

ECOLOGICAL FAUNA AND FLORA HABITAT SURVEY

**Proposed Goutrou development, Hopetown, Northern
Cape Province, South Africa**



Flowers and foliage of alien invasive weed, *Salsola kali*, at the site.
Photo: R.F. Terblanche.

JANUARY 2020

COMPILED BY:

Reinier F. Terblanche

(M.Sc : Ecology, *Cum Laude*; Pr.Sci.Nat, Reg. No. 400244/05)

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I) SPECIALIST EXPERTISE

SYNOPTIC CV: REINIER. F. TERBLANCHE

Reinier is an ecologist and in particular a habitat specialist with an exceptional combination of botanical and zoological expertise which he keeps fostering, updating and improving. He is busy with a PhD for which he registered at the Department of Conservation Ecology at the University of Stellenbosch in July 2013. The PhD research focuses on the landscape ecology of selected terrestrial and wetland butterflies in South Africa. Reinier's experience includes being a lecturer in ecology and zoology at the North West University, Potchefstroom Campus (1998-2008). Reinier collaborates with a number of institutes, organizations and universities on animal, plant and habitat research.

Qualifications:

| Qualification | Main subject matter | University |
|---|--|--------------------------------------|
| M.Sc Cum Laude, 1998: Botany: Ecology | Quantitative study of invertebrate assemblages and plant assemblages of rangelands in grasslands. | North-West University, Potchefstroom |
| B.Sc Honns Cum Laude, 1992 Botany: Taxonomy | Distinctions in all subjects: Plant Anatomy, Taxonomy, Modern Systematics, System Modelling, Plant Ecology, Taxonomy Project. Also included: Statistics Attendance Course. | North-West University, Potchefstroom |
| B.Sc Botany, Zoology | Main subjects: Botany, Zoology. | North-West University, Potchefstroom |
| Higher Education Diploma, 1990 | Numerous subjects aimed at holistic training of teachers. | North-West University, Potchefstroom |

In research Reinier specializes in conservation biology, threatened butterfly species, vegetation dynamics and ant assemblages at terrestrial and wetland butterfly habitats as well as enhancing quantitative studies on butterflies of Africa. He has published extensively in the fields of taxonomy, biogeography and ecology in popular journals, peer-reviewed scientific journals and as co-author and co-editor of books (see 10 examples beneath).

Reinier practices as an ecological consultant and has been registered as a Professional Natural Scientist by SACNASP since 2005: Reg. No. 400244/05. His experience in consultation includes: Flora and fauna habitat surveys, Threatened species assessments, Riparian vegetation index surveys, Compilation of Ecological Management Plans, Biodiversity Action Plans and Status quo of biodiversity for Environmental Management Frameworks, Wetland Assessments, Management of Rare Wetland Species.

Recent activities/ awards: Best Poster Award at Oppenheimer De Beers Group Research Conference 2015, Johannesburg. One of the co-authors of Guidelines for Standardised Global Butterfly Monitoring, 2015, Group on Earth Observations Biodiversity Observation Network, Leipzig, Germany (UNEP-WCMC), GEO BON Technical Series 1. Awarded the prestigious Torben Larsen Memorial Tankard in October 2017; one is awarded annually to the person responsible for the most outstanding written account on Afrotropical Lepidoptera. Lectured as Conservationist-in-Residence in the Wildlife Conservation Programme of the African Leadership University, Kigali, Rwanda, 9-23 February 2019. Reinier won a photographic competition which resulted his photograph of the Critically Endangered *Erikssonia edgei* (Waterberg Copper) being on the front cover of the Synthesis Report of the National Biodiversity Assessment (2018) prepared by SANBI. Reinier is a Research Fellow at the University of South Africa (Unisa) from 1 January 2020.

EXPERIENCE

| Lecturer: Zoology 1998-2008 | Main subject matter and level | Organization |
|---|---|--|
| Lectured subjects | - <u>3rd year level</u> Ecology, Plantparasitology - <u>2nd year level</u> Ethology - <u>Master's degree</u> Evolutionary Ethology, Systematics in Practice, Morphology and Taxonomy of Insect Pests, Wetlands. | North-West University, Potchefstroom and University of South Africa |
| Co-promoter | PhD: Edge, D.A. 2005. Ecological factors that influence the survival of the Brenton Blue butterfly | North-West University, Potchefstroom |
| Study leader/ assistant study leader | Six MSc students, One BSc Honn student: Various quantitative biodiversity studies (terrestrial and aquatic). | North-West University, Potchefstroom |
| Teacher 1994-1998 | Biology and Science, Secondary School | Afrikaans Hoër Seunskool, Pretoria |
| Owned Anthene Ecological CC 2008 – present | - Flora and Fauna habitat surveys - Highly specialized ecological surveys - Riparian vegetation index surveys - Ecological Management Plans - Biodiversity Action Plans - Biodiversity section of Environmental Management Frameworks - Wetland assessments | Private Closed Corporation that has been subcontracted by many companies |
| Herbarium assistant 1988-1991 | - Part-time assistant at the A.P. Goossens herbarium, Botany Department, North-West University, 1988, 1989, 1990 and 1991 (as a student). | North-West University, Potchefstroom |

10 EXAMPLES OF PUBLICATIONS OF WHICH R.F. TERBLANCHE IS AUTHOR/ CO-AUTHOR

(Three books, two chapters in books and five articles are listed here as examples)

- HENNING, G.A., TERBLANCHE, R.F. & BALL, J.B. (eds) 2009. *South African Red Data Book: butterflies*. SANBI Biodiversity Series 13. South African National Biodiversity Institute, Pretoria. 158p. ISBN 978-1-919976-51-8
- MECENERO, S., BALL, J.B., EDGE, D.A., HAMER, M.L., HENNING, G.A., KRÜGER, M., PRINGLE, E.L., TERBLANCHE, R.F. & WILLIAMS, M.C. (eds). 2013. *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and atlas*. Safronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.
- VAN SWAAY, C., REGAN, E., LING, M., BOZHINOVSKA, E., FERNANDEZ, M., MARINI-FILHO, O.J., HUERTAS, B., PHON, C.-K., KŐRÖSI, A., MEERMAN, J., PE'ER, G., UEHARA-PRADO, M., SÁFIÁN, S., SAM, L., SHUEY, J., TARON, D., TERBLANCHE, R.F. & UNDERHILL, L. 2015. Guidelines for Standardised Global Butterfly Monitoring. Group on Earth Observations Biodiversity Observation Network, Leipzig, Germany. GEO BON Technical Series 1.
- TERBLANCHE, R.F. & HENNING, G.A. 2009. *A framework for conservation management of South African butterflies in practice*. In: Henning, G.A., Terblanche, R.F. & Ball, J.B. (eds). *South African Red Data Book: Butterflies*. SANBI Biodiversity Series 13. South African National Biodiversity Institute, Pretoria. p. 68 – 71.
- EDGE, D.A., TERBLANCHE, R.F., HENNING, G.A., MECENERO, S. & NAVARRO, R.A. 2013. Butterfly conservation in southern Africa: Analysis of the Red List and threats. In: Mecenero, S., Ball, J.B., Edge, D.A., Hamer, M.L., Henning, G.A., Krüger, M., Pringle, E.L., Terblanche, R.F. & Williams, M.C. (eds). *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas*. pp. 13-33. Safronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.
- TERBLANCHE, R.F., SMITH, G.F. & THEUNISSEN, J.D. 1993. Did Scott typify names in *Haworthia* (Asphodelaceae: Aloioideae)? *Taxon* 42(1): 91–95. (International Journal of Plant Taxonomy).
- TERBLANCHE, R.F., MORGENTHAL, T.L. & CILLIERS, S.S. 2003. The vegetation of three localities of the threatened butterfly species *Chrysoritis aureus* (Lepidoptera: Lycaenidae). *Koedoe* 46(1): 73-90.
- EDGE, D.A., CILLIERS, S.S. & TERBLANCHE, R.F. 2008. Vegetation associated with the occurrence of the Brenton blue butterfly. *South African Journal of Science* 104: 505 - 510.
- GARDINER, A.J. & TERBLANCHE, R.F. 2010. Taxonomy, biology, biogeography, evolution and conservation of the genus *Erikssonia* Trimen (Lepidoptera: Lycaenidae) *African Entomology* 18(1): 171-191.
- TERBLANCHE, R.F. 2016. *Acraea trimeni* Aurivillius, [1899], *Acraea stenobea* Wallengren, 1860 and *Acraea neobule* Doubleday, [1847] on host-plant *Adenia repanda* (Burch.) Engl. at Tswalu Kalahari Reserve, South Africa. *Metamorphosis* 27: 92-102.

* A detailed CV with more complete publication list is available.

II) SPECIALIST DECLARATION

I, Reinier F. Terblanche, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: Reinier F. Terblanche



Signature of the specialist

Date: 16 January 2020

1 INTRODUCTION

An ecological habitat survey was required for a proposed development Goutrou, at the eastern side of Hopetown, Northern Cape Province, South Africa (elsewhere referred to as the site). The survey mainly focused on the possibility that Threatened flora and fauna known to occur in Northern Cape Province are likely to occur at the site or not. Species which are not threatened but of conservation concern, for example near threatened, data deficient or declining species also received attention in the survey.

1.1 OBJECTIVES OF THE HABITAT STUDY

The objectives of the habitat study are to provide:

- A detailed fauna and flora habitat survey;
- A detailed habitat survey of possible threatened or localised plant species, vertebrates and invertebrates;
- Recording of possible host plants of fauna such as butterflies.
- Evaluate the conservation importance and significance of the site with special emphasis on the current status of threatened species;
- Literature investigation of possible species that may occur on site;
- Identification of potential ecological impacts on fauna and flora that could occur as a result of the development; and
- Make recommendations to reduce or minimise impacts, should the development be approved.

1.2 SCOPE OF STUDY

- A survey consisting of visits to investigate key elements of habitats on the site, relevant to the conservation of fauna and flora.
- Recording of any sightings and/or evidence of existing fauna and flora.
- The selective and careful collecting of voucher specimens of invertebrates where deemed necessary.
- An evaluation of the conservation importance and significance of the site with special emphasis on the current status of threatened species.
- Recording of possible host plants or foodplants of fauna such as butterflies.
- Literature investigation of possible species that might occur on site.
- Integration of the literature investigation and field observations to identify potential ecological impacts that could occur as a result of the development.
- Integration of literature investigation and field observations to make recommendations to reduce or minimise impacts, should the development be approved.

2 STUDY AREA

The study area is at the eastern side of Hopetown, Northern Cape Province, South Africa (elsewhere referred to as the site). Site is part of the Savanna Biome which is represented by the Kimberley Thornveld vegetation type at the northern parts of the site as well as Northern Upper Karoo at the southern parts of the site (Mucina & Rutherford 2006).

To serve as local context for the landscape and vegetation at the site an outline of the Kimberley Thornveld (SVk 4) and Northern Upper Karoo (NKu 3) from Mucina and Rutherford (2006) follows.

SVk 4 Kimberley Thornveld

Distribution: In South Africa the Kimberley Thornveld is found in the North West, Free State and Northern Cape Provinces. Kimberley Thornveld is present in most of the Kimberley, Hartswater, Bloemhof and Hoopstad Districts as well as substantial parts of the Warrenton, Christiana, Taung, Boshof and to some extent the Barkly West Districts. The distribution also includes pediment areas in the Herbert and Jacobsdal Districts (Mucina & Rutherford 2006).

Vegetation and landscape features: Plains often slightly irregular with well-developed tree layer of *Acacia erioloba*, *Acacia tortilis*, *Acacia karroo* and *Boscia albitrunca* and well-developed shrub layer with occasional dense stands of *Tarchonanthus camphoratus* and *Acacia mellifera*. Grass layer open with much uncovered soil (Mucina & Rutherford 2006).

Geology and soils: Andesitic lavas of the Allanridge formation in the north and west and fine-grained sediments of the Karoo Supergroup in the south and east. Deep sandy (0.6 – 1.2 m) to loamy soils of the Hutton soil form are present on slightly undulating sandy plains (Mucina & Rutherford).

Climate: Climate is characterized by summer and autumn rainfall and very dry winters. Mean annual precipitation from about 300 mm in the southwest to about 500 mm in the northeast. Frost frequent in winter (Mucina & Rutherford 2006).

Important taxa of the Kimberley Thornveld listed by Mucina & Rutherford (2006): Tall Tree: *Acacia erioloba*. Small Trees: *Acacia karroo*, *Acacia mellifera* subsp. *detinens*, *Acacia tortilis* subsp. *heteracantha*, *Searsia lancea*. Tall Shrubs: *Tarchonanthus camphoratus*, *Diospyros pallens*, *Ehretia rigida*, *Euclea crispa* subsp. *ovata*, *Grewia flava*, *Lycium arenicola*, *Lycium hirsutum*, *Searsia tridactyla*. Low Shrubs: *Acacia hebeclada* subsp. *hebeclada*,

Anthospermum rigidum subsp. *pumilum*, *Helichrysum zeyheri*, *Hermannia comosa*, *Lycium pilifolium*, *Melolobium microphyllum*, *Pavonia burchellii*, *Peliostomum leucorrhizum*, *Plinthus sericeus*, *Wahlenbergia nodosa*. Succulent Shrubs: *Aloe hereroensis* var. *hereroensis*, *Lycium cinereum*. Graminoids: *Eragrostis lehmanniana*, *Aristida canescens*, *Aristida congesta*, *Aristida mollissima* subsp. *argentea*, *Cymbopogon pospischilii*, *Digitaria argyrograpta*, *Digitaria eriantha* subsp. *eriantha*, *Heteropogon contortus*, *Themeda triandra*. Herbs: *Barleria macrostegia*, *Dicoma schinzii*, *Harpagophytum procumbens* subsp. *procumbens*, *Helichrysum cerastioides*, *Hermbsstaedtia odorata*, *Hibiscus marlothianus*, *Jamesbrittenia aurantiaca*, *Lippia scaberrima*, *Osteospermum muricatum*, *Vahlia capensis* subsp. *vulgaris*. Succulent Herbs: *Aloe grandidentata*, *Piранthus decipiens*.

Northern Upper Karoo (NKu 3)

Distribution: Northern Upper Karoo is found in South Africa in the Northern Cape and Free State Provinces. Northern Upper Karoo occurs at the northern regions of the Upper Karoo plateau and ranges from Prieska, Vosburg and Carnarvon in the west to Phillipstown, Petrusville and Petrusburg in the east. Northern Upper Karoo is bordered in the north by Niekerkshoop, Douglas and Petrusburg and in the south by Carnarvon, Pampoenpoort and De Aar. A few patches occur in Griqualand West. Altitude varies mostly from 1000 – 1500 m (Mucina & Rutherford, 2006).

Vegetation and landscape features: Shrubland dominated by dwarf karoo shrubs, grasses and *Acacia mellifera* subsp. *detinens* and some other low trees (especially on sandy soils in the northern parts and vicinity of the Orange River). Flat to gently sloping, with isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans (Mucina & Rutherford 2006).

Geology and soils: Shales of the Volksrust Formation and to a lesser extent the Prince Albert Formation (both of the Ecca Group) as well as Dwyka Group diamictites from the underlying geology. Jurassic Karoo Dolerite sills and sheets support this vegetation complex in places. Wide stretches of land are covered by superficial deposits including calcretes of the Kalahari Group. Soils are variable from the shallow to deep, red-yellow, apedal, freely drained soils to very shallow Glenrosa and Mispah forms. Mainly Ae, Ag and Fc land types (Mucina & Rutherford, 2006).

Climate: Rainfall peaks in autumn (March). Mean annual precipitation (MAP) ranges from about 190 mm in the west to 400 mm in the northeast (Mucina & Rutherford, 2006).

Important taxa of the Northern Upper Karoo listed by Mucina & Rutherford (2006): Small Trees: *Acacia mellifera* subsp. *detinens*, *Boscia albitrunca*. Tall Shrubs: *Lycium cinereum*, *Lycium horridum*, *Lycium oxycarpum*, *Lycium schizocalyx*, *Rhigozum trichotomum*. Low Shrubs: *Chrysocoma ciliata*, *Gnidia polycephala*, *Pentzia calcarea*, *Pentzia globosa*, *Pentzia incana*, *Pentzia spinescens*, *Rosenia humilus*, *Amphiglossa triflora*, *Aptosimum marlothii*, *Aptosimum spinescens*, *Asparagus glaucus*, *Barleria rigida*, *Berkheya annectens*, *Eriocephalus ericoides* subsp. *ericoides*, *Eriocephalus glandulosus*, *Eriocephalus spinescens*, *Euryops asparagoides*, *Felicia muricata*,

Helichrysum lucilioides, *Hermannia spinosa*, *Leucas capensis*, *Limeum aethiopicum*, *Melolobium candicans*, *Microlooma armatum*, *Osteospermum leptolobum*, *Osteospermum spinescens*, *Pegolettia retrofracta*, *Pentzia lanata*, *Phyllanthus maderaspatensis*, *Plinthus karoicus*, *Pteronia glauca*, *Pteronia sordida*, *Selago geniculata*, *Selago saxatilis*, *Tetragonia arbuscula*, *Zygophyllum lichtensteinianum*. Succulent Shrubs: *Hertia pallens*, *Salsola calluna*, *Salsola glabrescens*, *Salsola rabieana*, *Salsola tuberculata*, *Zygophyllum flexuosum*. Semiparasitic Shrub: *Thesium hystrix*. Herbs: *Chamaesyce inaequilatera*, *Convolvulus saggitatus*, *Dicoma capensis*, *Gazania krebsiana*, *Hermannia comosa*, *Indigofera alternans*, *Lessertia pauciflora*, *Radyera urens*, *Sesamum capense*, *Sutera pinnatifida*, *Tribulus terrestris*, *Vahlia capensis*. Succulent Herb: *Psilocaulon coriarium*. Geophytic Herb: *Moraea pallida*. Graminoids: *Aristida adscensionis*, *Aristida congesta*, *Aristida diffusa*, *Enneapogon desvauxii*, *Eragrostis lehmanniana*, *Eragrostis obtusa*, *Eragrostis truncata*, *Sporobolus fimbriatus*, *Stipagrostis obtusa*, *Eragrostis bicolor*, *Eragrostis parosa*, *Fingerhuthia africana*, *Heteropogon contortus*, *Stipagrostis ciliata*, *Themeda triandra*, *Tragus berteronianus*, *Tragus koelerioides*, *Tragus racemosa*.

Note: Though some plant species of the above listed vegetation types are present at the site, not necessarily all of the plant species listed above are present at the site.



Figure 1 Map with indication of the location of the site.

Map information were analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2020).

3 METHODS

A desktop study comprised not only an initial phase, but also it was used throughout the study to accommodate and integrate all the data that become available during the field observations.

Surveys were conducted by R.F. Terblanche on 23 November 2019 to note key elements of habitats on the site, relevant to the conservation of fauna and flora. The main purpose of the site visit was ultimately to serve as a habitat survey that noted the possible presence or not of threatened species and other species of particular conservation concern.

The following sections highlight the materials and methods applicable to different aspects that were observed.

3.1 HABITAT CHARACTERISTICS AND VEGETATION

The habitat was investigated by noting habitat structure (rockiness, slope, plant structure/ physiognomy) as well as floristic composition. Voucher specimens of plant species were only taken where the taxonomy was in doubt and where the plant specimens were of significant relevance for invertebrate conservation. In this case no plant specimens were needed to be collected as voucher specimens or to be send to a herbarium for identification. A wealth of guides and detailed works of plant identifications, ecology and conservation is fortunately available and very useful. Field guides, biogeographic works, species lists, diagnostic outlines, conservation statuses and detail on specific plant groups were sourced from Court (2010), Germishuizen (2003), Germishuizen, Meyer & Steenkamp (2006), Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), Manning (2003), Manning (2009), McMurtry, Grobler, Grobler & Burns (2008), Pooley (1998), Retief & Herman (1997), Smit (2008), Van Ginkel, Glen, Gordon-Gray, Cilliers, Muasya & Van Deventer (2011), Van Jaarsveld (2006), Van Oudtshoorn (2012), Van Wyk (2000), Van Wyk & Smith (2001), Van Wyk & Smith (2014), Van Wyk & Malan (1998) and Van Wyk & Van Wyk (2013). Lists of species, species names and the conservation status of species were mainly sourced from Raimondo, von Staden, Victor, Helme, Turner, Kamundi & Manyama (2009) and updated versions of red lists and species from the Threatened Species Programme of SANBI and the Red List of South African Plants (sanbi.org.za)

3.2 MAMMALS

Mammals were noted as sight records by day. For the identification of species and observation of diagnostic characteristics Smithers (1986), Skinner & Chimimba (2005), Cillié, Oberprieler and Joubert (2004) and Apps (2000) are consulted. Sites have been walked, covering as many habitats as possible. Signs of the presence of mammal species, such as calls of animals, animal tracks (spoor), burrows, runways, nests and faeces were recorded. Walker (1996), Stuart & Stuart (2000) and Liebenberg (1990) were consulted for additional information and for the identification of tracks and signs. Because of the type of threatened mammals that are assessed in the local area such as the blackfooted cat and golden moles or rough-haired golden moles which are not to be trapped in normal way, the poor trapping success with normal traps of species in question such as the White-tailed Mouse

as well as the similarity of terrestrial habitats and lack of unique habitats at the sites, trapping was not done since it was not deemed necessary in the case of this study. The focus has been on signs and surveying habitat characteristics to note potential occurrences of mammals of particular conservation concern. Many mammals can be identified from field sightings but, with a few exceptions, bats, rodents and shrews can only be reliably identified in the hand, and then some species needs examination of skulls, or even chromosomes (Apps, 2000).

3.3 BIRDS

Birds were noted as sight records, mainly with the aid of binoculars (10x30). Nearby bird calls of which the observer was sure of the identity were also recorded. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Ryan (2001) is followed. For information on identification, biogeography and ecology Barnes (2000), Hockey, Dean & Ryan, P.G. (2005), Cillié, Oberprieler & Joubert (2004), Tarboton & Erasmus (1998) and Chittenden (2007) were consulted. Ringing of birds fell beyond the scope of this survey and was not deemed necessary. Sites have been walked, covering as many habitats as possible. Signs of the presence of bird species such as spoor and nests have additionally been recorded. Habitat characteristics were surveyed to note potential occurrences of birds.

3.4 REPTILES

Reptiles were noted as sight records in the field. Binoculars (10x30) can also be used for identifying reptiles of which some are wary. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques, Branch (1998), Marais (2004), Alexander & Marais (2007) and Cillié, Oberprieler and Joubert (2004) were followed. The Atlas and Red List of Reptiles of South Africa, Lesotho and South Africa (Bates, Branch, Bauer, Burger, Marais, Alexander & de Villiers, 2014) has been used as the main source to compile the list for assessment. Sites were walked, covering as many habitats as possible. Smaller reptiles are sometimes collected for identification, but this practice was not necessary in the case of this study. Habitat characteristics are surveyed to note potential occurrences of reptiles.

3.5 AMPHIBIANS

Frogs and toads are noted as sight records in the field or by their calls. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Carruthers (2001), Du Preez (1996), Conradie, Du Preez, Smith & Weldon (2006) and the recent complete guide by Du Preez & Carruthers (2009) are consulted. CD's with frog calls by Carruthers (2001) and Du Preez & Carruthers (2009) are used to identify species by their calls when applicable. Sites are walked, covering as many habitats as possible. Smaller frogs are often collected by pitfall traps put out for epigeal invertebrates (on the soil), but this practice falls beyond the scope of this survey. Habitat characteristics are also surveyed to note potential occurrences of amphibians.

3.6 BUTTERFLIES

Butterflies were noted as sight records or voucher specimens. Voucher specimens are mostly taken of those species of which the taxa warrant collecting due to taxonomic difficulties or in the cases where species can look similar in the veldt. Many butterflies use only one species or a limited number of plant species as host plants for their larvae. Myrmecophilous (ant-loving) butterflies such as the *Aloeides*, *Chrysoritis*, *Erikssonia*, *Lepidochrysops* and *Orachrysops* species (Lepidoptera: Lycaenidae), which live in association with a specific ant species, require a unique ecosystem for their survival (Deutshländer & Bredenkamp, 1999; Terblanche, Morgenthal & Cilliers, 2003; Edge, Cilliers & Terblanche, 2008; Gardiner & Terblanche, 2010). Known food plants of butterflies were therefore also recorded. After the visits to the site and the identification of the butterflies found there, a list was also compiled of butterflies that will most probably be found in the area in all the other seasons because of suitable habitat. The emphasis of this study remains a habitat survey that focuses on the likelihood of occurrence of threatened, near threatened or rare butterfly species.

3.7 FRUIT CHAFER BEETLES

Different habitat types in the areas were explored for any sensitive or special fruit chafer species. Selection of methods to find fruit chafers depends on the different types of habitat present and the species that may be present. Fruit bait traps would probably not be successful for capturing *Ichnestoma* species in a grassland patch (Holm & Marais 1992). Possible chafer beetles of high conservation priority were noted as sight records accompanied by the collecting of voucher specimens with grass nets or containers where deemed necessary.

3.8 ROCK SCORPIONS

Relatively homogenous habitat / vegetation areas were identified and explored to identify any sensitive or special species. Selected stones that were lifted to search for Arachnids were put back very carefully resulting in the least disturbance possible. All the above actions were accompanied by the least disturbance possible.

3.9 LIMITATIONS

For each site visited, it should be emphasized that surveys can by no means result in an exhaustive list of the plants and animals present on the site, because of the time constraint. There are many invertebrate groups with huge taxonomic and biogeographic impediments which further add to limitations of present surveys. The site survey was conducted during November 2019 which is an optimal time of the season to find sensitive plant and animal species of high conservation priority. Conditions were very dry during the time of the site visits which are sub-optimal. Weather conditions during the surveys were favourable for recording fauna and flora. The focus of the present survey remains a habitat survey that concentrates on the possibility that species of particular conservation priority occur on the site or not. It is unlikely that any more visits would reveal information that would change the outcome of this assessment both in terms of ecosystems of special conservation concern or suitable

habitats of species of particular conservation concern. Visits that were conducted therefore appear to be sufficient to address the objectives of this study.

4 RESULTS

4.1 HABITAT AND VEGETATION CHARACTERISTICS

Table 4.1 Outline of main landscape and habitat characteristics of the site.

| HABITAT FEATURE | DESCRIPTION |
|----------------------------------|--|
| Topography | Site is situated on gentle slopes (flat). |
| Rockiness | No rocky ridges are present. |
| Presence of wetlands | Wetlands appear to be absent at the site. |
| Broad overview of vegetation | <p>Large parts of vegetation at the site have been transformed or modified. Remaining vegetation is mainly karroid with few individual trees. Exotic trees occur at informal residential areas. The aggressive alien invasive tree <i>Prosopis glandulosa</i> is found at various places at the site. Indigenous trees include shrub-height <i>Diospyros lycioides</i> subsp. <i>lycioides</i>, <i>Vachellia tortilis</i>, <i>Ziziphus mucronata</i> and <i>Senegalia mellifera</i> subsp. <i>detinens</i>.</p> <p>The tall shrub <i>Rhigozum trichotomum</i> is found in dense clumps at some places at the site. Other tall shrubs include <i>Lycium cinereum</i> and <i>Lycium horridum</i>. The succulent shrub <i>Hertia pallens</i> is widespread at remaining vegetation at the site. occurs Low shrubs are visibly frequent at remaining vegetation at the site and include <i>Aptosimum marlothii</i>, <i>Pentzia globosa</i>, <i>Chrysocoma ciliata</i>, <i>Gnidia polycephala</i>, <i>Melolobium candicans</i>, <i>Plinthus karoocicus</i>, <i>Pteronia glauca</i>, <i>Selago geniculata</i> and <i>Zygophyllum</i> species. Herbaceous plant species include <i>Gazania krebsiana</i>, <i>Chamaesyce inaequilatera</i>, <i>Hermannia comosa</i>, <i>Indigofera alternans</i>, <i>Sesamum capense</i> and <i>Tribulus terrestris</i>. Indigenous grass species at the site include <i>Eragrostis lehmanniana</i>, <i>Eragrostis echinochloidea</i>, <i>Aristida congesta</i>, <i>Tragus berteronianus</i> and <i>Enneapogon desvauxii</i>.</p> <p>Some of the alien invasive weed species at hirtherto bare ground or ecologically disturbed areas at the site are <i>Salsola kali</i>, <i>Argemone ochroleuca</i>, <i>Schkuhria pinnata</i>, <i>Xanthium spinosum</i>, <i>Chenopodium album</i>, <i>Alternanthera pungens</i> and <i>Datura ferax</i>.</p> |
| Signs of ecological disturbances | Informal settlements are present at large parts of the site. Roads, fences and infrastructure associated with informal settlements are present at the site. Informal dumping is widespread. Many parts of the site are surrounded by residential areas, roads, scraped areas and fences. Various alien invasive weeds are widespread at the site. |
| Connectivity | The scope for corridors of particular conservation importance at the site is small. |



Photo 1 Remaining vegetation adjacent to informal settlements at the site.
Photo: R.F. Terblanche.



Photo 2 Informal settlement and remaining vegetation at the site.
Photo: R.F. Terblanche



Photo 3 Cleared areas and settlements at the site.
Photo: R.F. Terblanche.



Photo 4 Remaining vegetation, informal settlements and informal dumping at the site.
Photo: R.F. Terblanche



Photo 5 Extensive informal dumping at the site.
Photo: R.F. Terblanche.



Photo 6 Small tree in picture is aggressive alien invasive species *Prosopis glandulosa* (Mesquite), at the site.
Photo: R.F. Terblanche



Photo 7 Foliage and pod of alien invasive *Prosopis glandulosa* at the site.
Photo: R.F. Terblanche.



Photo 8 Foliage and of indigenous *Vachellia tortilis* (Umbrella Thorn) at the site.
Photo: R.F. Terblanche



Photo 9 Indigenous succulent shrub *Hertia pallens*, often occurring at degraded areas, at the site.
Photo: R.F. Terblanche.



Photo 10 Flowers and foliage of alien invasive *Salsola kali* at the site.
Photo: R.F. Terblanche

4.2 ASSESSMENT OF PLANT SPECIES OF PARTICULAR HIGH CONSERVATION PRIORITY

Studying the geographical extent of the Griqualand West Centre of Plant Endemism (van Wyk & Smith, 2001) as well as the Eastern Kalahari Bushveld Bioregion (Mucina & Rutherford, 2006) it is clear that these regions which stretch across the boundaries of Northern Cape and North West Provinces will include similar suitable habitat for localized plant and animal species. A number of other similar Grassland and Savanna Biome Vegetation Types as well as karroid patches occur in both provinces. Because of this occurrence of similar suitable habitat types in the different provinces, the assessment that follows focus on northern Northern Cape Province and North West Province combined for assessing the likely occurrence or not of species of particular conservation concern.

4.2.1 Plant species of particular conservation concern according to the red list of plants

Table 4.2 Threatened plant species of the North West Province and northern parts of Northern Cape Province which are listed in the **Critically Endangered** category. The list here follows the Red List of South African plant species (Raimondo *et al.* 2009) as well as its updated versions on websites of the South African National Biodiversity Institute (SANBI). No = Plant species is unlikely to be a resident at the site; Yes = Plant species is a resident at the site.

| Species | Status: Global status or national status indicated | Resident at the site |
|---------------------------------|--|---------------------------------|
| <i>Brachystelma canum</i> | Critically Endangered | No |
| <i>Brachystelma gracillimum</i> | Critically Endangered | No |

Table 4.3 Threatened plant species of the North West Province and northern parts of Northern Cape Province which are listed in the **Endangered** category. The list here follows the Red List of South African plant species (Raimondo *et al.* 2009) as well as its updated versions on websites of the South African National Biodiversity Institute (SANBI). No = Plant species is unlikely to be a resident at the site; Yes = Plant species is a resident at the site.

| Species | Status: Global status or national status indicated | Resident at the site |
|--------------------------------|--|---------------------------------|
| <i>Aginon jaarsveldii</i> | Endangered | No |
| <i>Aloe peglerae</i> | Endangered | No |
| <i>Aloidendron pillansii</i> | Endangered | No |
| <i>Brachystelma discoideum</i> | Endangered | No |
| <i>Lithops dorotheae</i> | Endangered | No |

Table 4.4 Threatened plant species of the North West Province and northern parts of the Northern Cape Province which are listed in the **Vulnerable** category. The list here follows the Red List of South African plant species (Raimondo *et al.* 2009) or recent update. No = Plant species is unlikely to be a resident at the site; Yes = Plant species is a resident at the site.

| Species | Status: Global status or national status indicated | Resident at the site |
|---|--|-------------------------------------|
| <i>Aloidendron dichotomum</i> (= <i>Aloe dichotoma</i>) | Vulnerable | No |
| <i>Aloidendron ramosissimum</i> | Vulnerable | No |
| <i>Brachycorythis conica</i> subsp. <i>transvaalensis</i> | Vulnerable | No |
| <i>Brachystelma incanum</i> | Vulnerable | No |
| <i>Caesalpinia bracteata</i> | Vulnerable | No |
| <i>Ceropegia decidua</i> subsp. <i>pretoriensis</i> | Vulnerable | No |
| <i>Ceropegia stentiae</i> | Vulnerable | No |
| <i>Conophytum achabense</i> | Vulnerable | No |
| <i>Dinteranthus pole-evansii</i> | Vulnerable | No |
| <i>Ledebouria atrobrunnea</i> | Vulnerable | No |
| <i>Lithops dinteri</i> subsp. <i>frederici</i> | Vulnerable | No |
| <i>Lithops olivacea</i> | Vulnerable | No |
| <i>Marsilea farinosa</i> | Vulnerable | No |
| <i>Melolobium subspicatum</i> | Vulnerable | No |
| <i>Prunus africana</i> | Vulnerable | No |
| <i>Rennera stellata</i> | Vulnerable | No |
| <i>Searsia maricoan</i> | Vulnerable | No |
| <i>Schwantesia borchersii</i> | Vulnerable | No |

Table 4.5 Near Threatened plant species of the North West Province and northern parts of the Northern Cape Province. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is unlikely to be a resident at the site; Yes = Plant species is a resident at the site.

| Species | Status: Global status or national status indicated | Resident at the site |
|--|--|-------------------------------------|
| <i>Adromischus umbraticola</i> subsp. <i>umbraticola</i> | Near Threatened | No |
| <i>Ceropegia turricula</i> | Near Threatened | No |
| <i>Cineraria austrotransvaalensis</i> | Near Threatened | No |
| <i>Cleome conrathii</i> | Near Threatened | No |
| <i>Conophytum limpidum</i> | Near Threatened | No |
| <i>Delosperma leendertziae</i> | Near Threatened | No |
| <i>Drimia sanguinea</i> | Near Threatened | No |
| <i>Elaeodendron transvaalense</i> | Near Threatened | No |
| <i>Kniphofia typhoides</i> | Near Threatened | No |
| <i>Lithops leslei</i> subsp. <i>leslei</i> | Near Threatened | No |
| <i>Nerine gracilis</i> | Near Threatened | No |

| | | |
|-----------------------------------|-----------------|----|
| <i>Sporobolus oxyphyllus</i> | Near Threatened | No |
| <i>Stenostelma umbelluliferum</i> | Near Threatened | No |

Table 4.6 Plant species of the North West Province and northern Cape Province which are not threatened and not near threatened but which are of particular conservation concern and listed in the **Critically Rare** category (Raimondo *et al.* 2009). The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is unlikely to be a resident at the site; Yes = Plant species is a resident at the site.

| Species | Conservation status | Resident at the site |
|-----------------------------|---------------------|----------------------|
| <i>Bulbine striata</i> | Critically Rare | No |
| <i>Gladiolus filiformis</i> | Critically Rare | No |

Table 4.7 Plant species of the North West Province and northern parts of the Northern Cape Province which are not threatened and not near threatened but of which are of particular conservation concern and listed in the **Rare** category (Raimondo *et al.* 2009). The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is unlikely to be a resident at the site; Yes = Plant species is a resident at the site.

| Species | Status: Global status or national status indicated | Resident at the site |
|---|---|-------------------------|
| <i>Adromischus marianiae</i> | Rare | No |
| <i>Anacampseros bayeriana</i> | Rare | No |
| <i>Anacampseros scopata</i> | Rare | No |
| <i>Brachystelma dimorphum</i> subsp. <i>gratum</i> | Rare | No |
| <i>Cephalophyllum fulleri</i> | Rare | No |
| <i>Ceropegia insignis</i> | Rare | No |
| <i>Conophytum bolusiae</i> subsp. <i>bolusiae</i> | Rare | No |
| <i>Eriospermum ernstii</i> | Rare | No |
| <i>Frithia pulchra</i> | Rare | No |
| <i>Gnaphalium nelsonii</i> | Rare | No |
| <i>Habenaria culveri</i> | Rare | No |
| <i>Hoodia officinalis</i> subsp. <i>officinalis</i> | Rare | No |
| <i>Ozoroa namaquensis</i> | Rare | No |
| <i>Schwantesia pillansii</i> | Rare | No |
| <i>Tridentia virescens</i> | Rare | No |
| <i>Tylecodon boddleyi</i> | Rare | No |
| <i>Tylecodon sulphureus</i> var. <i>armianus</i> | Rare | No |

Table 4.8 Plant species of the North West Province and northern parts of Northern Cape Province which are not threatened and not near threatened but which are of particular conservation concern and listed in the **Declining** category (Raimondo *et al.* 2009). The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is unlikely to be a resident at the site; Yes = Plant species is a resident at the site.

| Species | Status: Global status or national status indicated | Resident at the site |
|-------------------------------|---|-------------------------|
| <i>Boophone disticha</i> | Declining | No |
| <i>Crinum bulbispermum</i> | Declining | No |
| <i>Crinum macowanii</i> | Declining | No |
| <i>Drimia altissima</i> | Declining | No |
| <i>Eucomis autumnalis</i> | Declining | No |
| <i>Gunnera perpensa</i> | Declining | No |
| <i>Hypoxis hemerocallidea</i> | Declining | No |
| <i>Ilex mitis</i> | Declining | No |
| <i>Pelargonium sidoides</i> | Declining | No |
| <i>Vachellia erioloba</i> | Declining | No |

Table 4.9 Plant species of northern parts of the Northern Cape Province of which the conservation status is uncertain owing to a lack of information and which are listed in the **Data Deficient** category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

| Species | Conservation status | Resident at the site |
|--|---------------------|----------------------|
| <i>Avonia recurvata</i> subsp. <i>minuta</i> | Data Deficient | No |
| <i>Cephalaria amerioides</i> | Data Deficient | No |
| <i>Conophytum lithopsoides</i> subsp. <i>boreale</i> | Data Deficient | No |
| <i>Cotula loganii</i> | Data Deficient | No |
| <i>Felicia deserti</i> | Data Deficient | No |
| <i>Hoodia gordonii</i> | Data Deficient | No |
| <i>Manulea deserticola</i> | Data Deficient | No |
| <i>Oxalis extensa</i> | Data Deficient | No |
| <i>Senecio garipepiensis</i> | Data Deficient | No |

4.2.2 Plant species of particular conservation concern: Nationally Protected Tree Species

Table 4.10 Tree species of the North West Province and northern parts of the Northern Cape Province which are listed as **Protected Tree Species** under the National Forests Act No. 84 of 1998, Section 15(1) which was published under Section 12(1)d in GN1602 of 23 December 2016. No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

| Species | Conservation status | Resident at the site |
|---|---------------------------|----------------------|
| <i>Boscia albitrunca</i> (Shepherd's Tree) | Nationally Protected Tree | No |
| <i>Combretum imberbe</i> (Leadwood) | Nationally Protected Tree | No |
| <i>Euclea pseudebenus</i> (Ebony Guarri) | Nationally Protected Tree | No |
| <i>Ozoroa namaquensis</i> | Nationally Protected Tree | No |

| | | |
|--|---------------------------|----|
| (Gariep Resin Tree) | | |
| <i>Prunus africana</i> (Red Stinkwood) | Nationally Protected Tree | No |
| <i>Sclerocarya birrea</i> subsp. <i>caffra</i> (Marula) | Nationally Protected Tree | No |
| <i>Vachellia erioloba</i> (Camel Thorn Tree) | Nationally Protected Tree | No |
| <i>Vachellia haematoxylon</i> (Grey Camel Thorn) | Nationally Protected Tree | No |

4.2.3 Northern Cape Nature Conservation Act No. 9 of 2009: Specially Protected Plant Species (Schedule 1)

Table 4.11 Plant species of the Northern Cape Province which are listed as **Specially Protected Species** in Schedule 1 of Northern Cape Nature Conservation Act, No. 9 of 2009. No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

| Families and Species | Conservation status | Resident at the site |
|--|---|----------------------|
| FAMILY AMARYLLIDACEAE | | |
| <i>Clivia mirabilis</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Haemanthus graniticus</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Hessea pusilla</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Strumaria bidentata</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Strumaria perryae</i> | Specially Protected Plant (NCNCA, 2009) | No |
| FAMILY ANACARDIACEAE | | |
| <i>Ozoroa</i> spp. | Specially Protected Plant (NCNCA, 2009) | No |
| Family: APIACEAE | | |
| <i>Centella tridentata</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Chamarea snijmaniae</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: APOCYNACEAE | | |
| <i>Hoodia gordonii</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Pachypodium namaquanum</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: ASPHODELACEAE | | |
| <i>Aloe buhrii</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Aloe dichotoma</i> (Note <i>Aloe dichotoma</i> is now known as <i>Aloidendron dichotomum</i>) | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Aloe dichotoma</i> var. <i>ramosissima</i> | Specially Protected Plant (NCNCA, 2009) | No |

(Note *Aloe ramosissima* is now regarded as full species *Aloidendron ramosissimum*)

| | | |
|---|---|----|
| <i>Aloe dabenorisana</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Aloe erinacea</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Aloe meyeri</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Aloe pearsonii</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Aloe pillansii</i> (Note <i>Aloe pillansii</i> is now known as <i>Aloidendron pillansii</i>) | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Trachyandra prolifera</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: ASTERACEAE | | |
| <i>Athanasia adenantha</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Athanasia spathulata</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Cotula filifolia</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Euryops mirus</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Euryops rosulatus</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Euryops virgatus</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Felicia diffusa</i> subsp. <i>kamiesbergensis</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Othonna armiana</i> | Specially Protected Plant Species (NCNCA, 2009) | No |
| FAMILY CRASSULACEAE | | |
| <i>Tylecodon torulosus</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family DIOSCOREACEAE | | |
| <i>Dioscorea</i> spp. | Specially Protected Plant (NCNCA, 2009) | No |
| Family: ERIOSPERMACEAE | | |
| <i>Eriospermum erinum</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Eriospermum glaciale</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: FABACEAE | | |
| <i>Amphithalea obtusiloba</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Lotononis acutiflora</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Lotononis polycephala</i> | Specially Protected Plant (NCNCA, 2009) | No |

| | | |
|--|---|----|
| <i>Lessertia</i> spp. | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Sceletium toruosum</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Sutherlandia</i> spp. | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Wiborgia fusca</i> subsp. <i>macrocarpa</i> | Specially Protected Plant (NCNCA, 2009) | No |
| FAMILY GERANIACEAE | | |
| <i>Pelargonium</i> spp. | Specially Protected Plant (NCNCA, 2009) | No |
| FAMILY HYACINTHACEAE | | |
| <i>Drimia nana</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Ornithogalum bicornutum</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Ornithogalum inclusum</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: IRIDACEAE | | |
| <i>Babiana framesii</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Ferraria kamiesbergensis</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Freesia marginata</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Geissorhiza subrigida</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Hesperantha minima</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Hesperantha oligantha</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Hesperantha rivulicola</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Lapeirousia verecunda</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Moraea kamiesensis</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Moraea namaquana</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Romulea albiflora</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Romulea maculata</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Romulea rupestris</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: MOLLUGINACEAE | | |
| <i>Hypertelis trachysperma</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Psammotropha spicata</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: ORCHIDACEAE | | |

| | | |
|---|---|----|
| <i>Corycium ingaenum</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Disa macrostachya</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: OXALIDACEAE | | |
| <i>Oxalis pseudo-hirta</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: PEDALIACEAE | | |
| <i>Harpagophytum</i> spp. | Specially Protected Plant (NCNCA, 2009) | No |
| Family: POACEAE | | |
| <i>Prionanthium dentatum</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Secale strictum</i> subsp. <i>africanum</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: PROTEACEAE | | |
| <i>Leucadendron meyerianum</i> | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Mimetes</i> spp. | Specially Protected Plant (NCNCA, 2009) | No |
| <i>Orothamnus zeyheri</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: ROSACEAE | | |
| <i>Cliffortia arborea</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: SCROPHULARIACEAE | | |
| <i>Charadrophila capensis</i> | Specially Protected Plant (NCNCA, 2009) | No |
| Family: STANGERIACEAE | | |
| <i>Stangeria</i> spp. | Specially Protected Plant (NCNCA, 2009) | No |
| Family: ZAMIACEAE | | |
| <i>Encephalartos</i> spp. | Specially Protected Plant (NCNCA, 2009) | No |

4.2.4 Northern Cape Nature Conservation Act, No. 9 of 2009: Protected Plant Species (Schedule 2)

Table 4.12 Plant species of the Northern Cape Province which are listed as **Protected Species** in Schedule 2 of Northern Cape Nature Conservation Act, No. 9 of 2009. No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

| Families andSpecies | Conservation status | Resident at the site |
|----------------------------------|-------------------------------|----------------------|
| Family: ACANTHACEAE | | |
| <i>Barleria papillosa</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Monechma saxatile</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Peristrophe</i> spp. | Protected Plant (NCNCA, 2009) | No |

| | | |
|---|-------------------------------|----|
| Family: ADIANTHACEAE | | |
| <i>Adiantum</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: AGAPANTHACEAE | | |
| <i>Agapanthus</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: AIZOACEAE (MESEMBRYANTHEMACEAE) | | |
| All species of Aizoaceae | Protected Plant (NCNCA, 2009) | No |
| Family: AMARYLLIDACEAE | | |
| All species of Amaryllidaceae except those listed in Schedule 1 | Protected Plant (NCNCA, 2009) | No |
| Family: ANTHERICACEAE | | |
| All species of Anthericaceae | Protected Plant (NCNCA, 2009) | No |
| Family: APIACEAE | | |
| All species of Apiaceae except those listed in Schedule 1 | Protected Plant (NCNCA, 2009) | No |
| Family: APOCYNACEAE | | |
| All species of Apocynaceae except those listed in Schedule 1 | Protected Plant (NCNCA, 2009) | No |
| Family: AQUIFOLIACEAE | | |
| <i>Ilex mitis</i> | Protected Plant (NCNCA, 2009) | No |
| Family: ARACACEAE | | |
| <i>Zantedeschia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family ARALIACEAE | | |
| <i>Cussonia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: ASPHODELACEAE | | |
| All species of Asphodelaceae except those listed in Schedule 1 and <i>Aloe ferox</i> | Protected Plant (NCNCA, 2009) | No |
| Family: ASTERACEAE | | |
| <i>Helichrysum jubilatatum</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Felicia deserti</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Gnaphalium simii</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Lopholaena longipes</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Senecio albo-punctatus</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Senecio trachylaenus</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Trichogyne lerouxiae</i> | Protected Plant (NCNCA, 2009) | No |

| | | |
|--|-------------------------------|----|
| <i>Tripteris pinnatiflobata</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Troglophyton acocksianum</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Vallereophyton lasianthum</i> | Protected Plant (NCNCA, 2009) | No |
| Family: BURMANNIACEAE | | |
| <i>Burmattia madagascariensis</i> | Protected Plant (NCNCA, 2009) | No |
| Family: BURSERACEAE | | |
| <i>Commiphora</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: CAPPARACEAE | | |
| <i>Boscia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: CARYOPHYLLACEAE | | |
| <i>Dinanthus</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: CELASTRACEAE | | |
| <i>Gymnosporia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: COLCHICACEAE | | |
| <i>Androcymbium</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Gloriosa</i> spp. | Protected Plant (NCNCA, 2009) | No |
| FAMILY COMBRETACEAE | | |
| <i>Combretum</i> spp. | Protected Plant (NCNCA, 2009) | No |
| FAMILY CRASSULACEAE | | |
| All species of Crassulaceae except those listed in Schedule 1 | Protected Plant (NCNCA, 2009) | No |
| Family CUPRESSACEAE | | |
| <i>Widdringtonia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: CYATHACEAE | | |
| <i>Cyathea</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Cyathea capensis</i> | Protected Plant (NCNCA, 2009) | No |
| Family: CYPERACEAE | | |
| <i>Carex acocksii</i> | Protected Plant (NCNCA, 2009) | No |
| Family: DROSERACEAE | | |
| <i>Drosera</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: DRYOPTERIDACEAE | | |
| <i>Rumohro</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: ERICACEAE | | |

| | | |
|---|-------------------------------|----|
| <i>Erica</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: FABACEAE | | |
| <i>Aspalathus</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Erythrina zeyheri</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Argyrolobium petiolare</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Caesalpinia bracteata</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Calliandra redacta</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Crotalaria pearsonii</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Indigofera limosa</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Lebeckia bowieana</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Polhillia involucrata</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Rhyncosia emarginata</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Wiborgia humilis</i> | Protected Plant (NCNCA, 2009) | No |
| Family: HYACINTHACEAE | | |
| <i>Daubinya</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Lachenalia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Veltheimia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Eucomis</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Neopatersonia namaquensis</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Ornithogalum</i> spp. | Protected Plant (NCNCA, 2009) | No |
| FAMILY IRIDACEAE | | |
| All species of Iridaceae except those listed in Schedule 1 | Protected Plant (NCNCA, 2009) | No |
| FAMILY LAURACEAE | | |
| <i>Ocotea</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: MESEMBRYANTHEMACEAE (See Aizoaceae) | | |
| All species of Mesembryanthemaceae (see Aizoaceae) | Protected Plant (NCNCA, 2009) | No |
| Family: MELIACEAE | | |
| <i>Nymanina capensis</i> | Protected Plant (NCNCA, 2009) | No |

| | | |
|---|-------------------------------|----|
| Family: OLEACEAE | | |
| <i>Olea europaea</i> subsp. <i>africana</i> | Protected Plant (NCNCA, 2009) | No |
| Family: ORCHIDACEAE | | |
| All species of Orchidaceae except those listed in Schedule 1 | Protected Plant (NCNCA, 2009) | No |
| Family: OROBANCHACEAE | | |
| <i>Harveya</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: OXALIDACEAE | | |
| All <i>Oxalis</i> species except those listed in Schedule 1 | Protected Plant (NCNCA, 2009) | No |
| Family: PLUMBAGINACEAE | | |
| <i>Afrolimon namaquanum</i> | Protected Plant (NCNCA, 2009) | No |
| Family: POACEAE | | |
| <i>Brachiaria dura</i> var. <i>dura</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Diregeochloa calviniensis</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Pentaschistis lima</i> | Protected Plant (NCNCA, 2009) | No |
| Family: PODOCARPACEAE | | |
| <i>Podocarpus</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: PORTULACACEAE | | |
| <i>Anacampseros</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Avonia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Portulaca foliosa</i> | Protected Plant (NCNCA, 2009) | No |
| Family: PROTEACEAE | | |
| All species of Proteaceae except those listed in Schedule 1 | Protected Plant (NCNCA, 2009) | No |
| Family: RESTIONACEAE | | |
| All species of Restionaceae | Protected Plant (NCNCA, 2009) | No |
| Family: RHAMNACEAE | | |
| <i>Phylica</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: RUTACEAE | | |
| <i>Agathosma</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: SCROPHULARIACEAE | | |
| <i>Diascia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Halleria</i> spp. | Protected Plant (NCNCA, 2009) | No |

| | | |
|--------------------------------------|-------------------------------|----|
| <i>Jamesbrittenia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Manulea</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Nemesia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Pyllopodium</i> spp. | Protected Plant (NCNCA, 2009) | No |
| <i>Polycarena filiformis</i> | Protected Plant (NCNCA, 2009) | No |
| <i>Chaenostoma longipedicellatum</i> | Protected Plant (NCNCA, 2009) | No |
| Family: STRELITZIACEAE | | |
| <i>Strelitzia</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: TECOPHILAEACEAE | | |
| <i>Cyanella</i> spp. | Protected Plant (NCNCA, 2009) | No |
| Family: THYMELAEACEAE | | |
| <i>Gnidia leipoldtii</i> | Protected Plant (NCNCA, 2009) | No |
| Family: ZINGIBERACEAE | | |
| <i>Siphonochilus aethiopicus</i> | Protected Plant (NCNCA, 2009) | No |

4.3 ASSESSMENT OF VERTEBRATE SPECIES OF PARTICULAR HIGH PRIORITY CONSERVATION

4.3.1 Mammals of particular high conservation priority

Table 4.13 Threatened mammal species of the North West Province and Northern Cape Province. Literature sources: Friedman & Daly, (2004), Skinner & Chimimba (2005), Wilson & Reeder (2005). With mammal species which normally needs a large range their residential status does not implicate that they are exclusively dependent on the site or use the site as important shelter or for reproduction. No = Not recorded at site/ Unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

| Species | Threatened Status | Site is part of range | Recorded at site during survey | Likely to be found based on habitat assessment |
|--|-----------------------|-----------------------|--------------------------------|--|
| <i>Bunolagus monticularis</i> Riverine Rabbit | Critically Endangered | No | No | No |
| <i>Chrysospalax villosus</i> Rough-haired golden mole | Vulnerable | No | No | No |
| <i>Chrysochloris visagiei</i> Visagie's Golden Mole | Critically Endangered | No | No | No |

| | | | | |
|--|-----------------------------|-----|----|----|
| <i>Cryptochloris wintoni</i> De Winton's Golden Mole | Vulnerable | No | No | No |
| <i>Chryptochloris zyli</i> Van Zyl's Golden Mole | Critically Endangered | No | No | No |
| <i>Cloeotis percivali</i> Short-eared Trident Bat | Vulnerable/ Near-threatened | No | No | No |
| <i>Cistugo lesueuri</i> Lesueur's Hairy Bat | Vulnerable | No | No | No |
| <i>Diceros bicornis</i> Black rhinoceros | Critically Endangered | No | No | No |
| <i>Eremitalpa granti</i> Grant's Golden Mole | Vulnerable | No | No | No |
| <i>Felis nigripes</i> Black-footed Cat | Vulnerable | No | No | No |
| <i>Lycaon pictus</i> African wild dog | Endangered | No | No | No |
| <i>Loxodonta africana</i> African elephant | Vulnerable | No | No | No |
| <i>Mystromys albicaudatus</i> White-tailed mouse | Endangered | Yes | No | No |
| <i>Neamblysomus julianae</i> Juliana's Golden Mole | Critically Endangered | No | No | No |
| <i>Panthera leo</i> Lion | Vulnerable | No | No | No |
| <i>Rhinolophus blasii</i> Blasi's Horseshoe Bat | Vulnerable | No | No | No |
| <i>Smutsia temminckii</i> Ground Pangolin | Near threatened | No | No | No |

Table 4.14 Near threatened mammal species known to occur in the North West Province and Northern Cape Province. Literature sources: Skinner & Chimimba (2005). No = Not recorded at site/ unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

| Species | Threatened Status | Site is part of range | Recorded at site during survey | Likely to be found based on habitat assessment |
|---|-------------------|-----------------------|--------------------------------|--|
| <i>Ceratotherium simum</i> White Rhinoceros | Near threatened | No | No | No |
| <i>Cistugo seabrai</i> Angolan Hairy Bat | Near Threatened | No | No | No |

| | | | | |
|--|--------------------|----|----|----|
| <i>Rhinolophus capensis</i> Cape Horseshoe Bat | Near Threatened | No | No | No |
|--|--------------------|----|----|----|

Table 4.15 Data deficient (or uncertain) mammal species of the North West Province and Northern Cape Province. Literature sources: Skinner & Chimimba (2005). No = Not recorded at site/ unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

| Species | Threatened Status | Recorded at site during survey | Likely be a resident at the site |
|---|-------------------|--------------------------------|----------------------------------|
| <i>Myosorex varius</i> Forest shrew | Uncertain | No | No |
| <i>Rhinolophus denti</i> Dent's Horseshoe Bat | Data Deficient | No | No |

4.3.2 Birds of particular high conservation priority

Table 4.16 Threatened bird species of the North West Province and Northern Cape Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). No = Not recorded at site/ Unlikely to use site as breeding area or particular habitat on which the species depends. Yes = Recorded at site/ Likely to use site as breeding area or particular habitat on which the species depends.

| Species | Common name | Threatened Status | Recorded at site during survey | Likely to use site as breeding area or habitat |
|--------------------------------|-----------------------------------|-----------------------|--------------------------------|--|
| <i>Aegypius tracheliotos</i> | Lappet-faced Vulture | Vulnerable | No | No |
| <i>Anthropoides paradiseus</i> | Blue Crane | Vulnerable | No | No |
| <i>Aquila rapax</i> | Tawny Eagle | Vulnerable | No | No |
| <i>Ardeotis kori</i> | Kori Bustard | Vulnerable | No | No |
| <i>Balearica regulorum</i> | Grey Crowned Crane (Mahem) | Vulnerable | No | No |
| <i>Botaurus stellaris</i> | Eurasian Bittern | Critically Endangered | No | No |
| <i>Calendulauda burra</i> | Red Lark | Vulnerable | No | No |
| <i>Circus ranivorus</i> | African Marsh- Harrier | Vulnerable | No | No |
| <i>Crex crex</i> | Corn Crake | Vulnerable | No | No |
| <i>Eupodotis senegalensis</i> | White-bellied Korhaan | Vulnerable | No | No |
| <i>Falco naumanni</i> | Lesser Kestrel | Vulnerable | No | No |
| <i>Geronticus calvus</i> | Southern Bald Ibis | Vulnerable | No | No |
| <i>Gorsachius leuconotus</i> | White-backed Night-heron | Vulnerable | No | No |
| <i>Gypaetus barbatus</i> | Bearded Vulture | Endangered | No | No |
| <i>Gyps africanus</i> | White-backed Vulture | Vulnerable | No | No |

| | | | | |
|---------------------------------|-------------------------------|------------------------------|----|----|
| <i>Gyps coprotheres</i> | Cape Vulture | Vulnerable | No | No |
| <i>Neophron percnopterus</i> | Egyptian Vulture | Regionally almost extinct | No | No |
| <i>Neotis ludwigii</i> | Ludwig's Bustard | Vulnerable | No | No |
| <i>Pelecanus rufescens</i> | Pink-backed Pelican | Vulnerable | No | No |
| <i>Polemaetus bellicosus</i> | Martial Eagle | Vulnerable | No | No |
| <i>Rhynchops flavirostris</i> | African Skimmer | Endangered | No | No |
| <i>Sagittarius serpentarius</i> | Secretarybird | Vulnerable | No | No |
| <i>Sarothrura ayresi</i> | White-winged Flufftail | Critically Endangered | No | No |
| <i>Therathopius ecaudatus</i> | Bateleur | Vulnerable (in South Africa) | No | No |
| <i>Tyto capensis</i> | African Grass-Owl | Vulnerable | No | No |

* Though some of the above bird species that roams over large areas may occasionally be found at the site, the site does not appear to be a habitat of particular importance to these birds, and these birds also do not use the site as breeding area.

Table 4.17 Near threatened bird species of the North West Province and Northern Cape Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). No = Not recorded at site/ Unlikely to be particularly dependent on the site as breeding area or habitat. Yes = Recorded at site/ Likely to be particularly dependant on the site as breeding area or habitat.

| Species | Common name | Threatened Status | Recorded at site during survey | Likely to use site breeding area or habitat |
|---------------------------------|--------------------------------|-------------------|--------------------------------|---|
| <i>Buphagus erythrorhynchus</i> | Red-Billed Oxpecker | Near threatened | No | No |
| <i>Certhilauda chuana</i> | Short-clawed Lark | Near threatened | No | No |
| <i>Calendulauda barlowi</i> | Barlow's Lark | Near Threatened | No | No |
| <i>Charadrius pallidus</i> | Chestnut-banded Plover | Near threatened | No | No |
| <i>Ciconia nigra</i> | Black Stork | Near threatened | No | No |
| <i>Circus macrourus</i> | Pallid Harrier | Near threatened | No | No |
| <i>Circus maurus</i> | Black Harrier | Near threatened | No | No |
| <i>Eupodotis caerulea</i> | Blue Korhaan | Near threatened | No | No |
| <i>Falco biarmicus</i> | Lanner Falcon | Near threatened | No | No |
| <i>Falco peregrinus</i> | Peregrine Falcon | Near threatened | No | No |
| <i>Glareola nordmanni</i> | Black-winged Pratincole | Near threatened | No | No |
| <i>Leptoptilos crumeniferus</i> | Marabou Stork | Near threatened | No | No |
| <i>Mirafra cheniana</i> | Melodious lark | Near threatened | No | No |

| | | | | |
|--------------------------------|------------------------------|-----------------|----|----|
| <i>Mycteria ibis</i> | Yellow-billed Stork | Near threatened | No | No |
| <i>Pelecanus onocrotalus</i> | Great White Pelican | Near threatened | No | No |
| <i>Phoenicopterus minor</i> | Lesser Flamingo | Near threatened | No | No |
| <i>Phoenicopterus ruber</i> | Greater Flamingo | Near threatened | No | No |
| <i>Rostratula benghalensis</i> | Greater Painted-snipe | Near threatened | No | No |
| <i>Spizocorys sclateri</i> | Sclater's Lark | Near Threatened | No | No |
| <i>Sterna caspia</i> | Caspian Tern | Near threatened | No | No |

** Though some of the above bird species that roams over large areas may occasionally be found at the site, the site does not appear to be a habitat of particular importance to these birds, and these birds also do not use the site as breeding area.

4.3.3 Reptiles of particular high conservation priority

Table 4.18 Threatened reptile species in North West Province and Northern Cape Province. Main Source: (Bates, Branch, Bauer, Burger, Marais, Alexander & de Villiers, 2014). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

| Species | Threatened Status | Resident at site | Recorded at site during survey | Likely to be found based on habitat assessment |
|--|------------------------------------|------------------|--------------------------------|--|
| <i>Crocodylus niloticus</i> Nile Crocodile | Vulnerable | No | No | No |
| <i>Homopus signatus</i> Speckled Dwarf Tortoise | Vulnerable | No | No | No |
| <i>Pachydactylus goodi</i> Good's Gecko | Vulnerable | No | No | No |
| <i>Pachydactylus rangei</i> Namib Web-footed Gecko | Critically Endangered (Regionally) | No | No | No |

Table 4.19 Near threatened reptile species in North West Province and Northern Cape Province. Main Source: Bates, Branch, Bauer, Burger, Marais, Alexander & de Villiers (2014). Though *Homoroselaps dorsalis* has not yet been recorded from the North West Province, its presence in some areas or the Province is anticipated. No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

| Species | Threatened Status | Resident at site | Recorded at site during survey | Likely to be found based on habitat assessment |
|---|-------------------|------------------|--------------------------------|--|
| <i>Cordylus imkeae</i> Rooiberg Girdled Lizard | Near Threatened | No | No | No |
| <i>Cordylus macropholis</i> Large-scaled Girdled Lizard | Near Threatened | No | No | No |
| <i>Goggia gemmula</i> Richtersveld Pygmy Gecko | Near Threatened | No | No | No |
| <i>Homopus boulengeri</i> Karoo Dwarf Tortoise | Near Threatened | No | No | No |
| <i>Homoroselaps dorsalis</i> Striped Harlequin Snake | Near threatened | No | No | No |

| | | | | |
|---|--------------------|----|----|----|
| <i>Typhlosaurus lomiae</i> Lomi's Blind Legless Skink | Near Threatened | No | No | No |
|---|--------------------|----|----|----|

4.3.4 Amphibian species of particular high conservation priority

Table 4.20 Threatened amphibian species in Northern Cape Province. Sources: Du Preez & Carruthers (2009), Carruthers & Du Preez (2011). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

| Species | Red Listed Status | Resident at site | Recorded at site during survey | Likely to be found based on habitat assessment |
|---|-------------------|------------------|--------------------------------|--|
| <i>Breviceps macrops</i> Desert Rain Frog | Vulnerable | No | No | No |

Table 4.21 Near threatened (currently least concern) amphibian species in North West Province and Northern Cape Province. No = Amphibian species is not a resident on the site; Yes = Amphibian species is found to be resident on the site.

| Species | Threatened Status | Resident at site | Recorded at site during survey | Likely to be found based on habitat assessment |
|--|--|------------------|--------------------------------|--|
| <i>Pyxicephalus adspersus</i> Giant Bullfrog | Near threatened (Currently Least Concern) | No | No | No |

4.4 ASSESSMENT OF INVERTEBRATE SPECIES OF PARTICULAR HIGH CONSERVATION PRIORITY

4.4.1 Butterflies of particular conservation priority

Table 4.22 Threatened butterfly species in North West Province, northern Northern Cape Province and Gauteng Province. Sources: Henning, Terblanche & Ball (2009), Mecenero *et al.* (2013). Invertebrates such as threatened butterfly species are often very habitat specific and residential status imply a unique ecosystem that is at stake.

| Species | Threatened Status | Recorded at site during survey | Residential status at the site: Yes confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely |
|---|-------------------|--------------------------------|---|
| <i>Aloeides dentatis dentatis</i> Roodepoort Russet | Endangered | No | Highly unlikely |
| <i>Anthene lindae</i> Kalahari Hairtail | Vulnerable | No | Unlikely |
| <i>Chrysochrysis aureus</i> Golden Opal | Endangered | No | Highly unlikely |
| <i>Chrysochrysis trimeni</i> Diamond Opal | Vulnerable | No | Highly unlikely |

| | | | |
|---|-------------------|----|-----------------|
| <i>Lepidochrysops praeterita</i> Highveld Blue | Endangered | No | Highly unlikely |
| <i>Orachrysops mijburghi</i> Mijburgh's Blue | Endangered | No | Highly unlikely |

Table 4.23 Butterfly species of the Gauteng Province, North West Province and Northern Cape Province that are not threatened and not near threatened but of which are of particular conservation concern and listed as **Critically Rare/ Rare/ Data Deficient** category (Mecenero *et al.*, 2013). No = Butterfly species is unlikely to be a resident at the study area; Yes = Butterfly species is a resident at the study area.

| Species | Threatened Status | Recorded at site during survey | Residential status at the site: Yes confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely |
|--|---------------------------|---------------------------------------|--|
| <i>Chrysoritis beaufortia charlesi</i> Roggeveld Opal | Rare (Restricted Range) | No | Highly unlikely |
| <i>Chrysoritis beaufortia stepheni</i> Hantam Mountain Opal | Rare (Habitat Specialist) | No | Highly unlikely |
| <i>Chrysoritis turneri wykehami</i> Hantam Opal | Rare (Habitat Specialist) | No | Highly unlikely |
| <i>Chrysoritis violescens</i> Violescent Opal | Rare (Habitat Specialist) | No | Highly unlikely |
| <i>Colotis celimene amina</i> Lilac Tip | Rare (Low density) | No | Highly unlikely |
| <i>Lepidochrysops jamesi claassensi</i> Hantamsberg Nimble Blue | Rare (Habitat Specialist) | No | Highly unlikely |
| <i>Lepidochrysops jamesi jamesi</i> Karooobush Nimble Blue | Rare (Habitat Specialist) | No | Highly unlikely |
| <i>Lepidochrysops mcgregori</i> Copper-brown Nimble Blue | Rare (Habitat Specialist) | No | Highly unlikely |
| <i>Lepidochrysops penningtoni</i> Arid Nimble Blue | Data Deficient | No | Highly unlikely |
| <i>Lepidochrysops procera</i> Savanna Blue | Rare (Habitat specialist) | No | Highly unlikely |
| <i>Metisella meninx</i> Marsh Sylph | Rare (Habitat specialist) | No | Highly unlikely |
| <i>Platylesches dolomitica</i> Hilltop Hopper | Rare (low density) | No | Highly unlikely |
| <i>Pseudonympha southeyi kamiesbergensis</i> Kamiesberg Pepperbrown | Rare (Habitat Specialist) | No | Highly unlikely |
| <i>Thestor calviniae</i> Calvinia Skolly | Rare (Restricted Range) | No | Highly unlikely |
| <i>Tuxentius melaena griqua</i> Griqua Black Pie | Data Deficient | No | Highly unlikely |

4.4.2 Beetles of particular conservation priority

Table 4.24 Fruit chafer species (Coleoptera: Scarabaeidae: Cetoninae) in the Gauteng Province and North-West Province which are of known high conservation priority.

| Species | Threatened Status | Recorded at site during survey | Likely to be resident based on habitat assessment |
|------------------------------|-------------------|--------------------------------|---|
| <i>Ichneostoma stobbiai</i> | Uncertain | No | No |
| <i>Trichocephala brincki</i> | Uncertain | No | No |

4.4.3 Scorpion species of particular conservation priority

Table 4.25 Rock scorpion species (Scorpiones: Ischnuridae) species that are of known high conservation priority in the Gauteng Province and North-West Province.

| Species | Threatened Status | Recorded at site during survey | Likely to be resident at site based on habitat assessment |
|---------------------------|-------------------|--------------------------------|---|
| <i>Hadogenes gracilis</i> | Uncertain | No | No |
| <i>Hadogenes gunningi</i> | Uncertain | No | No |

5 DISCUSSION

5.1 HABITAT AND VEGETATION CHARACTERISTICS

An outline of the habitat and vegetation characteristics is given in Table 4.1.

5.2 PLANT SPECIES

Extinct, threatened, near threatened and other plant species of high conservation priority in Northern Cape Province are listed in Tables 4.2 – 4.9. Protected tree species are listed in Table 4.10. Plant species listed in Schedule 1 and Schedule 2 of the Northern Cape Nature Conservation Act No. 9 of 2009 are included in Table 4.11 and 4.12. The presence or not of all the species listed in the tables was investigated during the survey. None of the Threatened and Near-threatened plant species are likely to occur on the site. No other plant species of particular conservation concern are likely to occur at the site.

5.3 VERTEBRATES

5.3.1 Mammals

Table 4.13, Table 4.14 and Table 4.15 list the possible presence or absence of threatened mammal species, near threatened mammal species and mammal species of which the status is uncertain, respectively, at the site. Literature sources that were used are Friedman & Daly (2004), Skinner & Chimimba (2005) and Wilson & Reeder

(2005). Since the site falls outside reserves, threatened species such as the black rhinoceros (*Diceros bicornis*) and the African wild dog (*Lycaon pictus*) are obviously not present. No smaller mammals of particular high conservation significance are likely to be found on the site as well.

5.3.2 Birds

Table 4.16 and Table 4.17 list the possible presence or absence of threatened bird species and near threatened bird species at the site. With bird species which often have a large distributional range, their presence does not imply that they are particularly dependent on a site as breeding location. Therefore the emphasis in the right hand columns of Table 4.16 and Table 4.17 are on the particular likely dependence or not of bird species on the site. Literature sources that were mainly consulted are Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). No threat to any threatened bird species or any bird species of particular conservation importance are foreseen.

5.3.3 Reptiles

Table 4.18 and Table 4.19 list the possible presence or absence of threatened and near threatened reptile species on the site. The Atlas and Red List of Reptiles of South Africa, Lesotho and South Africa (Bates, Branch, Bauer, Burger, Marais, Alexander & de Villiers, 2014) has been used as the main source to compile the list for assessment. There appears to be no threat to any reptile species of particular high conservation importance if the site is developed.

5.3.4 Amphibians

Table 4.20 lists frog species that are threatened (vulnerable, endangered or critically endangered) in the Northern Cape according to Minter, Burger, Harrison, Braack, Bishop and Kloepfer (2004) as well as Du Preez & Carruthers (2009). Table 4.21 lists *Pyxicephalus adspersus* (Giant Bullfrog) as near threatened (Minter *et al.*, 2004; Du Preez & Carruthers, 2009). Though currently this species is listed as Least Concern (IUCN) it remains as species which is considered as of special conservation priority. There is no suitable habitat for *Pyxicephalus adspersus* (Giant Bullfrog) at the site. There appears to be no threat to any amphibian species of particular high conservation importance if the site is developed.

5.4 INVERTEBRATES

5.4.1 Butterflies

Studies about the vegetation and habitat of threatened butterfly species in South Africa showed that ecosystems with a unique combination of features are selected by these often localised threatened butterfly species (Deutschländer and Bredenkamp 1999; Edge 2002, 2005; Terblanche, Morgenthal & Cilliers 2003; Lubke, Hoare, Victor & Ketelaar 2003; Edge, Cilliers & Terblanche, 2008). Threatened butterfly species in South Africa can then be regarded as bio-indicators of rare ecosystems.

Four species of butterfly in Gauteng Province, northeastern Northern Cape Province and North West Province combined are listed as threatened in the recent butterfly conservation assessment of South Africa (Mecenero *et al.*, 2013). The expected presence or not of these threatened butterfly species as well as species of high conservation priority that are not threatened, at the site (Table 4.22 and Table 4.23) follows.

5.4.1.1 Assessment of threatened butterfly species

***Aloeides dentatis dentatis* (Roodepoort Russet)**

The proposed global red list status for *Aloeides dentatis dentatis* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.*, 2013). *Aloeides dentatis dentatis* colonies are found where one of its host plants *Hermannia depressa* or *Lotononis eriantha* is present. Larval ant association is with *Lepisiota capensis* (S.F. Henning 1983; S.F. Henning & G.A. Henning 1989). The habitat requirements of *Aloeides dentatis dentatis* are complex and not fully understood yet. See Deutschländer and Bredenkamp (1999) for the description of the vegetation and habitat characteristics of one locality of *Aloeides dentatis* subsp. *dentatis* at Ruimsig, Roodepoort, Gauteng Province. There is not an ideal habitat of *Aloeides dentatis* subsp. *dentatis* on the site and it is unlikely that the butterfly is present at the site.

***Anthene lindae* (Kalahari Hairtail)**

Small but distinct butterfly species discovered by R.F. Terblanche in 1990 at the present Witsand Nature Reserve in the Northern Cape. Recent red listing and extinction risk assessments list *Anthene lindae* as Vulnerable (Henning, Terblanche & Ball, 2009; Mecenero *et al.*, 2013). The butterfly is intimately associated with *Acacia erioloba* which may prove to be the larval food plant (Terblanche, 1994; Jessnitz pers. comm). However, all the localities for this butterfly species have been found on what appears to be a unique catchment area and basins with particular high water tables on the western side of the Langberg mountain chain, Northern Cape Province (Terblanche & Taylor, 2000). According to Henning *et al.* (2009) *Anthene lindae* has up to date only been found at an ecotone between Gordonias Plains Shrubland and Olifantshoek Plains Thornveld (Mucina & Rutherford, 2006). *Anthene lindae* is not found everywhere where *Vachellia erioloba* is present (Terblanche In prep.) and based on the present knowledge and surveys, presence of the butterfly at the site is unlikely.

***Chrysochrysis aureus* (Golden Opal/ Heidelberg Copper)**

The proposed global red list status for *Chrysochrysis aureus* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.*, 2013) *Chrysochrysis aureus* (Golden Opal/ Heidelberg Copper) is a resident where the larval host plant, *Clusia pulchella* is present. However, the distribution of the butterfly is much more restricted than that of the larval host plant (S.F. Henning 1983; Terblanche, Morgenthal & Cilliers 2003). One of the reasons for the localised distribution of *Chrysochrysis aureus* is that a specific host ant *Crematogaster liengmei* must also be present at the habitat. Fire appears to be an essential factor for the maintenance of suitable habitat (Terblanche, Morgenthal & Cilliers 2003). Research revealed that *Chrysochrysis aureus* (Golden Opal/ Heidelberg Copper) has very specific habitat requirements, which include rocky ridges with a steep slope and a southern aspect (Terblanche, Morgenthal & Cilliers 2003). Owing to a lack of habitat requirements and ideal habitat the presence of the taxon is highly unlikely.

***Lepidochrysops praeterita* (Highveld Blue)**

The proposed global red list status for *Lepidochrysops praeterita* according to the most recent IUCN criteria and categories is Endangered (G.A. Henning, Terblanche & Ball, 2009; Mecenero *et al.*, 2013). *Lepidochrysops praeterita* is a butterfly that occurs where the larval host plant *Ocimum obovatum* (= *Becium obovatum*) is present (Pringle, G.A. Henning & Ball, 1994), but the distribution of the butterfly is much more restricted than the distribution of the host plant. *Lepidochrysops praeterita* is found on selected rocky ridges and rocky hillsides in parts of Gauteng, the extreme northern Free State and the south-eastern Gauteng Province. No ideal habitat appears to be present for the butterfly on the site. It is unlikely that *Lepidochrysops praeterita* would be present on the site and at the footprint proposed for the development.

***Orachrysops mijburghi* (Mijburgh's Blue)**

The proposed global red status for *Orachrysops mijburghi* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.*, 2013). *Orachrysops mijburghi* favours grassland depressions where specific *Indigofera* plant species occur (Terblanche & Edge 2007). The Heilbron population of *Orachrysops mijburghi* in the Free State uses *Indigofera evansiana* as a larval host plant (Edge, 2005) while the Suikerbosrand population in Gauteng uses *Indigofera dimidiata* as a larval host plant (Terblanche & Edge 2007). There is no suitable habitat for *Orachrysops mijburghi* on the site and it is unlikely that *Orachrysops mijburghi* would be present on the site.

Conclusion on threatened butterfly species

There appears to be no threat to any threatened butterfly species if the site is developed.

5.4.1.2 Assessment of butterfly species that are not threatened but also of high conservation priority

***Colotis celimene amina* (Lilac tip)**

Colotis celimene amina is listed as Rare (Low density) by Mecenero *et al.* (2013). In South Africa *Colotis celimene amina* is present from Pietermaritzburg in the south and northwards into parts of Kwa-Zulu Natal, Gauteng, Limpopo, Mpumalanga and the North West Provinces (Mecenero *et al.* 2013). Reasons for its rarity are poorly understood. It is highly unlikely that *Colotis celimene amina* would be present at the site.

***Lepidochrysops procera* (Savanna Blue)**

Lepidochrysops procera is listed as Rare (Habitat specialist) by Mecenero *et al.* (2013). *Lepidochrysops procera* is endemic to South Africa and found in Gauteng, KwaZulu-Natal, Mpumalanga and North West (Mecenero *et al.*, 2013). Owing to a lack of habitat requirements and ideal habitat the presence of the taxon at the site is highly unlikely.

***Metisella meninx* (Marsh Sylph)**

Henning and Henning (1989) in the first South African Red Data Book of Butterflies, listed *Metisella meninx* as threatened under the former IUCN category Indeterminate. Even earlier in the 20th century Swanepoel (1953) raised concern about vanishing wetlands leading to habitat loss and loss of populations of *Metisella meninx*. According to the second South African Red Data Book of butterflies (Henning, Terblanche & Ball, 2009) the

proposed global red list status of *Metisella meninx* has been Vulnerable. During a recent large scale atlassing project the *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas* (Mecenero *et al.*, 2013) it was found that more *Metisella meninx* populations are present than thought before. Based on this valid new information, the conservation status of *Metisella meninx* is now regarded as Rare (Habitat specialist) (Mecenero *et al.*, 2013). Though *Metisella meninx* is more widespread and less threatened than perceived before, it should be regarded as a localised rare habitat specialist of conservation priority, which is dependent on wetlands with suitable patches of grass at wetlands (Terblanche In prep.). Another important factor to keep in mind for the conservation of *Metisella meninx* is that based on very recent discoveries of new taxa in the group the present *Metisella meninx* is species complex consisting of at least three taxa (Terblanche In prep., Terblanche & Henning In prep.). The ideal habitat of *Metisella meninx* is treeless marshy areas where *Leersia hexandra* (rice grass) is abundant (Terblanche In prep.). The larval host plant of *Metisella meninx* is wild rice grass, *Leersia hexandra* (G.A. Henning & Roos, 2001). Owing to a lack of habitat requirements and ideal habitat the presence of the taxon at the site is highly unlikely.

Platylesches dolomitica (Hilltop Hopper)

Platylesches dolomitica is listed as Rare (Low density) by Mecenero *et al.* (2013). Historically the conservation status of *Platylesches dolomitica* was proposed to be Vulnerable (Henning, Terblanche & Ball 2009). However this butterfly which is easily overlooked and has a wider distribution than perceived before. *Platylesches dolomitica* has a patchy distribution and is found on rocky ledges where *Parinari capensis* occurs, between 1300 m and 1800m (Mecenero *et al.* 2013, Dobson Pers comm.). Owing to a lack of habitat requirements and ideal habitat the presence of the taxon at the site is highly unlikely.

5.5 Ecological Sensitivity at the site

Ecological sensitivity at most of the is currently low. Ecological sensitivity at vegetation that remains at the site is medium (Figure 2). In the recent past before informal settlements were constructed the ecological sensitivity of the entire site, based on habitat at and in the vicinity of the site, was probably medium.

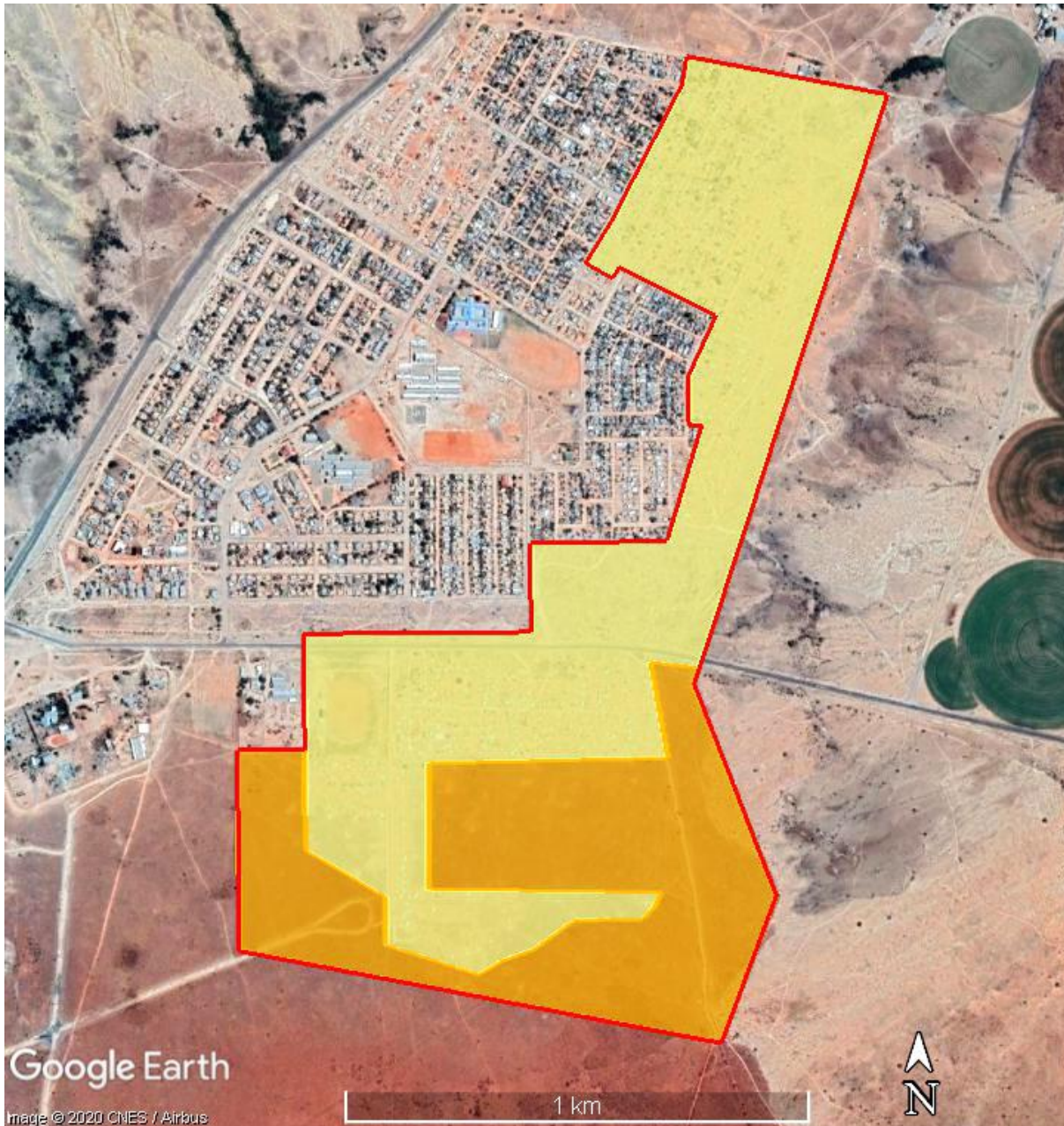





Figure 2 Indications of ecological sensitivity at the site.

- | | | |
|---|----------------------------------|------------------------|
|  | Red outline | Boundaries of the site |
|  | Orange-brown outline and shading | Medium Sensitivity |
|  | Light yellow outline and shading | Low Sensitivity |

Grid references and altitudes were taken at site with a GPS Garmin E-trex 20 © instrument. Map information were analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2020).

6 RISKS, IMPACTS AND MITIGATION

Background:

Habitats of threatened plants are in danger most often due to urban developments such as is the case for the Gauteng Province (Pfab & Victor, 2002). Habitat conservation is the key to the conservation of invertebrates such as threatened butterflies (Deutschländer and Bredenkamp 1999; Edge 2002, 2005; Terblanche, Morgenthal & Cilliers 2003; Lubke, Hoare, Victor & Ketelaar 2003; Edge, Cilliers & Terblanche, 2008). Furthermore, corridors and linkages may play a significant role in insect conservation (Pryke & Samways, 2003, Samways, 2005).

Urbanisation is a major additional influence on the loss of natural areas (Rutherford & Westfall 1994). In the South Africa the pressure to develop areas are high since its infrastructure allows for improvement of human well-being. Urban nature conservation issues in South Africa are overshadowed by the goal to improve human well-being, which focuses on aspects such as poverty, equity, redistribution of wealth and wealth creation (Cilliers, Müller & Drewes 2004). Nevertheless, the conservation of habitats is the key to invertebrate conservation, especially for those threatened species that are very habitat specific. This is also true for any detailed planning of corridors and buffer zones for invertebrates. Though proper management plans for habitats are not in place, setting aside special ecosystems is in line with the recent Biodiversity Act (2004) of the Republic of South Africa.

Corridors are important to link ecosystems of high conservation priority. Such corridors or linkages are there to improve the chances of survival of otherwise isolated populations (Samways, 2005). How wide should corridors be? The answer to this question depends on the conservation goal and the focal species (Samways, 2005). For an African butterfly assemblage this is about 250m when the corridor is for movement as well as being a habitat source (Pryke and Samways 2003). Hill (1995) found a figure of 200m for dung beetles in tropical Australian forest. In the agricultural context, and at least for some common insects, even small corridors can play a valuable role (Samways, 2005). Much more research remains to be done to find refined answers to the width of grassland corridors in South Africa. The width of corridors will also depend on the type of development, for instance the effects of the shade of multiple story buildings will be quite different from that of small houses.

To summarise: In practice, as far as developments are concerned, the key would be to prioritise and plan according to sensitive species and special ecosystems.

In the case of this study:

Large parts of vegetation at the site have been transformed or modified. Remaining vegetation is mainly karroid with few individual trees. Exotic trees occur at informal residential areas. The aggressive alien invasive tree *Prosopis glandulosa* is found at various places at the site. Indigenous trees include shrub-height *Diospyros lycioides* subsp. *lycioides*, *Vachellia tortilis*, *Ziziphus mucronata* and *Senegalia mellifera* subsp. *detinens*.

The tall shrub *Rhigozum trichotomum* is found in dense clumps at some places at the site. Other tall shrubs include *Lycium cinereum* and *Lycium horridum*. The succulent shrub *Hertia pallens* is widespread at remaining vegetation at the site. Low shrubs are visibly frequent at remaining vegetation at the site and include *Aptosimum marlothii*, *Pentzia globosa*, *Chrysocoma ciliata*, *Gnidia polycephala*, *Melolobium candicans*, *Plinthus karoocicus*, *Pteronia glauca*, *Selago geniculata* and *Zygophyllum* species. Herbaceous plant species include *Gazania krebsiana*, *Chamaesyce inaequilatera*, *Hermannia comosa*, *Indigofera alternans*, *Sesamum capense* and *Tribulus terrestris*. Indigenous grass species at the site include *Eragrostis lehmanniana*, *Eragrostis echinochloidea*, *Aristida congesta*, *Tragus berteronianus* and *Enneapogon desvauxii*.

Some of the alien invasive weed species at hitherto bare ground or ecologically disturbed areas at the site are *Salsola kali*, *Argemone ochroleuca*, *Schkuhria pinnata*, *Xanthium spinosum*, *Chenopodium album*, *Alternanthera pungens* and *Datura ferox*.

Informal settlements are present at large parts of the site. Roads, fences and infrastructure associated with informal settlements are present at the site. Informal dumping is widespread. Many parts of the site are surrounded by residential areas, roads, scraped areas and fences. Various alien invasive weeds are widespread at the site.

Rocky ridges and wetland appear to be absent at the site.

No Threatened or Near Threatened plant or animal species appear to be resident at the site. No other plant or animal species of particular conservation concern appear to be present at the site.

The scope for the site to be part of a corridor of particular conservation importance is small.

The following potential risks, impacts and mitigation measures apply to the proposed development:

6.1 Identification of potential impacts and risks

The potential impacts identified are:

Construction Phase

- Potential impact 1: Loss of habitat owing to the removal of vegetation at the proposed development.
- Potential impact 2: Loss of sensitive species (Threatened, Near-Threatened, Rare, Declining or Protected species) during the construction phase.
- Potential impact 3: Loss of connectivity and conservation corridor networks in the landscape.
- Potential impact 4: Contamination of soil during construction in particular by hydrocarbon spills.
- Potential impact 5: Killing of vertebrate fauna during the construction phase.

Operational Phase

- Potential impact 6: An increased infestation of exotic or alien invasive plant species owing to disturbance.

6.2 Potential impacts and risks during the construction phase

Classes of impacts for this study: Very High, High, Moderate, Low, Very Low

| | |
|---------------------------------------|--|
| Aspect/Activity | Clearance of vegetation at part of the site for the development |
| Type of Impact (i.e. Impact Status) | Direct |
| Potential Impact | Clearing of vegetation at the proposed development. This will entail the destruction of habitat of medium/ low ecological sensitivity. |
| Status | Negative |
| Mitigation Required | If the development is approved cultivation of indigenous vegetation at the site is imperative. |
| Impact Significance (Pre-Mitigation) | High |
| Impact Significance (Post-Mitigation) | Moderate |
| RISK | Following the mitigation measures a moderate risk of impact is expected. |

| | |
|---------------------------------------|---|
| Aspect/Activity | Removal of sensitive species |
| Type of Impact (i.e. Impact Status) | Direct |
| Potential Impact | Sensitive species: Presence of Threatened or Near Threatened Plants, Mammals, Reptiles, Amphibians and Invertebrates at the site appear to be unlikely. No other plant or animal species of particular conservation concern are anticipated to be resident at the site. |
| Status | Neutral. |
| Mitigation Required | No specific mitigation measures for sensitive species apply at the site. |
| Impact Significance (Pre-Mitigation) | Low |
| Impact Significance (Post-Mitigation) | Low |
| RISK | A low risk of threat to any sensitive species at the site is anticipated. |

| | |
|---------------------------------------|--|
| Aspect/Activity | Fragmentation of corridors of particular conservation concern |
| Type of Impact (i.e. Impact Status) | Direct |
| Potential Impact | Vegetation containing some indigenous vegetation will be destroyed. This vegetation is currently conspicuously transformed or modified or degraded and isolated. |
| Status | Negative |
| Mitigation Required | If the development is approved cultivation of indigenous plant species at the site is imperative. |
| Impact Significance (Pre-Mitigation) | Moderate |
| Impact Significance (Post-Mitigation) | Low |
| RISK | Following mitigation, a low impact risk is expected. |

| | |
|---------------------------------------|---|
| Aspect/Activity | Contamination of soil by leaving rubble/ waste or spilling petroleum fuels or any pollutants on soil which could infiltrate the soil |
| Type of Impact (i.e. Impact Status) | Direct |
| Potential Impact | Rubble or waste could lead to infiltration of unwanted pollutants into the soil. Spilling of petroleum fuels and unwanted chemicals onto the soils that infiltrate these soils could lead to pollution of soils. |
| Status | Negative |
| Mitigation Required | Rubble or waste that could accompany the construction effort, if the development is approved, should be removed during and after construction. Measures should be taken to avoid any spills and infiltration of petroleum fuels or any chemical pollutants into the soil during construction phase. |
| Impact Significance (Pre-Mitigation) | Moderate |
| Impact Significance (Post-Mitigation) | Low |

| | |
|--|--|
| RISKS | A low risk is expected following mitigation. |
| Aspect/Activity | Possible disturbance, trapping, hunting and killing of vertebrates during construction phase |
| Type of Impact (i.e. Impact Status) | Direct |
| Potential Impact | During the construction phase animal species could be disturbed, trapped, hunted or killed. |
| Status | Negative |
| Mitigation Required | If the development is approved, contractors must ensure that no animal species are disturbed, trapped, hunted or killed during the construction phase. |
| Impact Significance (Pre-Mitigation) | Moderate |
| Impact Significance (Post-Mitigation) | Low |
| RISKS | Following mitigation a low risk is anticipated. |

6.3 Potential impacts during the operational phase

| | |
|--|---|
| Aspect/Activity | An increased infestation of exotic or alien invasive plant species owing to clearance or disturbance where the footprint took place. |
| Type of Impact (i.e. Impact Status) | Direct |
| Potential Impact | Infestation by alien invasive species could replace indigenous vegetation or potential areas where indigenous vegetation could recover. It is in particular declared alien invasive species such as <i>Prosopis glandulosa</i> (Mesquite) that should not be allowed to establish. Once established combatting these alien invasive plant species may become very expensive in the long term. |
| Status | Negative |
| Mitigation Required | Continued monitoring and eradication of alien invasive plant species are imperative. It is in particular declared alien invasive species such as <i>Prosopis glandulosa</i> (Mesquite) that should not be allowed to establish. |
| Impact Significance (Pre-Mitigation) | Moderate |
| Impact Significance (Post-Mitigation) | Low |
| RISKS | Following mitigation, a low risk is anticipated. |

6.4 Risk and impact assessment summary for the construction phase

| Aspect/ Impact Pathway | Nature of Potential Impact/ Risk | Status | Spatial Extent | Duration | Consequence | Probability | Reversibility of Impact | Irreplaceability | Potential Mitigation Measures | Significance of Impact and Risk | | Confidence Level |
|--|---|----------|----------------|-----------|-----------------------------------|-------------|-------------------------|------------------|---|---------------------------------|---|------------------|
| | | | | | | | | | | Without Mitigation/ Management | With Mitigation/ Management (Residual Impact/ Risk) | |
| Clearing of vegetation | Habitat loss, loss of indigenous species | Negative | Part of site | Long-Term | Substantial | Very likely | Low | Low | The removal of vegetation takes place at an area of medium/ low ecological sensitivity. If the development is approved, cultivation of indigenous plant species at the site is essential. | High | Moderate | High |
| Loss of sensitive species | Loss of sensitive species (Note no Threatened species or Near-threatened species) | Neutral | Site | Long-Term | Very low (No species anticipated) | Unlikely | Not applicable | Not applicable | No specific mitigation measures apply to sensitive species at the site. | Moderate | Low | High |
| Loss of corridors of particular conservation concern | Fragmentation of landscape and loss of connectivity | Negative | Site | Long-Term | Moderate | Unlikely | Moderate | Moderate | The scope for the degraded and isolated site to be a corridor of particular conservation importance is small. Cultivation of indigenous plant species at the site is essential and will enhance urban conservation corridors. | Moderate | Low | High |
| Contamination of soil by spilling pollutants on soil which could infiltrate the soil | Soil contamination | Negative | Site | Long-Term | Moderate | Unlikely | Moderate | Moderate | Rubble and waste removal. Measures that avoid hydrocarbon (petroleum) spills to get into contact with the soil. | Moderate | Low | High |

| | | | | | | | | | | | | |
|---------------------------------------|-----------------------------------|----------|------|-----------|----------|----------|----------|----------|--|----------|-----|------|
| Disturbance or killing of vertebrates | Disturbance or killing of species | Negative | Site | Long-Term | Moderate | Unlikely | Moderate | Moderate | If the development is approved, contractors must ensure that no animal species are disturbed, trapped, hunted or killed during the construction phase. | Moderate | Low | High |
|---------------------------------------|-----------------------------------|----------|------|-----------|----------|----------|----------|----------|--|----------|-----|------|

6.5 Risk/ Impact assessment summary for the operational phase

| Aspect/ Impact Pathway | Nature of Potential Impact/ Risk | Status | Spatial Extent | Duration | Consequence | Probability | Reversibility of Impact | Irreplaceability | Potential Mitigation Measures | Significance of Impact and Risk | | Confidence Level |
|---|----------------------------------|----------|----------------|-----------|-------------|-------------|-------------------------|------------------|--|---------------------------------|---|------------------|
| | | | | | | | | | | Without Mitigation/ Management | With Mitigation/ Management (Residual Impact/ Risk) | |
| Increased infestation of exotic or alien invasive plant species | Loss of habitat quality | Negative | Site | Long-Term | Substantial | Likely | Moderate | Moderate | Monitoring and eradication of alien invasive plant species. Cultivation of indigenous plant species at the site. | Moderate | Low | High |

6.5 Summary of risks and impacts

Large parts of vegetation at the site have been transformed or modified. Remaining vegetation is mainly karroid with few individual trees. Informal settlements are present at large parts of the site. Roads, fences and infrastructure associated with informal settlements are present at the site. Informal dumping is widespread. Many parts of the site are surrounded by residential areas, roads, scraped areas and fences. Various alien invasive weeds are widespread at the site.

Rocky ridges and wetland appear to be absent at the site.

No Threatened or Near Threatened plant or animal species appear to be resident at the site. No other plant or animal species of particular conservation concern appear to be present at the site.

The scope for the site to be part of a corridor of particular conservation importance is small.

Following the mitigations which will be upheld and planned footprint for development all the impact risks listed above are moderate or low.

7 CONCLUSION

- Large parts of vegetation at the site have been transformed or modified. Remaining vegetation is mainly karroid with few individual trees. Exotic trees occur at informal residential areas. The aggressive alien invasive tree *Prosopis glandulosa* is found at various places at the site. Indigenous trees include shrub-height *Diospyros lycioides* subsp. *lycioides*, *Vachellia tortilis*, *Ziziphus mucronata* and *Senegalia mellifera* subsp. *detinens*.
- The tall shrub *Rhigozum trichotomum* is found in dense clumps at some places at the site. Other tall shrubs include *Lycium cinereum* and *Lycium horridum*. The succulent shrub *Hertia pallens* is widespread at remaining vegetation at the site. occurs Low shrubs are visibly frequent at remaining vegetation at the site and include *Aptosimum marlothii*, *Pentzia globosa*, *Chrysocoma ciliata*, *Gnidia polycephala*, *Melolobium candicans*, *Plinthus karoicus*, *Pteronia glauca*, *Selago geniculata* and *Zygophyllum* species. Herbaceous plant species include *Gazania krebsiana*, *Chamaesyce inaequilatera*, *Hermannia comosa*, *Indigofera alternans*, *Sesamum capense* and *Tribulus terrestris*. Indigenous grass species at the site include *Eragrostis lehmanniana*, *Eragrostis echinochloidea*, *Aristida congesta*, *Tragus berteronianus* and *Enneapogon desvauxii*.
- Some of the alien invasive weed species at hirtherto bare ground or ecologically disturbed areas at the site are *Salsola kali*, *Argemone ochroleuca*, *Schkuhria pinnata*, *Xanthium spinosum*, *Chenopodium album*, *Alternanthera pungens* and *Datura ferox*.
- Informal settlements are present at large parts of the site. Roads, fences and infrastructure associated with informal settlements are found at the site. Informal dumping is widespread and at some places, extensive. Many parts of the site are surrounded by residential areas, roads, scraped areas and fences. Various alien invasive weeds are widespread at the site.
- Rocky ridges and wetlands appear to be absent at the site.
- No Threatened or Near Threatened plant or animal species appear to be resident at the site. No other plant or animal species of particular conservation concern appear to be present at the site.
- None of the protected plant species according to Northern Cape Nature Conservation Act No. 9 of 2009 (Updated in Provincial Gazette No. 1566, Desember 2011 with date of commencement 1 January 2012) have been found at the site.
- The scope for the site to be part of a corridor of particular conservation importance is small.
- The vegetation types at the site are Upper Karoo (NKu 3) and Kimberley Thornveld (SVk 4) which are not listed as threatened according to the National List of Threatened Ecosystems (2011).
- Ecological sensitivity at most of the is currently low. Ecological sensitivity at vegetation that remains at the site is medium (Figure 2).

- In the recent past before informal settlements were constructed the ecological sensitivity of the entire site, based on habitat at and in the vicinity of the site, was probably medium.
- In the recent past before informal settlements were constructed at the site, based on the habitat at and in the vicinity of the site, it appears unlikely that any plant or animal species of particular conservation concern were resident at the site.
- Following the mitigations which will be upheld and planned footprint for development all the impact risks listed above are moderate or low.
- Establishment of exotic weeds should be monitored and exotic weeds at the site should be eradicated. A declared invader such as the mesquite tree (*Prosopis* species), should not be planted or allowed to spread from adjacent areas to the proposed footprint.

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ANNEXURE 1: Plants

List of plant species recorded at the site.

Note this plant list is preliminary and will hopefully be extended with more research in the area.

Plant species are listed alphabetically under life forms that are generally recognizable.

Plant species marked with an asterisk (*) are exotic.

Sources: Germishuizen (2003), Manning (2003), Manning (2009), Van Oudtshoorn (1999), Van Wyk (2000), Van Wyk & Malan (1998), Van Wyk & Van Wyk (1997), Crouch, Klopper, Burrows & Burrows (2011), Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), McMurtry, Grobler, Grobler & Burns (2008), Smit (2008), Van Jaarsveld (2006), Van Wyk & Smith (2003), Waanders (2011), Kok (1998).

| GRAMINOIDS (Grasses or "grass-like" plants) | |
|---|------------------------------|
| <i>Aristida adscensionis</i> | Annual Three-awn |
| <i>Aristida congesta</i> subsp. <i>barbicollis</i> | Spreading Three-awn |
| <i>Cynodon dactylon</i> | Couch Grass |
| <i>Eleusine coracana</i> | Goose Grass |
| <i>Enneapogon desvauxii</i> | Eight Day Grass |
| <i>Eragrostis curvula</i> | Weeping Love Grass |
| <i>Eragrostis echinochloidea</i> | Tick Grass |
| <i>Eragrostis lehmanniana</i> | Lehmann's Love Grass |
| <i>Melinis repens</i> | Natal Red Top |
| * <i>Pennisetum clandestinum</i> | Kikuyu Grass |
| HERBS | |
| * <i>Achyranthes aspera</i> | Chaff Flower |
| * <i>Alternanthera pungens</i> | Duwweltjie |
| * <i>Amaranthus deflexus</i> | Perennial Pigweed |
| * <i>Amaranthus viridus</i> | Slender Amaranth |
| <i>Arctotis venusta</i> | Free State Daisy |
| * <i>Argemone ochroleuca</i> | White-flowered Mexican poppy |
| * <i>Atriplex semibaccata</i> | Australian Salt Bush |
| <i>Barleria macrostegia</i> | |
| <i>Berkheya onopordifolia</i> var. <i>onopordifolia</i> | |
| * <i>Capsella bursa-pastoris</i> | Shepherd's Purse |
| <i>Chamaesyce inaequilatera</i> | Smooth Creeping Milkweed |
| * <i>Chenopodium album</i> | White Goosefoot |
| * <i>Chenopodium ambrosioides</i> | Wormseed Goosefoot |
| * <i>Datura ferox</i> | Large Thorn-apple |
| * <i>Datura stramonium</i> | Common Thorn-apple |
| * <i>Flaveria bidentis</i> | Smelter's bush |

| | |
|--|--------------------------|
| * <i>Galinsoga parviflora</i> | Small-flowered quickweed |
| <i>Gazania krebsiana</i> subsp. <i>krebsiana</i> | |
| <i>Geigeria ornativa</i> | |
| <i>Gisekia pharnacioides</i> | Gisekia |
| * <i>Gomphrena celosioides</i> | Bachelor's Button |
| * <i>Guilleminea densa</i> | Carrot weed |
| <i>Helichrysum cerastioides</i> | |
| <i>Heliotropium ciliatum</i> | String of Stars |
| * <i>Hibiscus trionum</i> | Bladder hibiscus |
| <i>Indigofera daleoides</i> | |
| * <i>Lactuca serriola</i> | Wild Lettuce |
| <i>Lepidium africanum</i> | Pepperweed |
| * <i>Lepidium bonariense</i> | Pepperweed |
| * <i>Malva parviflora</i> | Small Mallow |
| <i>Nidorella anomala</i> | |
| * <i>Salsola kali</i> | Russian Tumbleweed |
| * <i>Schkuhria pinnata</i> | Dwarf Marigold |
| <i>Senecio consanguineus</i> | Starvation Senecio |
| <i>Tribulus terrestris</i> | Devil's Thorn |
| * <i>Verbena officinalis</i> | |
| * <i>Xanthium spinosum</i> | Spiny Cocklebur |
| * <i>Xanthium strumarium</i> | Large Cocklebur |
| LOW SHRUBS | |
| <i>Aptosimum marlothii</i> | |
| <i>Felicia muricata</i> | |
| <i>Helichrysum cerastioides</i> | |
| <i>Pentzia calcarea</i> | |
| <i>Pentzia globosa</i> | |
| <i>Zygophyllum gilfillanii</i> | |
| SHRUBS | |
| <i>Hertia pallens</i> | |
| <i>Lycium cinereum</i> | Common Wild Asparagus |
| <i>Lycium horridum</i> | Milkweed |
| <i>Rhigozum trichotomum</i> | |
| TREES | |
| <i>Diospyros lycioides</i> var. <i>lycioides</i> | Bluebush |
| * <i>Ligustrum species</i> | Privets |
| * <i>Opuntia ficus-indica</i> | Sweet Prickly Pear |

| | |
|--|----------------|
| <i>* Prosopis glandulosa</i> | Mesquite |
| <i>Senegalia mellifera</i> subsp. <i>detinens</i> | Black Thorn |
| <i>Vachellia tortilis</i> subsp. <i>heteracantha</i> | Umbrella Thorn |
| <i>Ziziphus mucronata</i> | Buffalo-thorn |