. <i>nudifolium</i> ^{1,2}		Hottentot's tea / Hottentotstee
<i>Hermannia depressa</i> ^{2,3}		Creeping red Hermannia / Rooiopslag
<i>Indigastrum burkeanum</i>		
<i>Indigofera egens</i>		
<i>Ipomoea purpurea</i> *	3	
<i>Justicia anagalloides</i>		
<i>Lantana rugosa</i> ^{2,3}		Bird's brandy / Voëlbrandewyn
<i>Leonotis intermedia</i>		Wild dagga / Wildedagga
<i>Lippia wilmsii</i>		
<i>Lotononis calycina</i>		Hairy lotononis
<i>Loudetia simplex</i>		Russet grass / Stingelgras
<i>Melia azedarach</i> *	3	Syringa / Sering
<i>Melinis nerviglumis</i>		Bristle leaf red top / Steekblaarblinkgras
<i>Melinis repens</i> subsp. <i>repens</i>		Red top grass
<i>Morus alba</i> *	3	Common mulberry / Gewone moerbeï
<i>Nidorella hottentotica</i>		
<i>Panicum natalense</i>		Natal panicum / Suurbuffelsgras
<i>Parinari capensis</i> subsp. <i>capensis</i>		Dwarf mobola / Grysappeltjie
<i>Pachystigma pygmaeum</i>		Gousiektebos
<i>Pearsonia sessilifolia</i> subsp. <i>sessilifolia</i>		Silwerertjietee
<i>Pentarrhinum inspidum</i>		Donkieperske

SCIENTIFIC NAME	INV CAT	COMMON NAMES
<i>Rhynchosia monophylla</i>		
<i>Rothea louwalbertsii</i>		
<i>Schizachyrium sanguineum</i>		Red autumn grass / Rooi herfsgras
<i>Searsia lancea</i>		Karee / Karee
<i>Sida rhombifolia</i> subsp. <i>rhombifolia</i>		Arrow leaf Sida / Taaiman
<i>Solanum mauritianum</i> *	1b	Bugweed / Luisboom
<i>Solanum delagoense</i>		Poison apple / Gifappel
<i>Solanum sisymbriifolium</i> *	1b	Wild tomato / Doringbitterappel
<i>Sphenostylis angustifolia</i>		Wild swetpea bush / Wilde ertjie
<i>Tagetes minuta</i> *		Khaki weed / Kakiebos
<i>Tephrosia elongata</i> var. <i>elongata</i>		
<i>Teucrium trifidum</i>		Koorsbossie
<i>Themeda triandra</i>		Red grass / Rooigras
<i>Trachypogon spicatus</i>		Giant spear grass / Bokbaardgras
<i>Tristachya biseriata</i>		Trident grass / Drieblomgras
<i>Ursinia nana</i> subsp. <i>nana</i>		Magriet
<i>Polydora poskeana</i>		
<i>Xerophyta retinervis</i> ^{1,2}		Monkey's tail / Bobbejaanstert

INV CAT Invasive species 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.

2.2 Ridge Ecology

2.2.1 Habitat and Ecological Functions

The topography slopes in a southwestern direction and runoff flows overland and via a storm water channel between the M28 and the site boundary, towards the Apies River.

The habitat consists mostly of rocky grassland with a very small arboreal component consisting of a few scattered indigenous trees and several alien invasive trees. The rupicolous component consists of exposed shale and creates the ideal habitat for certain red listed plants (Refer to 2.1), of which no red listed plants were observed during the site visit. Several functioning and moribund termitaria on site provide additional habitat for small mammals.



FIGURE 4: THE RUPICULOUS HABITAT ON SITE

Evidence of faunal activity include mole hills, rabbit faeces, small movement paths in vegetation and invertebrate observations include functioning and abandoned termitaria, harvester termites collecting plant matter, pollinators (*Apis Melifera*; various butterflies), trapdoor spider webs and scorpion pits.



FIGURE 5: TERMITARIA ON ROCKY OUTCROP

The processes of nutrient cycling on site include termite and other invertebrate activity, such as pollination and seed dispersal, as well as small mammal activity (molehills and rabbit faeces observed on site).



FIGURE 6; RABBIT (*LEPUS SAXATILLIS*) FAECES ON ROCKY OUTCROP



FIGURE 7: POLLINATOR, *JUNONIA HIERTA*, ON ROCKY OUTCROP.



FIGURE 8: FUNNEL TRAP SPIDER WEB ON ROCKY OUTCROP.



FIGURE 9: TERMITARIA USED BY OTHER FAUNAL SPECIES ON ROCKY OUTCROP.

Small mammals such as the Yellow mongoose (*Cynictis penicillata*) may use these moribund termitaria. It is unlikely that aardvark occurs on this site due to anthropogenic disturbances.



FIGURE 10: SPITTLE BUG NEST ON VEGETATION ON ROCKY OUTCROP.



FIGURE 11: *APIS MELIFERA* POLLINATING VEGETATION ON SITE.

Pollination is an important aspect of ecology in natural areas and plays an essential role in plant propagation.

2.2.2 Connectivity

Connectivity of the rocky outcrop is limited by major roads including the R21, N1, Solomon Mahlangu Drive and the M28, and exists only towards the Apies River, which serves as a movement corridor for fauna. Challenges in natural areas within the urban setting include migration, genetic-material exchange, and the persistence of small populations of fauna and flora (Ellery *et al*, 2001). Therefore, maintaining the connectivity between the rocky outcrop and the watercourse is essential.

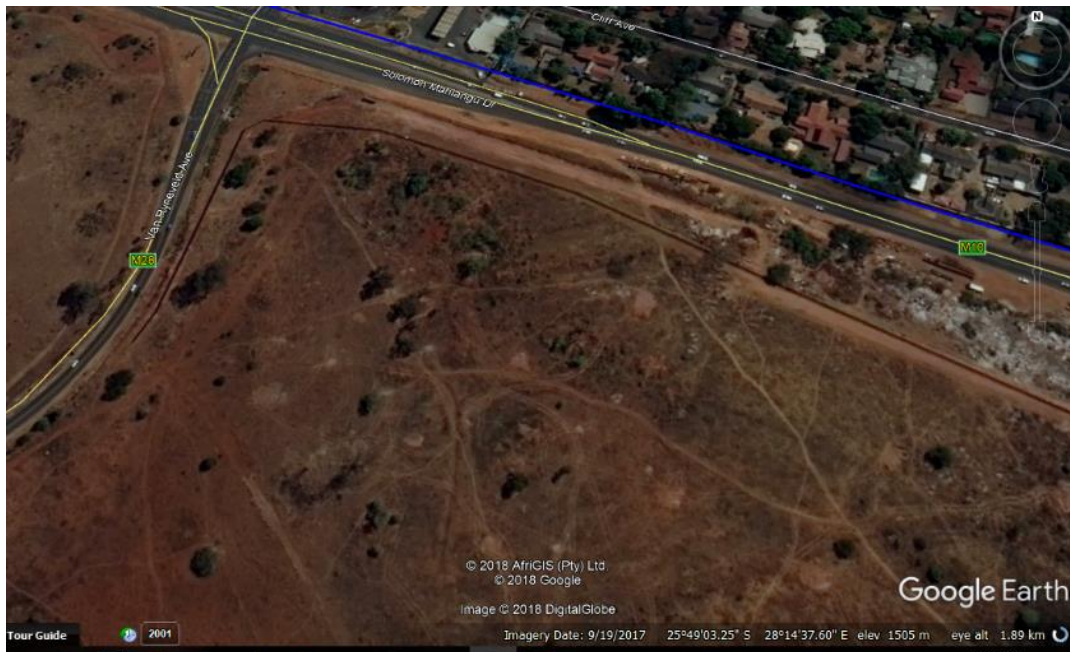


FIGURE 12: GOOGLE EART IMAGE OF THE ROCKY OUTCROPS SHOWING FOOTPATHS AND MAIN ROADS



FIGURE 13: VIEW OF THE ROCKY OUTCROP IN A SOUTH EASTERN DIRECTION (3 MAY 2018)

Weathering shale adds fine grained clay particles to soils and is carried to lower lying areas by overland flow, affecting the permeability for water (King, 2018).

2.2.3 Sensitivity and Importance

Alien invasive vegetation is one of the current threats to the section of the outcrop north of the proposed access road from the M28.



FIGURE 14: ALIEN INVASIVE VEGETATION IMPACTING THE SITE

Illegal waste disposal is evident on and around the rocky outcrop and these disturbances are often coupled with pioneer and/or alien invasive vegetation (Figure 15).



FIGURE 15: ILLEGAL WASTE DUMPING

Vagrants occupy a clump of trees just below the rocky outcrop and grass harvesters were also observed on site (Figure 16).



FIGURE 16: VAGRANTS OBSERVED ON SITE

On the southeastern side of the rocky outcrop a linear berm was observed surrounded by pioneer vegetation (Figure 17).



FIGURE 17: LINEAR BERM/EXCAVATION ALONG CONTOUR OF ROCKY RIDGE

Impacts from borehole test pits were observed on the rocky outcrop (Figure 18).



FIGURE 18: BOREHOLE TEST PIT REHABILITATION REQUIRED

The ecological integrity of the site has been impacted by alien vegetation, illegal dumping and other impacts and only the more common faunal species can be expected on site as a result. From an ecological perspective, the site has a medium sensitivity.

2.3 Impact summary

Current impacts on the rocky outcrop include:

- Alien invasive vegetation
- Illegal dumping (most likely from before the ClearView fence was put up along Solomon Mahlangu Drive and the northern section of the M28).
- Footpaths, vagrants, cooking fires, littering and human excrement
- Linear excavation and berm along the contour of the south eastern section of the rocky outcrop
- Filling material remaining around closed geological test pit boreholes

3 Limitations and assumptions

This study focuses on the sensitivity and impacts on the rocky ridge on site only, for purposes as set out in the Method of Assessment above. This report is not meant as a report of the general vegetation of the area.

As the Environmental Authorisation has been obtained for the development and the focus of this report is current site conditions as regulated by the NEMA, minimum requirements of GDARD in terms of biodiversity and the Ridges Policy were used as guideline for the assessment.

The rocky outcrop was visited at the end of the flowering season. Although most grasses have lost their inflorescences, sufficient material was left to accomplish identification. The vegetative parts of herbs not in flower were of such nature that they could be identified without much difficulty.

4 Conclusion

The Rocky outcrop vegetation study unit as well as the site itself is situated within a Critical Biodiversity area. It is threatened by alien invasive species and other alien species, especially along the many footpaths criss-crossing the outcrop. Although a high fence has been erected along most of the length of Solomon Mahlangu Drive and along Van Ryneveld Avenue to prevent pedestrian traffic, access points were still available to determined trespassers. The sensitivity status of the rocky outcrop is severely challenged by the alien species, the species composition and the pedestrian access to the site, and although the rocky outcrop is considered sensitive, it is deemed to be of **medium sensitivity** only.

Because connectivity with natural grassland to the west is very limited, its continued existence as a healthy vegetation unit is doubtful. All alien species should be removed. No Red List or Orange List species occur on the rocky outcrop, although the habitat is suitable for three Red List species, especially *Lithops lesliei* subsp. *lesliei*. Pedestrian access should be prohibited.

5 Recommendations

- The sensitive areas as indicated on the Ecological Layout 2 must be fenced off and access control must be implemented. The only access include maintenance and/or emergency incidents.
- The access road should be elevated and suitable terrestrial underpasses such as pipes of at least 30 cm diameter and extending well into the road reserve, should be provided to facilitate safe movement of small mammals, reptiles, amphibians and terrestrial pollinators as well as to facilitate drainage from the rocky outcrop. Underpasses should be accessible to maintenance staff and should be cleared of accumulated material at least at the start of each rainy season.
- It is important that fauna be deterred from the road surface by putting up a barrier along either side of the road section passing through the sensitive area. Natural vegetation along the movement corridor must be retained to provide temporary shelter. No strong lighting should be used in close proximity to the corridor and culverts.
- The number and spacing of underpasses will need to be determined by a specialist registered in accordance with the Natural Scientific Professions Act (No. 27 of 2003) in the fields of Ecological / Zoological Science.
- Alien invasive vegetation must be managed and/removed on site as per specialist recommendations. It is recommended that a site specific Alien Invasive Species Plan be commissioned for the effective eradication and management of invasive species.
- An Ecological Management Plan must be compiled for the open space area and should include:
 - Firebreak and burning regime
 - Access control
 - Environmental Awareness Plan

- Culvert maintenance programme (removal of litter and debris)
 - Corridor management considerations
- Where possible, trees naturally growing on the site should be retained as part of the landscaping. Measures to ensure that these trees survive the physical disturbance from the development should be implemented. A tree surgeon should be consulted in this regard.
- Dumping of builders' rubble and other waste in the areas earmarked for exclusion must be prevented, through fencing or other management measures. These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics etc. to ensure continuous biodiversity.
- Outside lighting should be designed to minimize impacts on important pollinators. All outside lighting should be directed away from sensitive areas. Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.
- The road reserve of the access road should be kept clear and be fenced at the start of construction to prevent widening of the road reserve and preclude entry into the rocky outcrop vegetation.
- No pedestrian walkways should be constructed in the rocky outcrop and pedestrian entry must be prohibited, except for maintenance staff. Information boards to inform the public of the sensitive nature of the rocky outcrop should be strategically placed.

These recommendations must be integrated with the overall open space plan for the site, as well as in the EMP.

The following are applicable general mitigation measures of the GDARD minimum requirements for biodiversity (2014) and must also be adhered to:

- An appropriate management authority (e.g. the body corporate) that must be contractually bound to implement the Environmental Management Plan (EMP and Record of Decision (ROD) during the operational phase of the development should be identified and informed of their responsibilities in terms of the EMP and ROD.
- The open space system should be managed in accordance with an Ecological Management Plan that complies with the Minimum Requirements for Ecological Management Plans and forms part of the EMP.
- The open space system should be fenced off prior to construction commencing (including site clearing and pegging). All construction-related impacts (including service roads, temporary housing, temporary ablution, disturbance of natural habitat, storing of equipment/building materials/vehicles or any other activity) should be excluded from the open space system. Access of vehicles to the open space system should be prevented and access of people should be controlled, both during the construction and operational phases. Movement of indigenous fauna should however be allowed (i.e. no solid walls, e.g. through the erection of palisade fencing).
- The crossing of natural drainage systems should be minimized and only constructed at the shortest possible route, perpendicular to the natural drainage system. Where possible, bridge crossings should span the entire stretch of the buffer zone.
- Only indigenous plant species, preferably species that are indigenous to the natural vegetation of the area, should be used for landscaping in communal areas. As far as possible, plants naturally growing on the development site, but would otherwise be

destroyed during clearing for development purposes, should be incorporated into landscaped areas. Forage and host plants required by pollinators and seed-dispersers should also be planted in landscaped areas, and

- 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
- All storm water structures should be designed so as to block amphibian and reptile access to the road surface.
- Where roads traverse natural corridors such as streams and ridges, traffic control measures are recommended (e.g. 60km/h speed limits, speed traps, rumble strips and speed bumps).
- 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.
- Suitable terrestrial underpasses should be provided to facilitate safe movement of animals, specifically where roads traverse provincially important species/climate change corridors or ridges or habitat suitable for any Red/Orange List amphibian/ reptile/ mammal species. The number and spacing of underpasses will need to be determined by a specialist registered in accordance with the Natural Scientific Professions Act (No. 27 of 2003) in the fields of Ecological / Zoological Science. All underpasses should be dressed with a layer of sand (minimum 10cm), should be a minimum of 1.5m high and 1.0m wide so as to facilitate maintenance access and should be provided with small grates in the road surface to allow light penetration into the underpass. Underpasses should be accessible to maintenance staff and should be cleared of accumulated material at least at the start of each rainy season.

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

Species	Flower season	Suitable habitat	Priority group	Conserv status	Presence on site
<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>	Sep-Jan	Rock crevices on rocky ridges, usually south-facing, or in shallow gravel on top of rocks, but often in shade of other vegetation.	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-Mar	Short grasslands, hillsides, on sandy gravel overlying dolomite, sometimes also on quartzites; occasionally open woodland; 1000 - 1705m.	A1	Critically 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 suitable
▲ <i>Ceropegia decidua</i> subsp. <i>pretoriensis</i>	Nov-Apr	Direct sunshine or shaded situations, rocky outcrops of the quartzitic Magaliesberg mountain series, in pockets of soil among rocks, in shade of shrubs and low trees, can be seen twining around grass spikes.	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 rock.	A2	Vulnerable ¹	Habitat not suitable
▲ <i>Cleome conrathii</i>	Mar-May; Dec-Jan	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>Delosperma gautengense</i>	Aug-Mar	Amongst rocks on hillslopes of the Magaliesberg and associated ridge systems, on south facing slopes.	A1	Vulnerable ¹	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 suitable
<i>Eucomis autumnalis</i>	Nov-Apr	Damp, open grassland and sheltered places.	N/A	Declining ²	Habitat not suitable
<i>Gnaphalium nelsonii</i>	Oct-Dec	Seasonally wet grasslands.	A2	Near Threatened ¹	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 barbertoni</i>	Feb-Mar	In grassland on rocky hillsides.	A2	Near Threatened ¹	Habitat not suitable

Species	Flower season	Suitable habitat	Priority group	Conserv status	Presence on site
▲ <i>Habenaria kraenzliniana</i>	Feb-Apr	Terrestrial in stony, grassy hillsides, recorded from 1000 to 1400m.	A3	Near Threatened ¹	Habitat 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-Oct	Grassy slopes and 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, from sandy hills on the margins of dune forests to open rocky grassland; also grows on dry, stony, grassy slopes, mountain slopes and plateaux; appears to be drought and fire tolerant.	N/A	Declining ²	Habitat not suitable
<i>Ilex mitis</i> var. <i>mitis</i>	Oct-Dec	Riverbanks, streambeds, evergreen forests.	N/A	Declining ²	Habitat not suitable
▲ <i>Lithops</i> subsp. <i>lesliei</i>	Mar-Jun	Primary habitat appears to be the arid grasslands in the interior of South Africa where it usually occurs in rocky places, growing under the protection of surrounding forbs and grasses.	A3	Near Threatened ²	Habitat suitable
<i>Melolobium subspicatum</i>	Sep-May	Grassland.	A1	Vulnerable ¹	Habitat not suitable
<i>Pearsonia bracteata</i>	Dec-Apr	Plants in Gauteng and North West occur in 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'

▲ Has been recorded from the farm on which the rocky outcrop is situated / within 5km of the rocky outcrop. Should suitable habitat be present, it is highly likely that this species occurs on the rocky outcrop.

ANNEXURE B: PROTECTED TREES

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

Species	Suitable habitat	Presence on site
<i>Pittosporum viridiflorum</i>	In forest margins, bush clumps and bushveld often on rock outcrops.	Habitat not suitable

ANNEXURE C: 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 No.10 of 2004).

Species	Presence on site
<i>Harpagophytum zeyheri</i>	Habitat suitable

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