ECOLOGICAL HABITAT SURVEY FAUNA AND FLORA

Remainder of Bultfontein 107 JR

The widespread indigenous butterfly species, *Junonia hierta* (Yellow Pansy), at the site.
Photo: Reinier F. Terblanche, January 2023.

FEBRUARY 2023

Compiled by:

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

ANTHENE ECOLOGICAL CC

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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. 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, 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.

EXPERIENCE

Lecturer: Zoology 1998-2008	**Main subject matter and level**	**Organization**
Lectured subjects	- 3rd year level Ecology, Plantparasitology - 2nd year level Ethology - *Master's degree* 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)

1. 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
2. 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.* Saftronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.
3. 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.
4. **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.
5. 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. Saftronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.
6. **TERBLANCHE, R.F.**, SMITH, G.F. & THEUNISSEN, J.D. **1993.** Did Scott typify names in *Haworthia* (Asphodelaceae: Alooideae)? *Taxon* **42**(1): 91–95. (International Journal of Plant Taxonomy).
7. **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.
8. 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.
9. 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.
10. **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: 12 February 2023

1 INTRODUCTION

An ecological habitat survey of flora and fauna is required for proposed developments at Bultfontein 107 JR which is located east of Soshanguwe in the Gauteng Province, at which developments are proposed (elsewhere referred to as the site). The survey focused on the possibility that fauna or flora of conservation concern, which include threatened species, known to occur in Gauteng Province are likely to occur within the study area or not.

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;
- Literature surveys that are integrated with the findings of the habitat survey;
- An evaluation of the sensitivity of habitats that in particular relate to current status of threatened species and conspicuous key biodiversity aspects;
- Identification of potential ecological impacts on fauna and flora that could occur as a result of the development; and

1.2 SCOPE OF STUDY

- A survey consisting of two visits to investigate key elements of habitats on the site, relevant to the conservation of fauna and flora;
- Recording of any sightings and signs of existing fauna and flora;
- Recording of possible significant biological interactions of importance to conserve habitats of species;
- The selective and careful collecting of voucher specimens of invertebrates where deemed necessary;
- Literature studies and integration of existing knowledge with the findings of the surveys in the field;

2 STUDY AREA

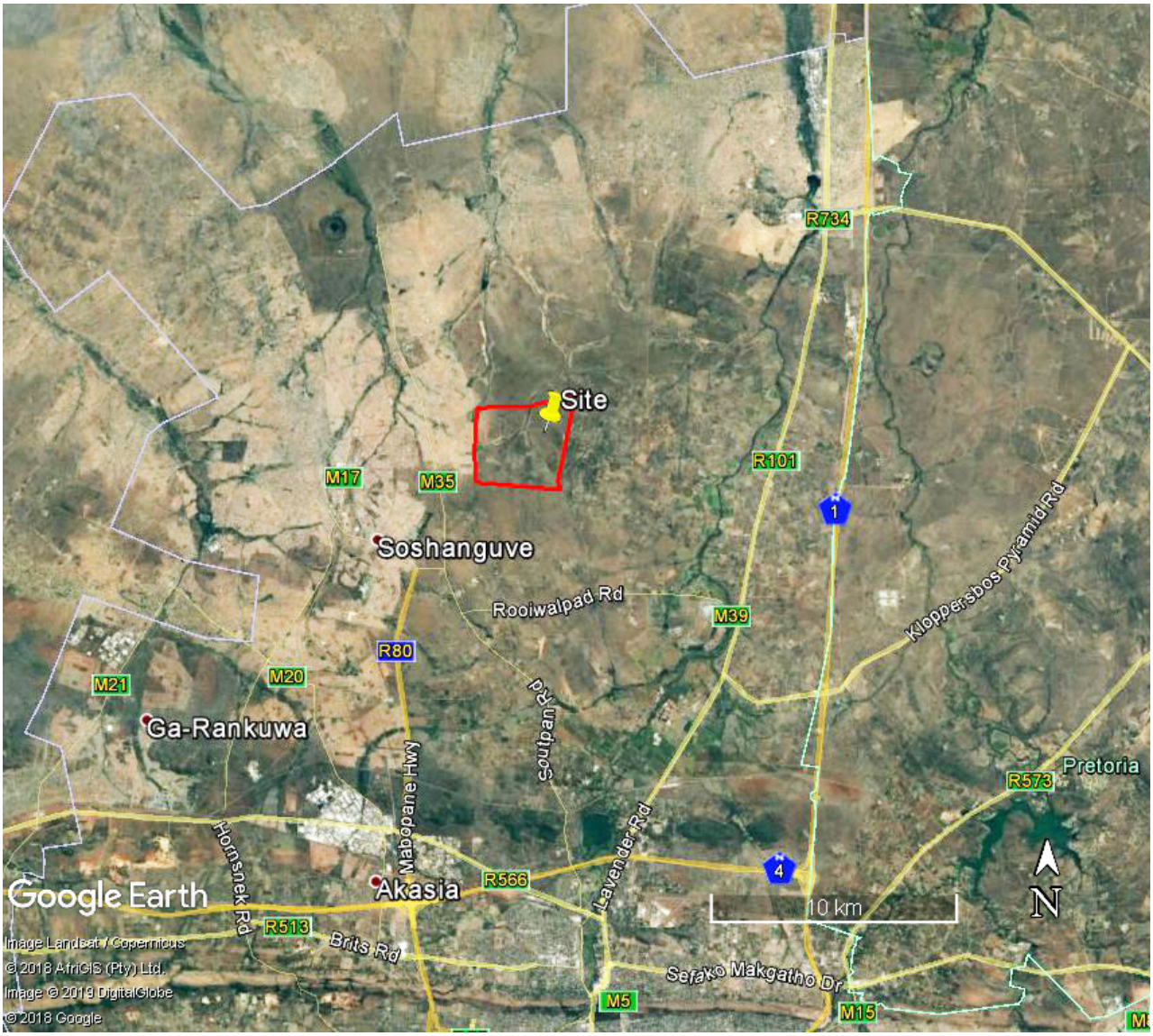

Figure 1 Map with indication of the location of the site (Yellow marker).

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, 2023).

The site is at Bultfontein 107 JR east of Soshanguwe in the Gauteng Province. The site is situated at the Savanna Biome (Mucina & Rutherford 2006). Savanna Biome at the site is represented by the Central Sandy Bushveld vegetation type (Mucina & Rutherford 2006) of which an outline follows.

SVcb 12 Central Sandy Bushveld

Distribution of Central Sandy Bushveld in South Africa: Limpopo, Mpumalanga, Gauteng and North West Provinces: Undulating terrain occurs mainly in a broad arc south of the Springbokvlakte from the Pilanesberg in the west through Hammanskraal and Groblersdal to GaMasemola in the east. A generally narrow irregular band along the north-western edge of the Springbokvlakte (including Modimolle) extending into a series of valleys and lower-altitude areas within the Waterberg including the upper Mokolo River Valley near Vaalwater, the corridor between Rankins Pass and the Doorndraai Dam, and the lowlands from the Mabula area to south of the Hoekberge. Some isolated sandy rises are found on the Springbokvlakte. Altitude about 850 – 1450 m.

Vegetation and Landscape Features: Low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous *Terminalia sericea* and *Burkea africana* woodland on deep sandy soils (with the former often dominant on the lower slopes of sandy catenas) and low, broad-leaved woodland on shallow rocky gravelly soils. Species of *Acacia*, *Ziziphus* and *Euclea* are found on flats and lower slopes on eutrophic sands and some less sandy soils. *Acacia tortilis* may dominate some areas along valleys. Grass-dominated herbaceous layer with relatively low basal cover on dystrophic sands (Mucina & Rutherford, 2006).

Geology & Soils: The large southern and eastern parts of this area are underlain by granite of the Lebowa Granite Suite and some granophyre of the Rashoop Granophyre Suite (both Bushveld Complex, Vaalian). In the north, the sedimentary rocks of the Waterberg Group (Mokolian Erathem) are most important. Specifically, sandstone, conglomerate and siltstone of the Alma Formation and sandstone, siltstone and shale of the Vaalwater formation. Well-drained, deep Hutton or Clovelly soils often with a catenary sequence from Hutton at the top to Clovelly on the lower slopes; shallow, skeletal Glenrosa soils also occur. Land types mainly Bb, Fa, Ba, Bd and Ac (Mucina & Rutherford, 2006).

Climate: Summer rainfall with very dry winters. Effectively three seasons, namely a cool dry season from May to mid-August, a hot dry season form mid-August to about October and a hot wet season form about November to April. Mean annual precipitation from about 500 mm to 700 mm. Frost fairly infrequent (Mucina & Rutherford, 2006).

Important taxa: Tall Trees: *Acacia burkei*, *Acacia robusta, Sclerocarya birrea* subsp. *caffra.* Small Trees: *Burkea africana, Combretum apiculatum, Combretum zeyheri, Terminalia*

sericea, Ochna pulchra, Peltophorum africanum, Searsia [Rhus] leptodictya. Tall Shrubs: *Combretum hereroense, Grewia bicolor, Grewia monticola, Strychnos pungens.* Low Shrubs: *Agathisanthemum bojeri, Indigofera filipes, Felicia fascicularis, Gnidia sericocephala.* Geoxyllic Suffrutex: *Dichapetalum cymosum*. Woody Climber: *Asparagus buchananii.* Graminoids: *Brachiaria nigropedata, Eragrostis pallens, Eragrostis rigidior, Hyperthelia dissoluta, Panicum maximum, Perotis patens, Anthephora pubescens, Aristida scabrivalvis* subsp. *scabrivalvis, Brachiaria serrata, Elionurus muticus, Eragrostis nindensis, Loudetia simplex, Schmidtia pappophoroides, Themeda triandra, Trachypogon spicatus*. Herbs: *Dicerocaryum senecioides, Barleria macrostegia, Blepharis integrifolia, Crabbea angustifolia, Evolvus alsinoides, Geigeria burkei, Hermannia lancifolia, Indigofera daleoides, Justica anagalloides, Kyphocarpa angustifolia, Lophiocarpus tenuissimus, Waltheria indica, Xerophyta humilis.* Geophytic Herb: *Hypoxis hemerocallidea.* Succulent Herb: *Aloe greatheadii* var. *davyana.*

Note: Not necessarily all the above plant species are present at the site.

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 by R.F. Terblanche during June 2019, July 2019 and January 2023 were conducted to note key elements of habitats on the site, relevant to the conservation of fauna and flora. The main purpose of the site visits was ultimately to serve as a habitat survey that concentrated on the possible presence or not of threatened species and other species of high conservation priority.

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

3.1 HABITAT CHARACTERISTICS AND VEGETATION

The habitat was investigated by noting habitat structure (rockiness, slope, plant structure/ physiognymy) 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 Boon (2010), 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 (1999), Van Wyk (2000), Van Wyk & Smith (2001), Van Wyk & Smith (2003), Van Wyk & Malan (1998) and Van Wyk & Van Wyk (1997). 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 spoor and signs. Trapping was not done since it proved not necessary in the case of this study. Habitat characteristics were also surveyed to note potential occurrences of mammals. 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 need 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. 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 (Deutschländer & Bredenkamp, 1999; Terblanche, Morghental & 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 is on a habitat survey.

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. Surveys were conducted during June 2019, July 2019 and January 2023 and include an optimal time of the year to find signs of animals such as invertebrates, signs of habitat sensitive plant species and vertebrate animal species high conservation priority. Weather conditions during the surveys were favourable for recording fauna and flora. The focus of the 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	The area proposed for the development is on gentle slopes (flat), with some undulations in the south where slopes of rocky outcrops enter. Extensive excavations and active channels also interrupt an otherwise relatively flat landscape.
Rockiness	Slopes of rocky ridges enter the southern parts of the site.
Presence of wetlands	No wetlands appear to be present at the site for the development. Non-perennial rivers, with their active channels and riparian zones, are present at the site. Artificial waterbodies, mostly in-channel dams, with groundwalls, are also present at the site. Waters gather at numerous excavations at the site.
Vegetation	Many areas at the site are disturbed, in particular, by extensive excavations. Remaining patches of open savanna contain a diversity of indigenous plant species. Conspicuous indigenous trees at the site are *Combretum zeyheri* (Large-fruited Bushwillow) *Vachellia tortilis* subsp. *heteracantha* (Umbrella Thorn), *Dichrostachys cinerea* (Sicklebush), *Searsia lancea* (Karee), *Searsa leptodictya* (Mountain Karee), *Ziziphus mucronata* (Buffalo Thorn) and *Peltophorum africanum* (African Wattle). *Sclerocarya birrea* (Marula) is sparsely distributed at the site. Alien invasive trees include *Melia azedarach* (Syringa Berrytree), *Opuntia ficus-indica* (Sweet Prickly Pear), *Jacaranda mimosifolia* (Jacaranda) and *Cereus jamacaru* (Queen of the Night). Aggresive alien invasive shrubs such as *Lantana camara* is also present at the site. Indigenous herbaceous species include *Chascanum hederaceum, Hibiscus pusillus, Blepharis integrifolia, Cleome maculata* and *Hilliardiella oligocephala.* Indigenous grass species include *Aristida congesta, Eragrostis lehmanniana, Eragrostis rigidior, Heteropogon contortus, Melinis repens* and *Panicum maximum.* Conspicuous exotic weeds at the site are *Flaveria bidentis, Tagetes minuta* (Khaki Weed), *Bidens bipinnata* (Black Jack), *Conyza bonariensis* (Flea Bane) and *Datura* species (Thorn-apples). Riparian vegetation at the site contains the indigenous reed *Phragmites mauritianus.* Other wetland plants such as *Cyperus* species, *Schoenoplectus* species (Cyperaceae), *Persicaria* species (Knot-weeds) and *Juncus* species (Juncaceae) occur along the fringes of the dams and active channels at the site. In many areas the riparian zones are extensively modified or transformed by excavations.
Signs of disturbances	Large parts of the site and particular at the riparian zones have been excavated in the past and it appears increasingly so in recent times. Pylons and roads are also present at the site. Exotic weeds in disturbed areas are also reflections of human induced impacts. Fences have been removed. Groundwalls and artificial waterbodies have been constructed at the site. Informal residences are spreading in the western parts of the site.
Connectivity	Non-perennial rivers and artificial waterbodies as well as slopes of rocky ridges (at the southern parts) at the site are corridors of particular conservation concern.

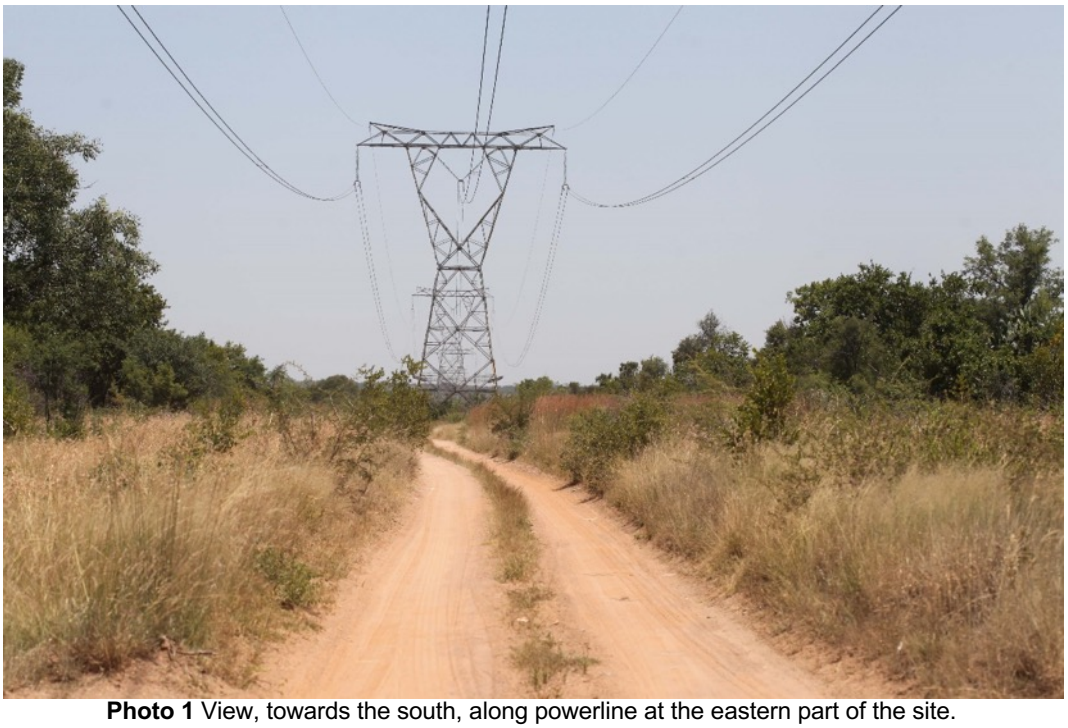

Photo 1 View, towards the south, along powerline at the eastern part of the site.
Photo: R.F. Terblanche.

Photo 2 View, towards the north, along the powerline at the eastern part of the site.
Photo: R.F. Terblanche

Photo 3 Scraped area at the eastern part of the site.
Photo: R.F. Terblanche.

Photo 4 Soshanguve extends to the western boundary of the site. Informal residential areas, increasingly extend into the western parts of the site. Urban edge effects, including pollution of tributaries that run into the site from Soshanguve, are visible at the western parts of the site.
Photo: R.F. Terblanche

Photo 5 Large areas at the site have been extensevily transformed or modified by excavations.
Photo: R.F. Terblanche.

Photo 6 Savanna patch at the site which contains a diversity of indigenous plant species.
Photo: R.F. Terblanche

Photo 7 Informal dumping at dirt road at the eastern part of the site.
Photo: R.F. Terblanche.

Photo 8 In recent years fences have been removed and at the time of the January 2023 surveys, free-roaming cattle was observed at the site.
Photo: R.F. Terblanche

Photo 9 The largest dam, Dam 1, near the northern boundary of the site.
Photo: R.F. Terblanche.

Photo 10 Fringe of wetland vegetation at Dam 1 at the site.
Photo: R.F. Terblanche

Photo 11 A small dam, Dam 3 at the site. Note sparse vegetation at groundwall.
Photo: R.F. Terblanche.

Photo 12 Part of Dam 4 at the site.
Photo: R.F. Terblanche

Photo 13 Groundwall at Dam 4 at the site.
Photo: R.F. Terblanche.

Photo 14 Dam 6 at the site. Groundwalls with sparse vegetation are prone to be eroded.
Photo: R.F. Terblanche

Photo 15 Extensive informal dumping has increased in recent years at Dam 6, such as observed in January 2023.
Photo: R.F. Terblanche.

Photo 16 Some parts of the groundwalls at Dam 6 at the stie, are covered by rubble owing to informal dumping.
Photo: R.F. Terblanche

Photo 17 Distubed riparian zone at the site. A partch of indigenous *Phragmites mauritianus* (reed species) is noticeable in the picture.
Photo: R.F. Terblanche.

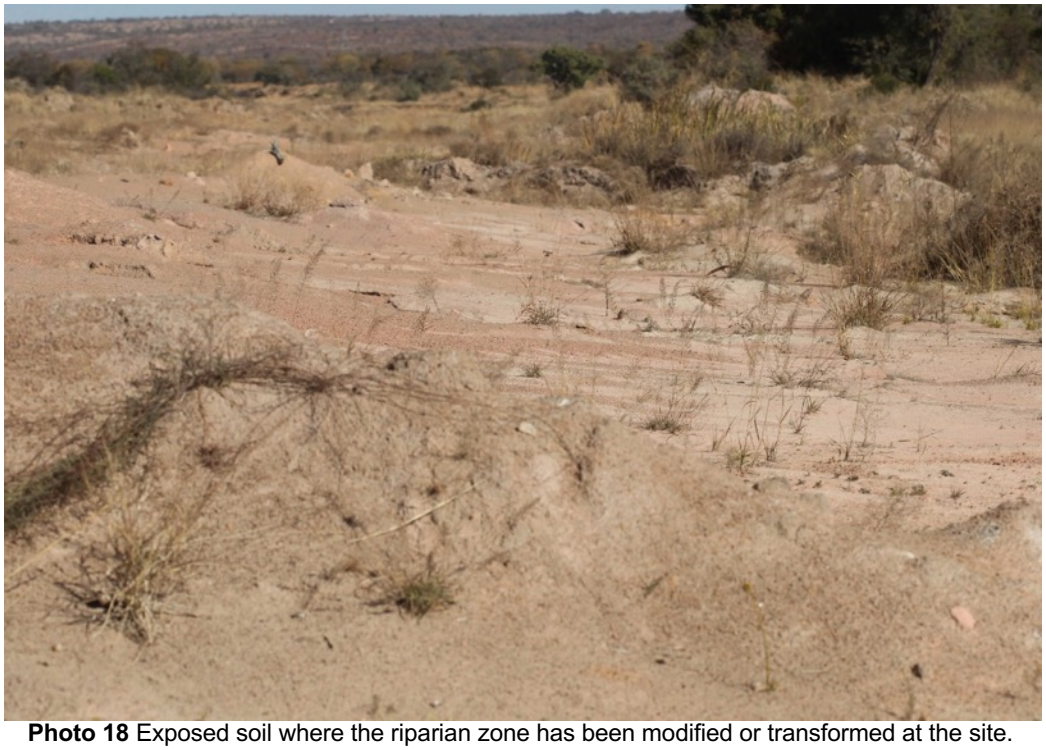

Photo 18 Exposed soil where the riparian zone has been modified or transformed at the site.
Photo: R.F. Terblanche

Photo 19 Damage to protected Marula tree, *Sclerocarya birrea*, at the site.
Photo: R.F. Terblanche.

Photo 20 Damage to protected Marula tree, *Sclerocarya birrea*, at the site.
Photo: R.F. Terblanche

Photo 21 Foliage and flowers of the Near-Threatened plant species *Searsia gracillima* var. *gracillima* at the site.
Photo: R.F. Terblanche.

Photo 22 Foliage and fruit of the Near-Threatened plant species *Searsia gracillima* var. *gracillima*, that has been found at the south-eastern parts of the site.
Photo: R.F. Terblanche

Photo 23 The Near Threatened plant species *Searsia gracillima* var. *gracillima* that blends the grass layer at the southeastern parts of the site.
Photo: R.F. Terblanche.

Photo 24 Characteristic trunk of the Marula tree, *Sclerocarya birrea*, at the site.
Photo: R.F. Terblanche.

Photo 25 Foliage and fruit of the Marula tree, *Sclerocarya birrea*, at the site.
Photo: R.F. Terblanche

Photo 26 Protected tree species, *Sclerocarya birrea* (Marula), at the site.
Photo: R.F. Terblanche.

Photo 27 Large-fruited Bushwillow, *Combretum zeyheri*, at the site.
Photo: R.F. Terblanche.

Photo 28 The indigenous small tree *Vitex zeyheri* at the rocky areas at the southern parts of the site.
Photo: R.F. Terblanche

Photo 29 *Mundulea sericea*, cork bush, at the southern parts of the site.
Photo: R.F. Terblanche.

Photo 30 *Dicrostachys cinerea*, Sicklebush, at the site.
Photo: R.F. Terblanche

Photo 31 The alien invasive *Melia azedarach*, Syringa berry-tree, at the site.
Photo: R.F. Terblanche.

Photo 32 Alien invasive *Jacaranda mimosifolia* (Jacaranda), at the site.
Photo: R.F. Terblanche

Photo 33 Flowers of the alien invasive Pompom weed, *Campuloclinium macrocephalum*, at the site.
Photo: R.F. Terblanche.

Photo 34 Alien invasive *Yucca filamentosa*, at the site.
Photo: R.F. Terblanche

Photo 35 Fruit and foliage of the alien invasive weed, *Lantana camara*, at the site.
Photo: R.F. Terblanche.

Photo 36 Fruit of alien invasive weed, *Datura ferox* at the site.
Photo: R.F. Terblanche

Photo 37 Flowers of indigenous herbaceous shrub, *Gomphocarpus fruticosus,* at the site.
Photo: R.F. Terblanche.

Photo 38 Fruit and foliage of the indigenous *Triumfetta sonderi*, at the site.
Photo: R.F. Terblanche

Photo 39 *Xerophyta retinervis*, at the southern parts of the site.
Photo: R.F. Terblanche.

Photo 40 The indigenous *Lannea edulis*, at the southern parts of the site.
Photo: R.F. Terblanche

Photo 41 Inflorescence of the indigenous widespread grass species *Pogonarthria squarrosa*, at the site.
Photo: R.F. Terblanche.

Photo 42 The widespread indigenous grass species, *Heteropogon contortus*, at the site.
Photo: R.F. Terblanche

Photo 43 Tracks of Water Mongoose, *Atilax paludinosus*, at the site. This mammal is widespread but favours areas which contain waterbodies and rivers.
Photo: R.F. Terblanche.

Photo 44 Signs of the widespread Helmeted Guineafowl, *Numida meleagris*, at the site.
Photo: R.F. Terblanche

Photo 45 Indigenous butterfly species *Deudorix dinochares* at the site. This widespread bushveld species uses the fruit of the large-fruited bushwillow, *Combretum zeyheri* as larval food to complete its life cycle.
Photo: R.F. Terblanche.

Photo 46 The widesrpead indigenous butterfly species, *Junonia hierta*, Yellow Pansy, at the site.
Photo: R.F. Terblanche

4.2 ASSESSMENT OF PLANT SPECIES OF CONSERVATION CONCERN

Table 4.2 Threatened plant species of the Gauteng Province that are listed in the **Critically Endangered** category. The list here follows the most recent updated 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 a site.

Species	Status: Global status or national status indicated	Resident at the site
Encephalartos middelburgensis	Critically Endangered	No

Table 4.3 Threatened plant species of the Gauteng Province that are listed in the **Endangered** category. The list here follows the most recent updated 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 a site.

Species	Status: Global status or national status indicated	Resident at the site
Aloe peglerae	Endangered	No
Brachystelma discoideum	Endangered	No
Delosperma purpureum	Endangered	No
Frithia humilis	Endangered	No
Habenaria mossii	Endangered	No
Holothrix micrantha	Endangered	No

Table 4.4 Threatened plant species of the Gauteng Province that are listed in the **Vulnerable** category. The list here follows the most recent updated 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 a site.

Species	Status: Global status or national status indicated	Resident at the site
Bowiea volubilis subsp. ***volubilis***	Vulnerable	No
Brachycorythis conica subsp. ***transvaalensis***	Vulnerable	No
Ceropegia decidua subsp. ***pretoriensis***	Vulnerable	No
Cheilanthes deltoidea subsp. ***silicicola***	Vulnerable	No
Cineraria longipes	Vulnerable	No
Cucumis humifructus	Vulnerable	No
Delosperma gautengense	Vulnerable	No
Dioscorea sylvatica	Vulnerable	No
Encephalartos lanatus	Vulnerable	No
Eulophia coddii	Vulnerable	No
Khadia beswickii	Vulnerable	No
Melolobium subspicatum	Vulnerable	No
Prunus africana	Vulnerable	No

Table 4.5 Near Threatened plant species of the Gauteng Province. The list here follows the most recent updated 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	Status: Global status or national status indicated	Resident at the site
Alepidea attenuata	Near Threatened	No
Adromischus umbraticola subsp. ***umbraticola***	Near Threatened	No
Argyrolobium campicola	Near Threatened	No
Argyrolobium megarrhizum	Near Threatened	No
Ceropegia turricula	Near Threatened	No
Cineraria austrotransvaalensis	Near Threatened	No
Cleome conrathii	Near Threatened	No
Delosperma leendertziae	Near Threatened	No
Drimia sanguinea	Near Threatened	No
Gladiolus robertsoniae	Near Threatened	No
Habenaria barbertoni	Near Threatened	No
Habenaria bicolor	Near Threatened	No
Habenaria kraenzliniana	Near Threatened	No
Holothrix randii	Near Threatened	No
Kniphofia typhoides	Near Threatened	No
Lithops leslei subsp. ***leslei***	Near Threatened	No
Nerine gracilis	Near Threatened	No
Searsia gracillima var. ***gracillima***	**Near Threatened**	**Yes**
Stenostelma umbelluliferum	Near Threatened	No

Table 4.6 Least Concern (= not threatened) plant species of the Gauteng Province that are however of particular conservation concern and listed in the **Rare** 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	Status: Global status or national status indicated	Resident at the site
Blepharis uniflora	Rare	No
Frithia pulchra	Rare	No
Gladiolus pole-evansii	Rare	No
Gnaphalium nelsonii	Rare	No

Table 4.7 Not threatened plant species of the Gauteng Province which are however of particular conservation concern and listed in the **Declining** 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	Status: Global status or national status indicated	Resident at the site
Boophone disticha	**Declining**	**Yes**
Callilepis leptophylla	Declining	No
Crinum bulbispermum	Declining	No
Crinum macowanii	Declining	No
Drimia altissima	Declining	No
Eucomis autumnalis	Declining	No
Gunnera perpensa	Declining	No
Hypoxis hemerocallidea	Declining	No
Ilex mitis	Declining	No

Table 4.8 Plant species of the Gauteng 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	Status: Global status or national status indicated	Resident at the site
Lepidium mossii	Data Deficient	No

Table 4.9 Some of the tree species of the Gauteng Province which are not threatened but listed as **Protected Species** under the National Forests Act No. 84 of 1998, Section 51(1)**.** 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
Boscia albitrunca	Protected	No
Combretum imberbe	Protected	No
Sclerocarya birrea	**Protected**	**Yes**
Vachellia erioloba	Protected	No

4.3 ASSESSMENT OF VERTEBRATE SPECIES OF CONSERVATION CONCERN

4.3.1 Mammals of particular high conservation priority

Table 4.10 Threatened mammal species of the Gauteng Province. Literature sources: Friedman & Daly, (2004), Skinner & Chimimba (2005), Wilson & Reeder (2005). Furthermore golden mole species that are rare and being reported from the adjacent Free State and Limpopo Provinces have also been included.

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment
Chrysospalax villosus Rough-haired golden mole	Vulnerable	No	No
Cloeotis percivali Short-eared trident bat	Vulnerable/ Near-threatened	No	No
Diceros bicornis Black rhinoceros	Critically Endangered	No	No
Lycaon pictus African wild dog	Endangered	No	No
Loxodonta africana African elephant	Vulnerable	No	No
Mystromys albicaudatus White-tailed mouse	Endangered	No	No
Neamblysomus julianae Juliana's Golden Mole	Critically Endangered	No	No
Panthera leo	Vulnerable	No	No

Lion			
Rhinolophus blasii Blasi's Horseshoe Bat	Vulnerable	No	No
Smutsia temminckii Ground Pangolin	Vulnerable	No	No

Table 4.11 Near threatened mammal species known to occur in the Gauteng Province, Free State Province and North-West Province. Literature sources: Skinner & Chimimba (2005).

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment
Ceratotherium simum White Rhinoceros	Near Threatened	No	No
Parahyaena brunnea Brown Hyaena	Near Threatened	No	Could possibly be present or cross through the site or larger study area

4.3.2 Birds of particular high conservation priority

Table 4.12 Threatened bird species of the Gauteng Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007).

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based on being dependant on site
Aegypius tracheliotos	**Lappet-faced Vulture**	Vulnerable	No	No
Anthropoides paradiseus	**Blue Crane**	Vulnerable	No	No
Aquila rapax	**Tawny Eagle**	Vulnerable	No	No
Ardeotis kori	**Kori Bustard**	Vulnerable	No	No
Botaurus stellaris	**Eurasian Bittern**	Critically Endangered	No	No
Buphagus africanus	**Yellow-billed Oxpecker**	Vulnerable	No	No
Circus ranivorus	**African Marsh-Harrier**	Vulnerable	No	No

Crex crex	**Corn Crake**	Vulnerable	No	No
Eupodotis senegalensis	**White-bellied Korhaan**	Vulnerable	No	No
Gorsachius leuconotus	**White-backed Night-heron**	Vulnerable	No	No
Gyps africanus	**White-backed Vulture**	Vulnerable	No	No
Gyps coprotheres	**Cape Vulture**	Vulnerable	No	No
Neophron percnopterus	**Egyptian Vulture**	Regionally almost extinct	No	No
Neotis denhami	**Denham's Bustard**	Vulnerable	No	No
Pelecanus rufescens	**Pink-backed Pelican**	Vulnerable	No	No
Polemaetus bellicosus	**Martial Eagle**	Vulnerable	No	No
Rhynchops flavirostris	**African Skimmer**	Endangered	No	No
Sarothrura ayresi	**White-winged Flufftail**	Critically Endangered	No	No
Therathopius ecaudatus	**Bateleur**	Vulnerable (in South Africa)	No	No
Tyto capensis	**African Grass-Owl**	Vulnerable	No	No

Table 4.13 Near threatened bird species of the Gauteng Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007).

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based or being dependant on site
Alcedo semitorquata	**Half-collared Kingfisher**	Near threatened	No	No
Anastomus lamelligerus	**African Openbill**	Near threatened	No	No
Aquila ayresii	**Ayres's Hawk-Eagle**	Near threatened	No	No
Buphagus erythrorynchus	**Red-Billed Oxpecker**	Near threatened	No	No
Charadrius pallidus	**Chestnut-banded Plover**	Near threatened	No	No
Ciconia nigra	**Black Stork**	Near threatened	No	No
Circus macrourus	**Pallid Harrier**	Near threatened	No	No
Falco biarmicus	**Lanner Falcon**	Near threatened	No	No
Falco peregrinus	**Peregrine Falcon**	Near threatened	No	No

Glareola nordmanni	**Black-winged Pratincole**	Near threatened	No	No
Leptoptilos crumeniferus	**Marabou Stork**	Near threatened	No	No
Mirafra cheniana	**Melodious lark**	Near threatened	No	No
Mycteria ibis	**Yellow-billed Stork**	Near threatened	No	No
Pelecanus onocrotalus	**Great White Pelican**	Near threatened	No	No
Phoenicopterus minor	**Lesser Flamingo**	Near threatened	No	No
Phoenicopterus ruber	**Greater Flamingo**	Near threatened	No	No
Pterocles gutturalis	**Yellow-throated Sandgrouse**	Near threatened	No	No
Rostratula benghalensis	**Greater Painted-snipe**	Near threatened	No	No
Sagittarius serpentarius	**Secretarybird**	Near threatened	No	No
Sternia caspia	**Caspian Tern**	Near threatened	No	No

4.3.3 Reptiles of particular high conservation priority

The following table lists possible presence or absence of reptile species of particular conservation concern at the site. This list to assess the possible presence or not of reptile species of conservation concern was compiled by using mainly the source Bates, Branch, Bauer, Burger, Marais, Alexander & De Villiers (2014), that is the Atlas and Red List of South Africa, Lesotho and Swaziland.

Table 4.1 Near Threatened reptile species in Gauteng 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	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
Chamaesaura aenea **Coppery Grass Lizard**	Near Threatened	No	No	No
Homoroselaps dorsalis **Striped Harlequin Snake**	Near threatened	No	No	No

4.4 ASSESSMENT OF INVERTEBRATE SPECIES OF CONSERVATION CONCERN

4.4.1 Butterflies of particular conservation priority

Table 4.15 Threatened butterfly species in North West Province and Gauteng Province (Mecenero *et. al.* 2020). Sources of information: Henning, Terblanche & Ball (2009), Mecenero *et al*. (2013), Mecenero *et.al.* (2020). 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
Aloeides dentatis dentatis Roodepoort Toothed Russet	Endangered	No	Highly unlikely
Chrysoritis aureus Golden Opal/ Heidelberg Copper	Endangered	No	Highly unlikely
Lepidochrysops praeterita Highveld Giant Cupid/ Highveld Blue	Endangered	No	Highly unlikely
Orachrysops mijburghi Heilbron Cupid	Endangered	No	Highly unlikely

Table 4.16 Butterfly species of the North West Province and Gauteng Province that are Near Threatened (Mecenero *et al.*, 2020). No = Butterfly species is unlikely to be a resident at the study area; Yes = Butterfly species is a resident at the study area. Sources of information Henning, Terblanche & Ball (2009), Mecenero *et. al.* (2013), Mecenero *et. al.* (2020).

Species	Threatened Status	Recorded at site during survey	Residential status at the site: Yes confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
Metisella meninx Marsh Sylph	**Near Threatened**	No	Possibly but riparian zone at site not ideal habitat; could use riparian zone as corridor

4.4.2 Beetles of particular conservation priority

Table 4.17 Fruit chafer species (Coleoptera: Scarabaeidae: Cetoninae) in the Gauteng Province and Gauteng Province which are of known high conservation priority.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
Ichnestoma stobbiai	Uncertain (Probably endangered)	No	No	No
Trichocephala brincki	Uncertain	No	No	No

4.4.3 Mygalomorph spiders of particular conservation priority

Table 4.18 Baboon spiders species (Araneae: Teraphosidae) species that are of known high conservation priority in the Gauteng Province and Gauteng Province.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
Brachionopus pretoriae	Uncertain	No	No	No

4.4.4 Scorpions of particular conservation priority

Table 4.19 Rock scorpion species (Scorpiones: Ischnuridae) species that are of known high conservation priority in the Gauteng Province and Gauteng Province.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
Hadogenes gracilis	Uncertain	No	No	No
Hadogenes gunningi	Uncertain	No	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 Gauteng Province are listed in Tables 4.2 – 4.9. The presence or not of all the species listed in the tables were investigated during the survey. Presence of Threatened and Near Threatened species of plants at the site is unlikely.

The Near Threatened plant species *Searsia gracillima* var. *gracillima* has been found in the south eastern parts of the site. This part of the site is avoided in the proposed footprint so that Searsia gracillima is not anticipated to be affected.

The Declining species *Boophone disticha* occurs at some rocky slopes which are not included in the proposed footprint at the site and therefore unlikely to be impacted.

One protected tree species *Sclerocarya birrea* (Marula Tree) occurs at the site. Only a few Marula trees (*Sclerocarya birrea*) are present at the site and particularly large trees are absent. In terms of a part of section 15(1) of the National Forests Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister.

5.3 VERTEBRATES

5.3.1 Mammals

Table 4.10 and Table 4.11 list the possible presence or absence of threatened mammal species and near threatened mammal species at the site. Literature sources that were used are Friedman & Daly (2004), Skinner & Chimimba (2005) and Wilson & Reeder (2005). Because 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. The brown hyaena (*Parahyaena brunnea*) could be present at the site from time to time or be resident in the larger area. Brown hyaenas can travel far and also has the ability to survive at or close to urban areas (Skinner & Chimimba, 2005). It is difficult to ascribe a certain part of the site or the larger study area to the brown hyaena or to ascertain whether the species is still present at the site and surrounding areas.

5.3.2 Birds

Table 4.12 and Table 4.13 list the possible presence or absence of threatened bird species and near threatened bird species at the site. Literature sources that were mainly consulted are Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). The site does not appear to form part of any habitat of particular importance for any threatened bird species or any bird species of particular conservation importance.

5.3.3 Reptiles

Table 14 lists the possible presence or absence of near threatened reptile species on the site. The Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland were used to compile the list for the assessment (Bates, Branch, Bauer, Burger, Marais, Alexander & De Villiers, 2014). There appears to be no threat to any reptile species of particular high conservation importance if the site is developed.

5.3.4 Amphibians

No frog species that occur in the Gauteng are red listed as threatened species or near threatened species at present. There appears to be no threat to any amphibian species of particular high conservation importance if the site is developed. Presence of *Pyxicephalus adspersus* (Giant Bullfrog), a species hitherto listed as near threatened is unlikely.

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 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 and North West Province combined are listed as threatened in the recent butterfly conservation assessment of South Africa (Mecenero *et al*., 2013; Mecenero *et. al.*, 2020). 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 4.16 and Table 4.17) follows.

5.4.1.1 Assessment of threatened butterfly species

***Aloeides dentatis dentatis (*Roodepoort Toothed 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.,* 2020). *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.

Chrysoritis aureus (Golden Opal/ Heidelberg Copper)

The proposed global red list status for *Chrysoritis aureus* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.,* 2020) *Chrysoritis aureus* (Golden Opal/ Heidelberg Copper) is a resident where the larval host plant, *Clutia 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 *Chrysoritis 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 *Chrysorits 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.,* 2020). *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.,* 2020). *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 butterfly species of particular high conservation importance if the site is developed.

5.4.1.2 Assessment of butterfly species that are Near Threatened

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 Near Threatened (Mecenero *et al.,* 2020). 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). There is not an ideal habitat for the species at the riparian zone at the site. However, it could be that the butterfly species uses the riparian zone as corridor, or even habitat if more suitable from time to time.

5.4.1 FRUIT CHAFER BEETLES

Table 4.17 lists the fruit chafer beetle species (Coleoptera: Scarabaeidae: Cetoninae) that are of known high conservation priority in the Gauteng Province.

Ichnestoma stobbiai is an endangered fruit chafer (Scarabaeidae: Cetoniinae) that occurs in small habitat fragments of South Africa (Kryger & Scholtz, 2008). The adults of this species are short-lived and the females are flightless. Thus, the vagility of these beetles is extremely low (Kryger & Scholtz, 2008). The Cetoniinae (Coleoptera: Scarabaeidae) genus *Ichnestoma* Gory & Percheron, 1833 currently comprises 13 described species and is endemic to South Africa. The species *I. stobbiai* Holm, 1992 is thought to occur in a very restricted area in and around Gauteng Province and all habitat patches should be protected (Kryger & Scholtz, 2008; Deschodt, Scholtz & Kryger, 2009). Unlike most cetoniine larvae, the larvae of this species usually occur in dolomitic to cherty, well-drained soils (Deschodt, Scholtz & Kryger, 2009).

Ichnestoma larvae feed under the soil surface and also pupate under the soil surface in specific grassland areas (Perissinotto, Smith & Stobbiai, 1999). All the habitat requirements of *Ichnestoma stobbiai* in these grassland patches are not fully understood yet, but it is normally a rocky area (dolomite to chert: see Deschodt, Scholtz & Kryger, 2009), consisting of grassland with a variety of indigenous grass species. From personal experience few trees occur in such patches, with species diverse grassland that are well developed in terms of succession. Rocks, often well-embedded in the soil, are scattered throughout such areas. Occurrence of *Ichnestoma stobbiai* at the site is highly unlikely. There appears to be no threat to listed rare and localized fruit-chafer beetles if the site is developed.

5.4.2 MYGALOMOPH SPIDERS

Table 4.18 lists the baboon spider species (Araneae: Teraphosidae) that are of known high conservation priority in the Gauteng Province. The assessment of the conservation status of baboon spiders in South Africa is in process but as a pre-caution the species listed in Table 4.18 has been included. None of the above baboon spider species were found on the site, or are likely to be resident at the site. There appears to be no threat to the baboon spider species of high conservation significance if the study site is developed.

5.4.3 SCORPIONS

Table 4.19 lists the rock scorpion species (Scorpiones: Ischnuridae) that are of known high conservation priority in the Gauteng Province. There appears to be no threat to the rock scorpion species of high conservation priority if the study site is developed.

5.5 Screening tool (DEFFE) and groundtruthing

Possible ecological sensitivities at the site were indicated by a report generated from the screening tool of DEFFE. These ecological sensitivities that could possibly/ are present at the site, follow.

Animal species theme sensitivity

Relative animal species theme sensitivity is high at an area associated with the larger dam at the northern parts of the site, as well as the southeastern part of the site. For the larger part

of the site the animal species theme sensitivity is medium. At the northwestern part of the site a low animal species theme sensitivity is listed. The avifaunal species *Tyto capensis*, *Mycteria ibis*, *Podica senegalensis*, *Hydroprogne caspia* and *Eupodotis senegalensis*, the mammal species *Dasymys robertsii* and *Neamblysomus julianae* as well as the reptile species *Kinixys lobatsiana* are flagged for the site area. The African Grass-owl, *Tyto capensis* often occurs in treeless areas associated with damp substrata, mainly marshes and vleis (Hockey, Dean & Ryan, 2005). *Tyto capensis* favours patches of tall, rank grass, sedges or weeds (Armstrong, 1991). Roost sites can develop into “caves” in grass that are interconnected by tunnels and open landing platforms (Hockey, Dean & Ryan, 2005). No signs of *Tyto capensis* that inhabits the site were observed. It appears unlikely based on the habitat at the site that *Tyto capensis* would be present. The habitat of the Yellow-billed Stork, *Mycteria ibis*, comprises wetlands, including alkaline and freshwater lakes, rivers, dams, flooded grassland and small pools or streams, less often marine mudflats and estuaries (Hockey, Dean & Ryan, 2005). *Mycteria ibis* is widespread over most of sub-Saharan Africa but in southern Africa largely absent from the Namib Desert, Kalahari Basin and Karoo (Hockey, Dean & Ryan, 2005). While *Mycteria ibis* could visit the site there is no distinct indication that the site would impact the species. The African Finfoot, *Podica senegalensis*, mostly occurs at quiet, wooded streams and rivers, flanked by thick riparian vegetation and overhanging trees (Hockey, Dean & Ryan, 2005). Presence of *Podica senegalensis* at the site is unlikely. The Caspian Tern, *Hydroprogne caspia* (Caspian Tern) is found worldwide apart from South America and Antarctica. In southern Africa *Hydroprogne caspia* occurs around entire coast and inland in Botswana, central-eastern South Africa and southern Mozambique (Hockey, Dean & Ryan, 2005). Along the coast *Hydroprogne caspia* is present mostly in sheltered bays and estuaries. Inland in southern Africa *Hydroprogne caspia* occurs at large waterbodies, natural and man-made, with preference for saline pans and large impoundments (Hockey, Dean & Ryan, 2005). Inland the species breeds on small, low islets in pans and dams (Hockey, Dean & Ryan, 2005). The white-bellied bustard, *Eupodotis senegalensis*, is patchily distributed in the Afrotropics from western Africa to South Africa. The subspecies that occurs in South Africa is near-endemic of which many populations appear to be localized. The habitat of *Eupodotis senegalensis* comprises fairly tall, dense grassland, especially sour and mixed grassland, in open or lightly wooded, undulating to hilly country (Hockey, Dean & Ryan, 2005). No *Eupodotis senegalensis* has been observed at the site. There is no distinct reason why *Eupodotis senegalensis* would occur at the site. Juliana’s Golden Mole, *Neamblysomus julianae,* has been recorded few at widely separated localities in South Africa in the past which includes Pretoria, the Nyl floodplain and the Pretoriuskop area of the Kruger National Park (Skinner & Chimimba, 2005). *Neamblysomus julianae* is endemic to the Savanna Biome where it is confined to sourish bushveld on sandy soil (Bronner, 1995). At the Pretoria area it occurs at sandy soils with rocky

outcrops in the Bronberg (Willlows) area. There are no indications that *Neamblysomus julianae* occurs at the site. *Dasymys robertsii* is patchily distributed in the lowveld of northern South Africa and Zimbabwe. In South Africa *Dasymys robertsii* occurs predominantly in the Limpopo, Mpumalanga and Gauteng Provinces (Mullin *et. al.*, 2005). Power (2014) recorded the *D. robertsii* in the North West Province at a tributary of the Waterkloofspruit at Kgaswane. The Lobatse hinged-back tortoise, *Kinixys lobatsiana,.* is found in southeastern Botswana and in South Africa from the north-eastern parts of the North West Province, through northern Gauteng, northwestern parts of Mpumalanga and into the Limpopo Province south of the Soutpansberg (Bates *et. al.*, 2014). *Kinixys lobatsiana* is present in savanna habitats, though absent from the subtropical lowveld, and is also absent from the highveld grassland (Bates *et. al.*, 2014). Vegetation at its habitats ranges from dens, short bushveld to open tree savanna. The tortoise species prefers rocky hillsides and rocky ridges (Boycott & Bourquin, 2000). Habitat which could sustain the tortoise appears to exist at the site. No tortoises have been found at the site. There is no distinct indication that the animal species listed above occur on the site. Some vegetation in good condition remains at the rocky ridges at the southern part of the site as well as some patches at the eastern part of the site. The site is increasingly disturbed, negative urban edge effects are present, large-scale groundworks are taking place and the site is increasingly isolated.

Aquatic biodiversity theme sensitivity

Relative aquatic biodiversity theme sensitivity at the site is listed as very high owing to the possible presence of wetlands and estuaries. Riparian zones, in-channel dams and artificial dams (that approaches quarries) were found at the site. Large-scale groundworks at and along the riparian zones and active channels have transformed large areas at the site. The scale to which riparian zones have been destroyed is considerable.

Plant species theme sensitivity

Relative plant species theme sensitivity is low and medium. A species that is prone to harvesting is listed. In this report possible sensitive plant species of which the likely presence or absence have been investigated are listed in Tables 4.2 – 4.9 and include plant species on a local and provincial scale which could be prone to harvesting. One species that is not threatened but which is a nationally protected tree species, *Sclerocarya birrea*, Marula has been noted at the site. For most of the site this protected tree is absent or occurs sparingly. An area at the eastern part of the site contains some areas where larger individuals of these protected trees have been found more concentrated. If the development is approved and the removal/ distruction of these Sclerocarya birrea (Marula) trees cannot be avoided, a permit should be applied for. A locality for the near threatened plant species, *Searsia gracillima* var.

gracillima has been found at the southeastern part of the site. This locality (which is possibly new for the species) of *Searsia gracillima* var. *gracillima* underscores the higher sensitivity of the southern part of the site. No Threatened plant species have been flagged for the site area by the screening tool and no Threatened plant species have been found at the site.

Terrestrial biodiversity theme sensitivity

Relative terrestrial biodiversity at the site is very high. This high sensitivity that is ascribed to the site area, is because of the presence of Critical Biodiversity Area 2, the presence of an Ecological Support Area and the presence of the Sterkwater Private Nature Reserve. During surveys at the site, it was found that the original vegetation type has been transformed or modified at large parts of the site. The southern parts of the site where a rocky ridge is also present ramained in fairly good condition and warrants conservation. Informal residences entered considerable areas of the western part of the site. Riparian zones at large parts of the site have been largely destroyed and transformed. The functioning of the Sterkwater Private Nature Reserve is in doubt at present. Fences have been removed. For large parts of the site the ecological integrity appears to be low or medium but not high.

5.6 Ecological Sensitivity at the site

Ecological sensitivity at most of the site is medium. Some of the terrestrial areas are of low sensitivity where these terrestrial areas have been degraded and transformed by extensive excavations and groundworks as well as informal residences. Ecological sensitivitty at the non-perennial rivers, their riparian zones and buffer zones as well as the artificial waterbodies at the site is high (Figure 13). The main reason for the high sensitivity of the active channel and riparian zones is only based on their importance as conservation corridors and not on the poor current state of the active channels and riparian zones. Rocky slopes and their bufferzones at the southwestern parts of the site are also of high ecological sensitivity (Figure 13). The area where the Near Threatened plant species *Searsia gracillima* var. *gracillima* has been found at the site, is of high ecological sensitivity.

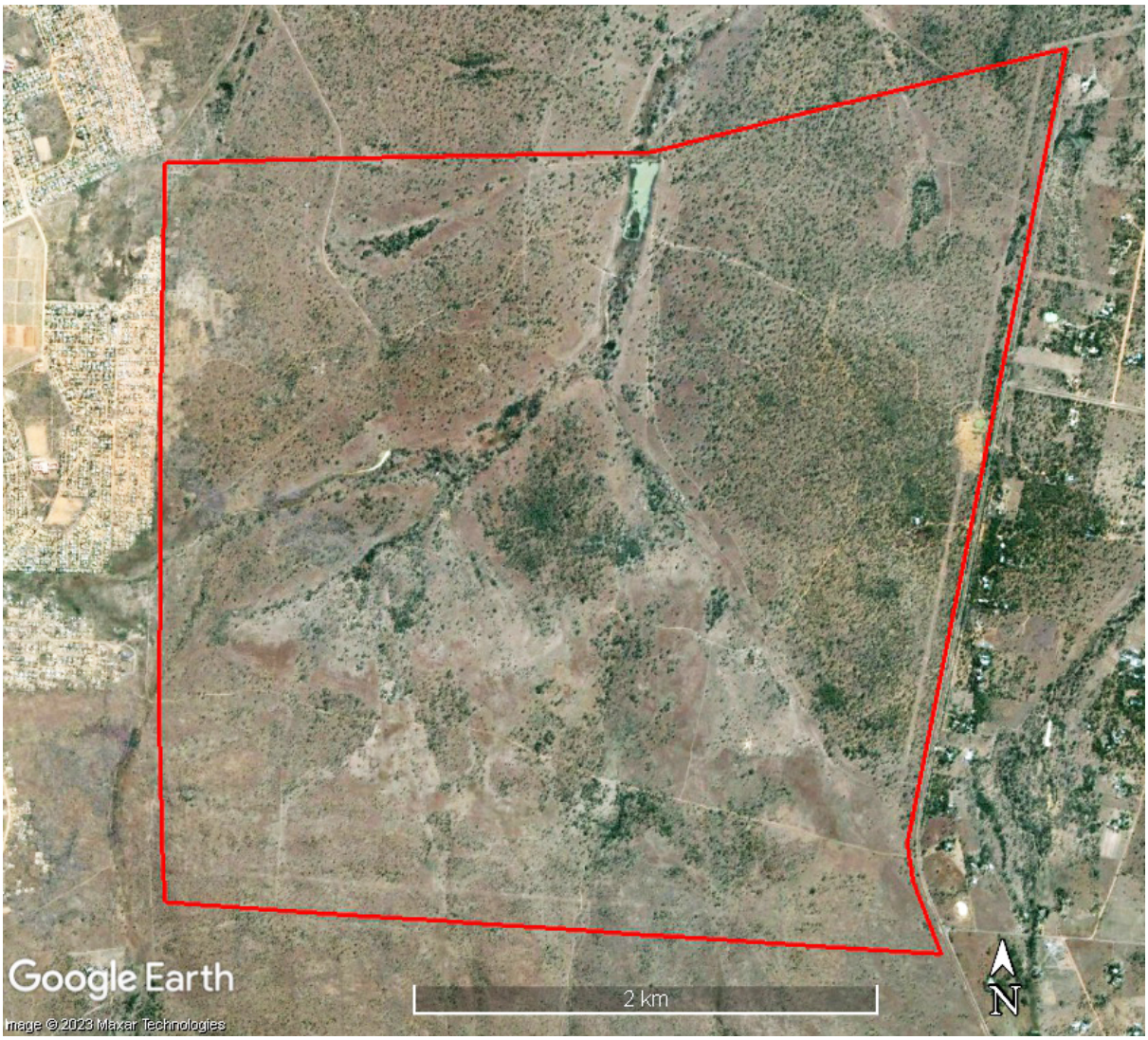

Figure 2 Google Earth Pro map of the study area for **June 2004**.

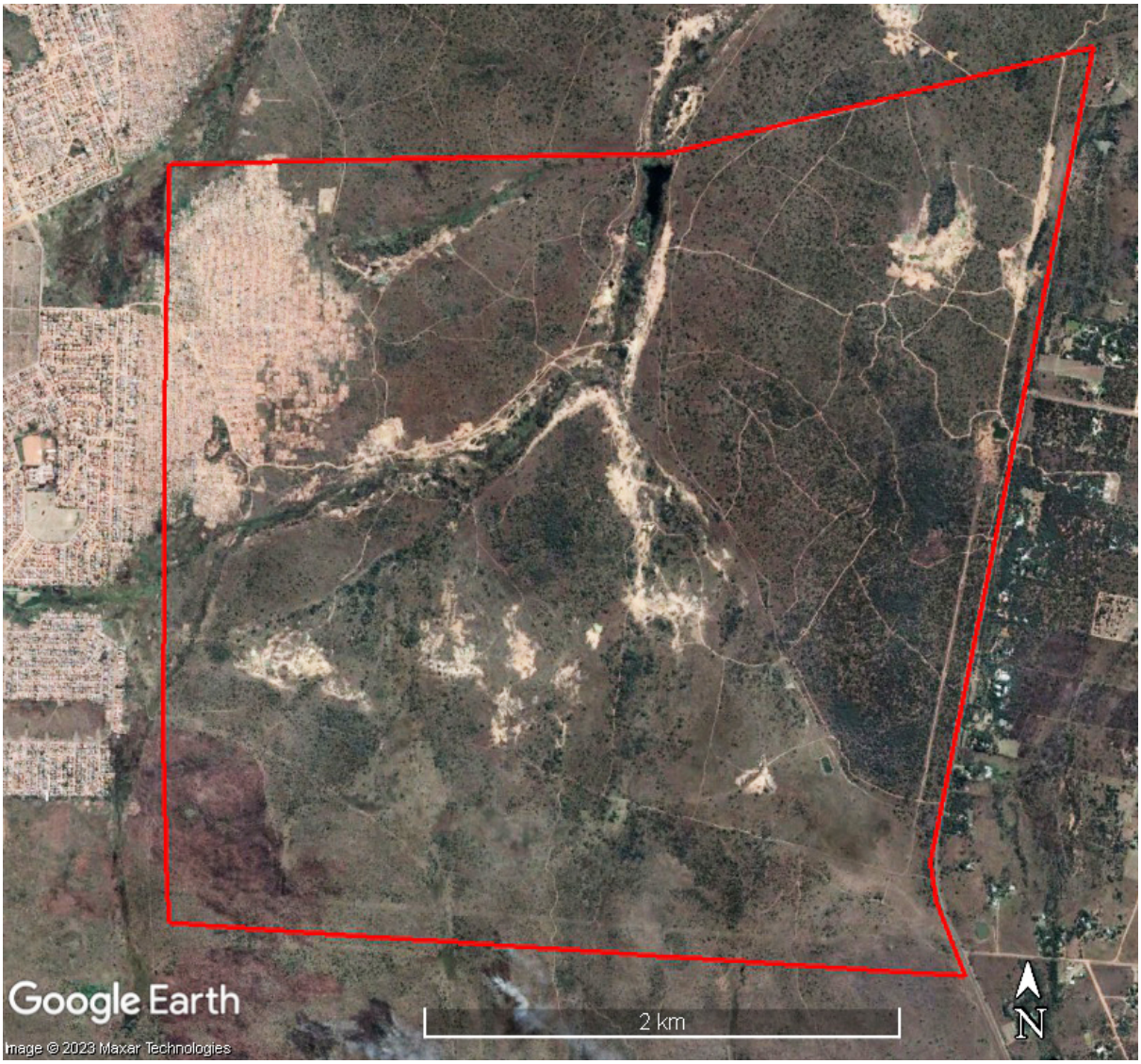

Figure 3 Google Earth Pro map of the study area for **February 2023**. Informal residential areas are spreading increasingly into the norheastern parts of the site. Extensive excavations and groundworks are taking place at many parts of the site including at the active channels and riparian zones.

Figure 4 Google Earth Pro map of a central-western part of the site where excavations and transformation of ecosystems at the site have been extensive. Grid reference coordinates are given as a reference point.

Figure 5 Google Earth Pro map of a central-eastern part of the site where excavations and transformation of ecosystems at the site have been extensive. Grid reference coordinates are given as a reference point.

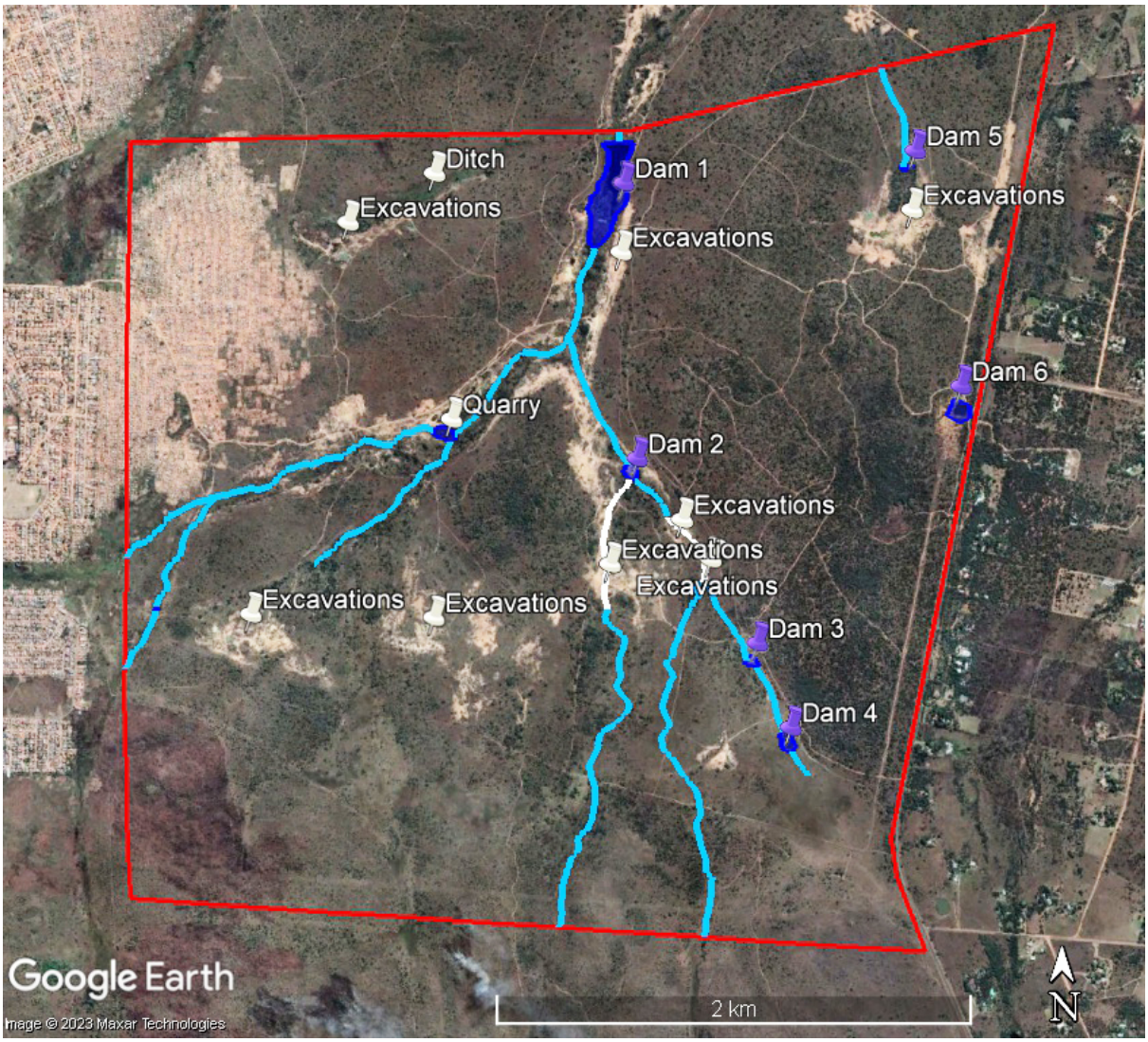

Figure 6 Indication of non-perennial rivers (active channels, riparian zones), dams and excavations at the site.

Light blue outline	Route of active channel at the site
Dark blue outline and shading	Artificial waterbodies (excavated or with groundwall)
Green outline and shading	Riparian zone

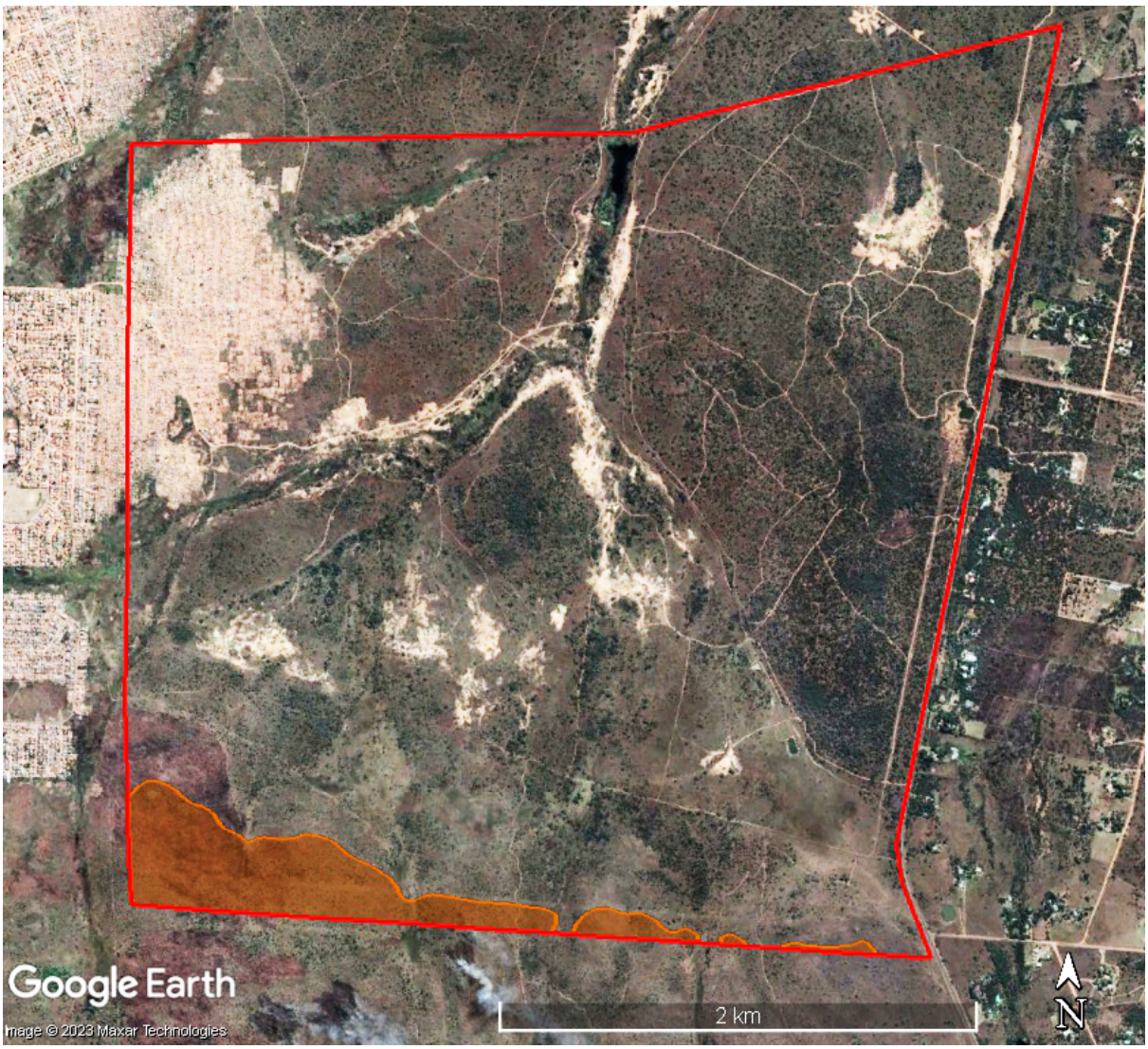

Figure 7 Indication of rocky ridges at the site.

Brown outline and shading	Rocky ridges

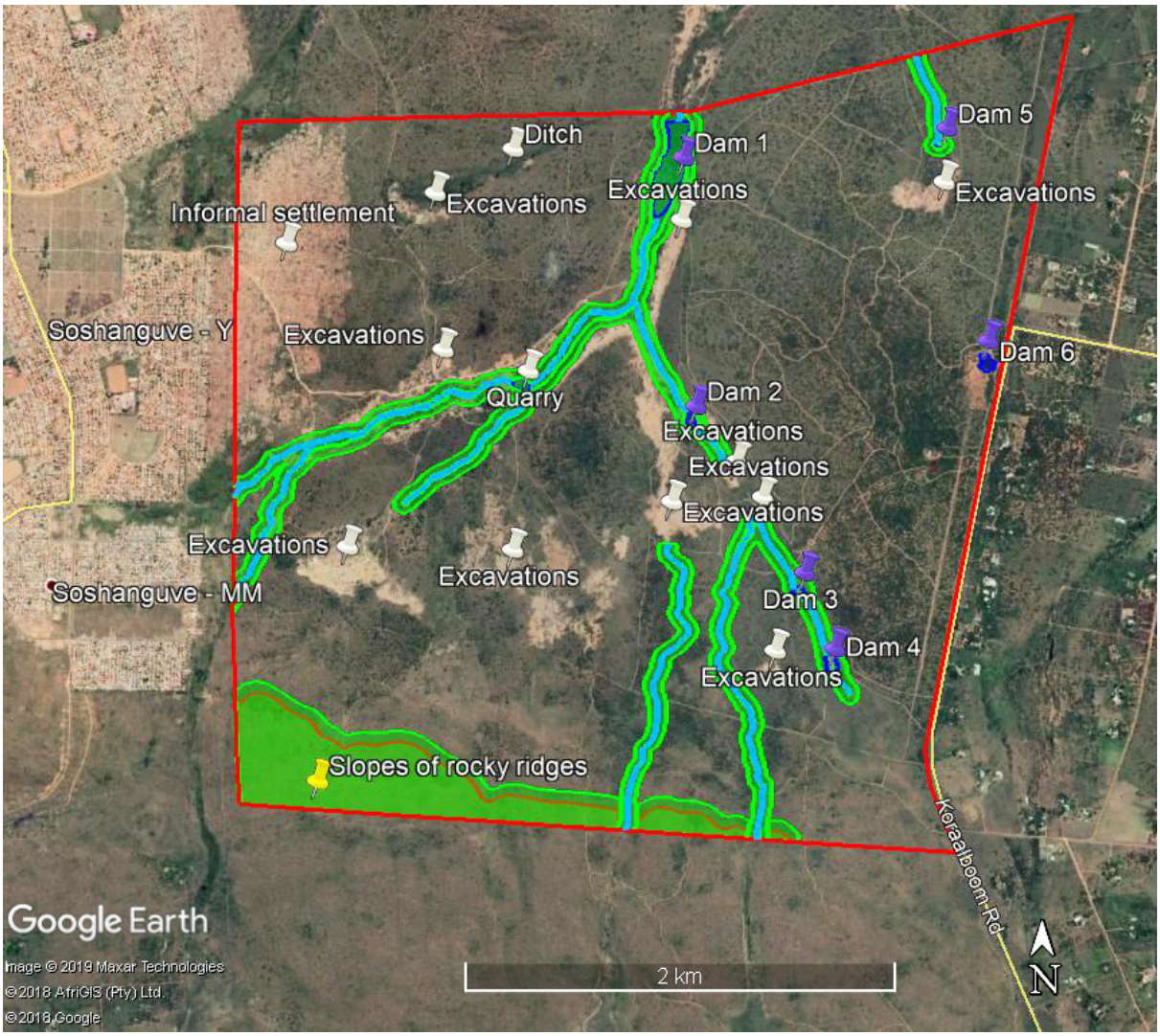

Figure 8 Indication of non-perennial rivers (active channels, riparian zones), dams and excavations at the site. Rocky slopes that enter the southwestern parts of the site are also depicted. An indication is also given of the buffer zones of the riparian areas as well as where the slopes of rocky ridges enter the site.

Light blue outline	Route of active channel at the site
Dark blue outline and shading	Artificial waterbodies (excavated or with groundwall)
Green outline and shading	Buffer Zone

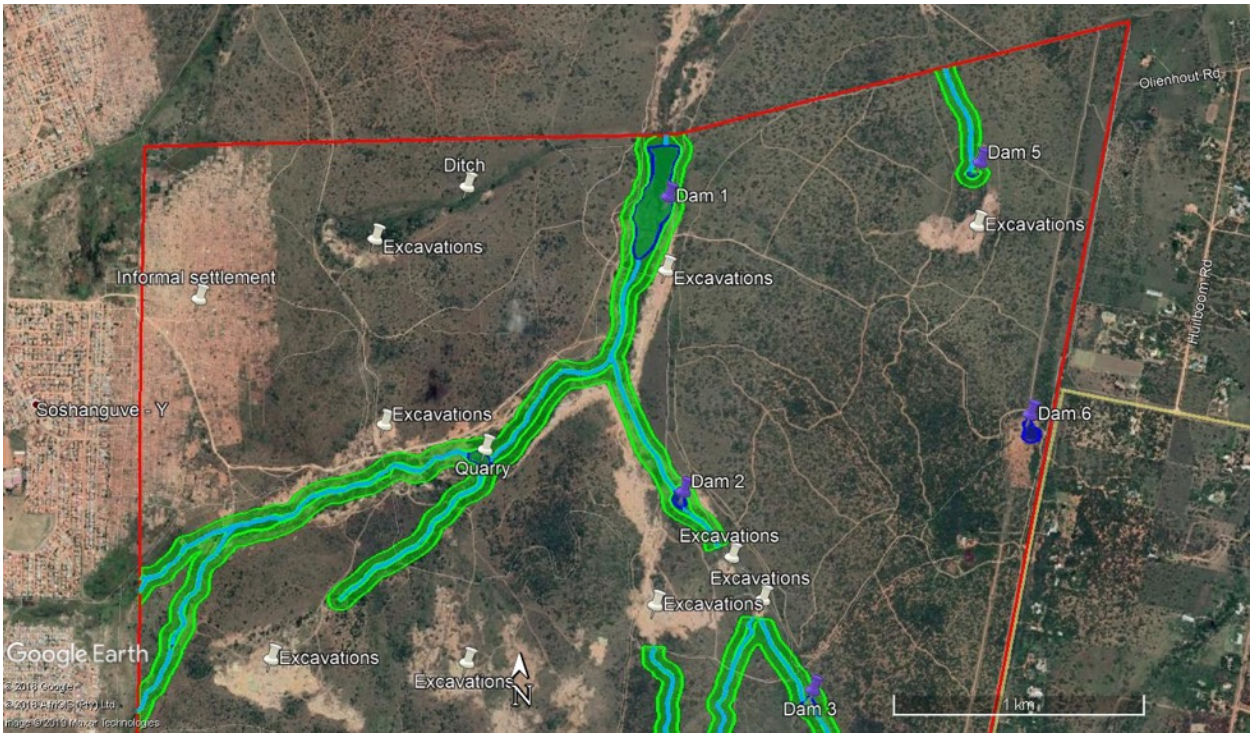

Figure 9 Indication of non-perennial rivers (active channels, riparian zones), dams and excavations at the northern parts of the site. An indication is also given of the buffer zones of the riparian areas.

Light blue outline	Route of active channel at the site
Dark blue outline and shading	Artificial waterbodies (excavated or with groundwall)
Green outline and shading	Buffer Zone

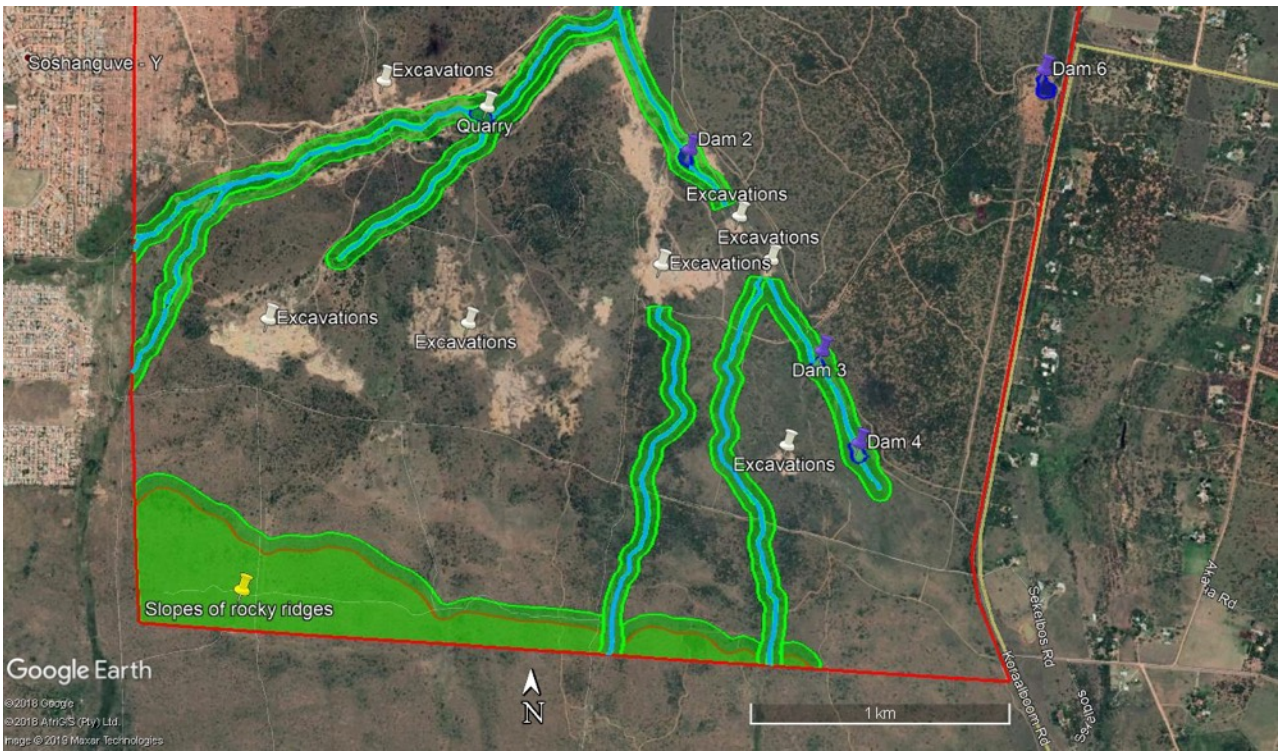

Figure 10 Indication of non-perennial rivers (active channels, riparian zones), dams and excavations at the southern parts of the site. Rocky slopes that enter the southwestern parts of the site are also depicted. An indication is also given of the buffer zones of the riparian areas as well as where the slopes of rocky ridges enter the site.

Light blue outline	Route of active channel at the site
Dark blue outline and shading	Artificial waterbodies (excavated or with groundwall)
Green outline and shading	Buffer Zone

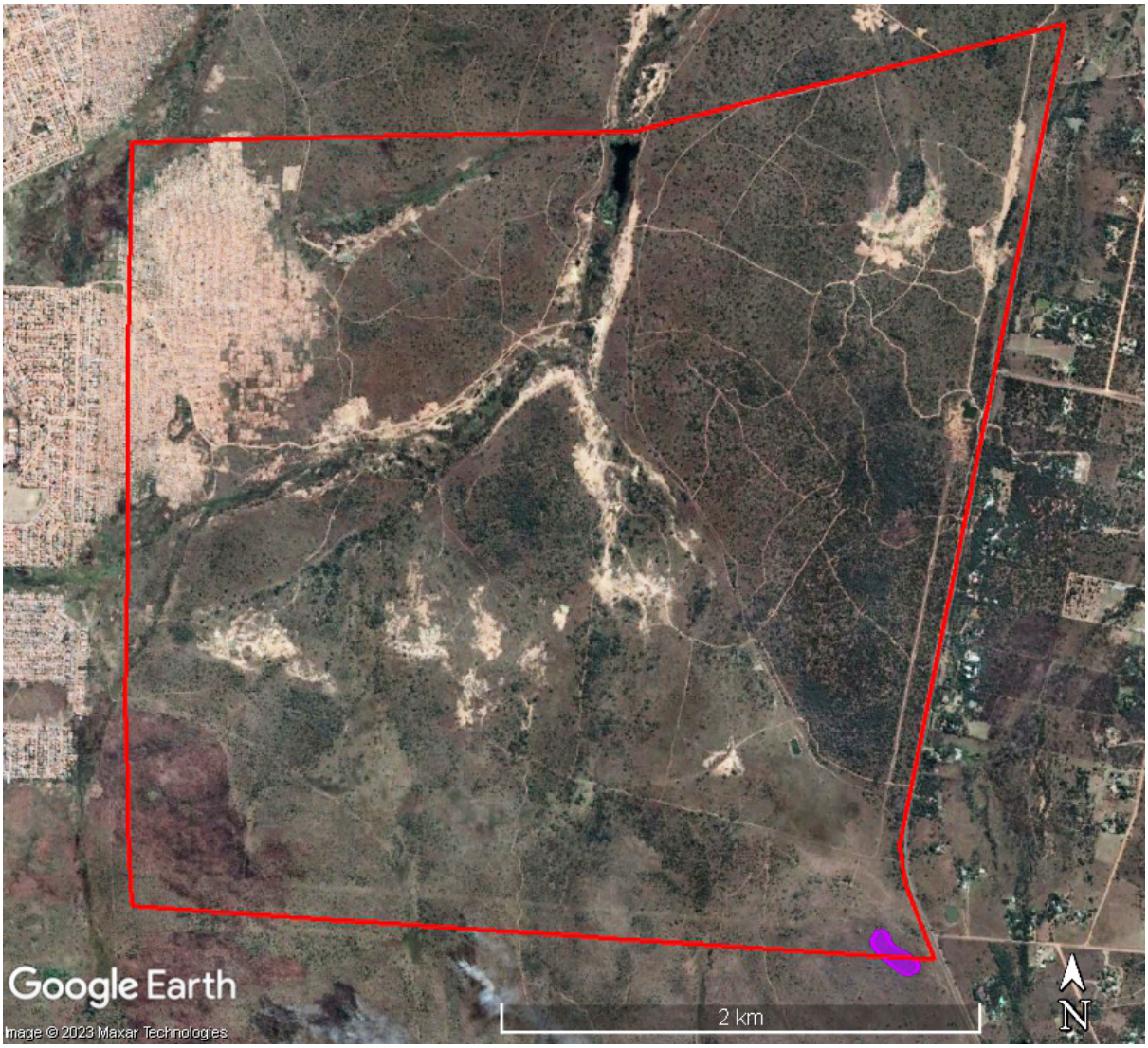

Figure 11 Indication of a locality where the Near Threatened plant species *Searsia gracillima* var. *gracillima* has been found at the southeastern part of the site.

Purple outline and shading	Area where *Searsia gracillima* var. *gracillima* has been found.

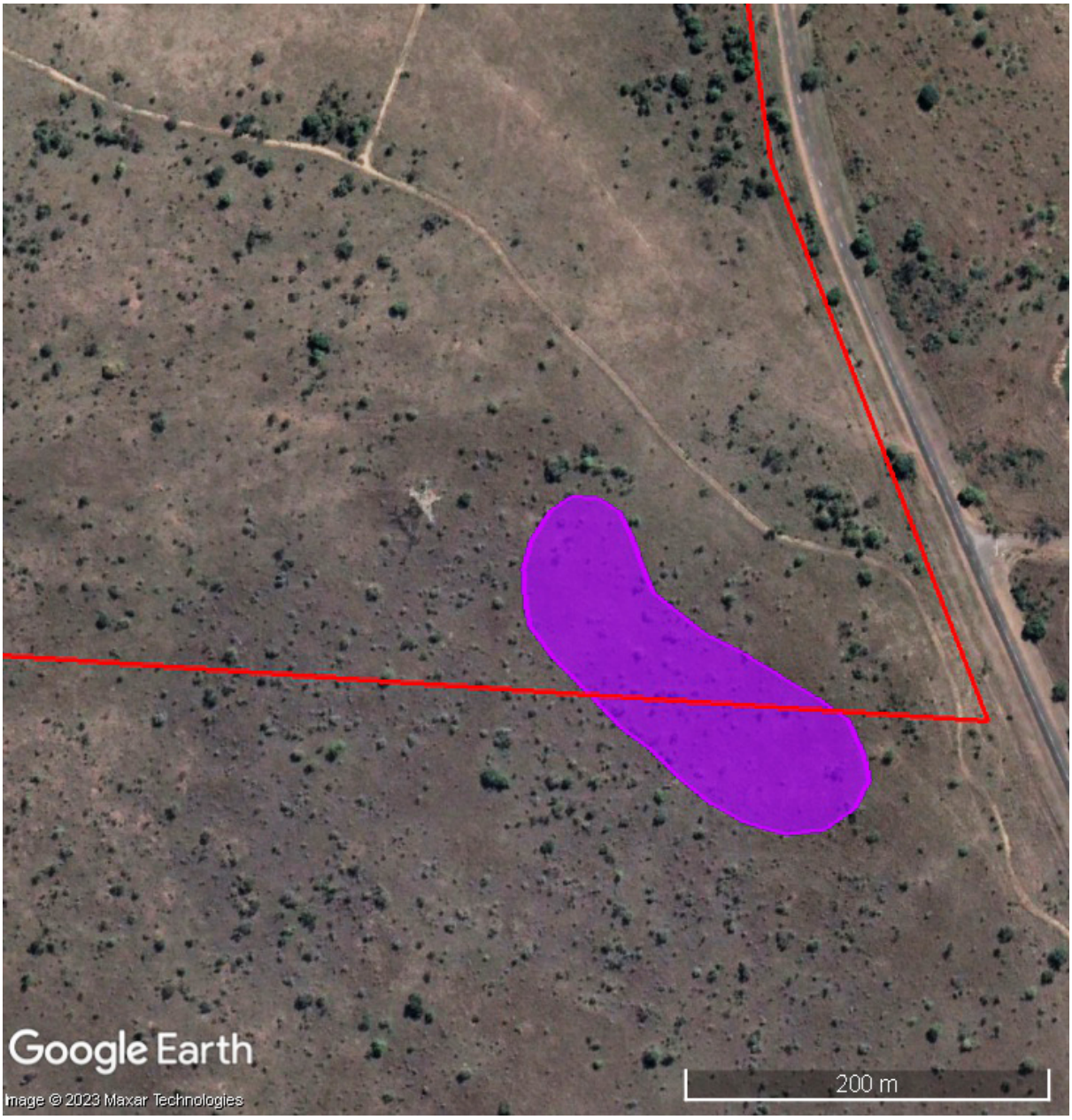

Figure 12 Indication of a locality where the Near Threatened plant species *Searsia gracillima* var. *gracillima* has been found at south-eastern part of the site.

Purple outline and shading	Area where *Searsia gracillima* var. *gracillima* has been found

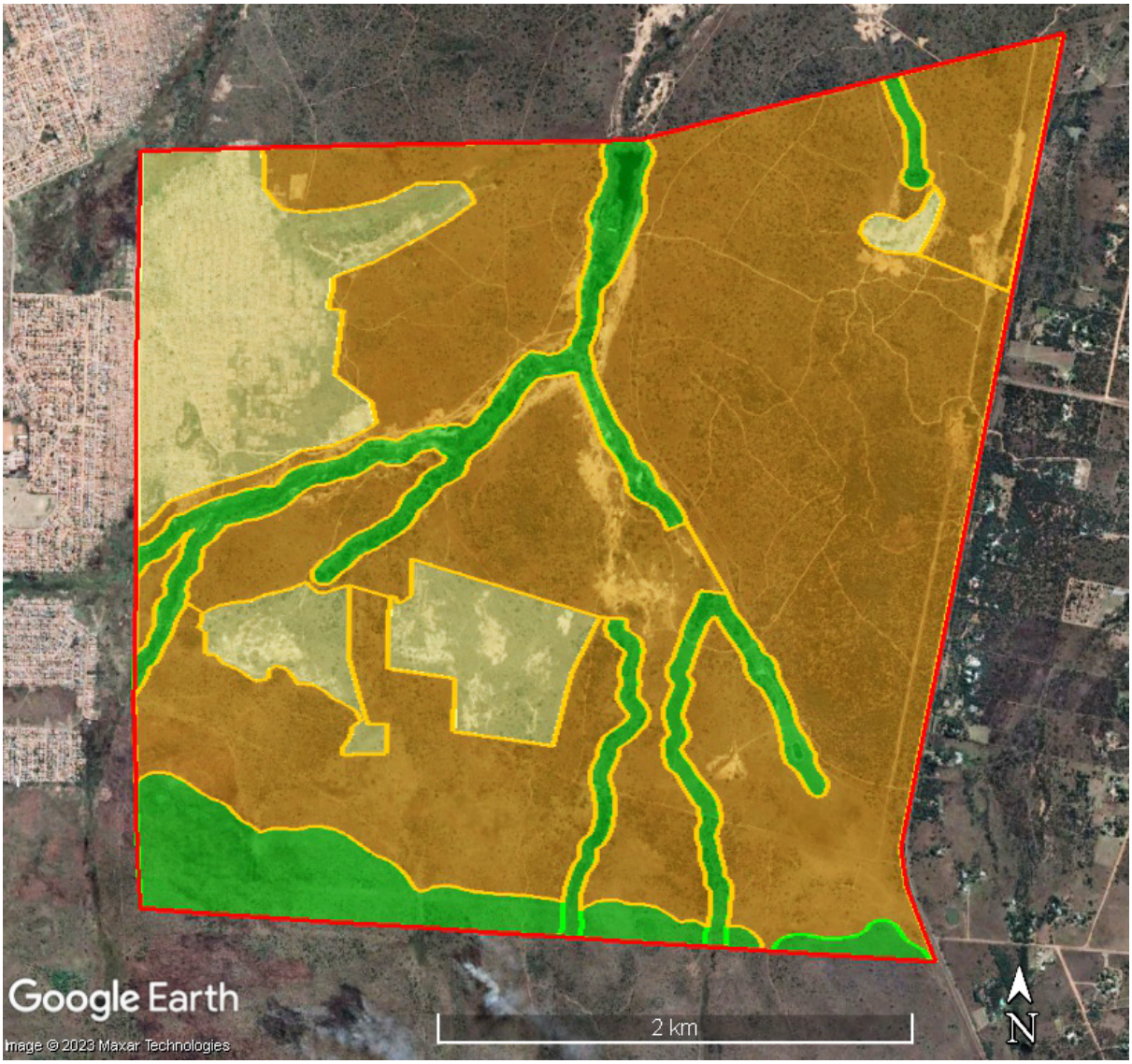

Figure 13 Indications of ecological sensitivity at the site.

Red outline	Boundaries of the site
Light yellow outline and shading	Low Sensitivity
Orange outline and shading	Medium Sensitivity
Green outline and shading	High Sensitivity

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 resent 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:

Many areas at the site are disturbed, in particular, by extensive excavations. Remaining patches of open savanna contain a diversity of indigenous plant species. Alien invasive trees and herbaceous weeds are noticeable at ecologically disturbed areas in particular at areas where excavations took place in the past.

No wetlands appear to be present at the proposed site for the development. Non-perennial rivers, with their active channels and riparian zones, are present at the site. Artificial waterbodies, mostly in-channel dams, with groundwalls, are also present at the site. Water gather at numerous excavations at the site. Riparian vegetation at the site contains the indigenous reed *Phragmites mauritianus.* Other wetland plant species such as *Cyperus* species, *Schoenoplectus* species (Cyperaceae), *Persicaria* species (Knot-weeds) and *Juncus* species (Juncaceae) occur along the fringes of the dams and active channels at the site. In many areas the riparian zones are extensively modified or transformed by removing vegetation and soil as part of extensive excavations and groundworks.

Slopes of rocky ridges enter the southern parts of the site.

One protected tree species *Sclerocarya birrea* (Marula), is sparsely distributed at the site. In terms of a part of section 15(1) of the National Forests Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister.

Apart from the above Protected plant species no loss of sensitive species is anticipated. The habitat of the Near Threatened plant species *Searsia gracillima* var. *gracillima* is avoided in the proposed footprint.

Though the riparian zones and active channels (of non-perennial rivers) are modified and transformed in many areas they remain important conservation corridors. A rehabilitation plan and actions are strongly recommended. In the case of this site the 32 m may not be practical at all areas.

If the development is approved a key aim should be to cultivate indigenous vegetation at the site and in particular at any corridors.

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 partial destruction of habitat of medium to low ecological sensitivity.
Status	Negative
Mitigation Required	Active channels and riparian zones with 32 m bufferzone are excluded from the development. Artificial waterbodies and 32 m bufferzones are excluded from the development.
Impact Significance (Pre-Mitigation)	High
Impact Significance (Post-Mitigation)	Low
RISK	Following the mitigation measures a low 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. A protected (but not threatened) tree species *Sclerocarya birrea* (Marula) is present at the site.
Status	Negative.
Mitigation Required	Mitigation measures for protected tree species: • A permit at the relevant authorities should be applied for in case of any damage or removal of individual trees of *Sclerocarya birrea* (Marula) trees, if the development is approved.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
RISK	If permit application procedure for protected trees and some trees are retained, the risk of significant impact is low.

Aspect/Activity	Fragmentation of corridors of particular conservation concern

Type of Impact (i.e. Impact Status)	Direct
Potential Impact	While there is little scope for most of the site to be part of a corridor of particular conservation importance. Though the riparian zones and active channels (of non-perennial rivers) are modified and transformed in many areas they remain important conservation corridors.
Status	Negative
Mitigation Required	Active channels and riparian zonez with 32 m bufferzones are excluded from the development. Small artificial waterbody and 32 m bufferzones are excluded from the development.
Impact Significance (Pre-Mitigation)	High
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 *Melia* azedarach (Syringa) or alien invasive Australian *Acacia* species (Australian Wattles) that should not be allowed to establish. Once established these 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 *Melia azedarach* (Syringa) and alien invasive Australian *Acacia* species (Australian wattles) 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	Keep disturbance to less sensitive area. Avoid non-perennial rivers and their buffer zones. Avoid artificial waterbodies and their buffer zones.	High	Moderate	High
Loss of sensitive species	Loss of sensitive species (Note no Threatened species or Near-threatened species)	Negative	Site	Long-Term	Very low (No species anticipated)	Unlikely	Not applicable	Not applicable	Permit application for protected tree species and retention of some of the protected trees at some areas.	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	Demarcate and avoid riparian zones and buffer zone. Demarcate and avoid artificial waterbodies and and buffer zones.	High	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	High	Low	High

6.5 Summary of risks and impacts

Many areas at the site are disturbed, in particular, by extensive excavations. Remaining patches of open savanna contain a diversity of indigenous plant species. No wetlands appear to be present at the proposed site for the development. Non-perennial rivers, with their active channels and riparian zones, are present at the site. Artificial waterbodies, mostly in-channel dams, with groundwalls, are also present at the site. Water gathers at numerous excavations at the site. Riparian vegetation at the site contains the indigenous reed *Phragmites mauritianus.* Other wetland plant species such as Cyperus species, *Schoenoplectus* species (Cyperaceae), *Persicaria* species (Knot-weeds) and *Juncus* species (Juncaceae) occur along the fringes of the dams and active channels at the site. In many areas the riparian zones are extensively modified or tranformed by clearing of vegetation by groundworks and excavations. Slopes of rocky ridges enter the southern parts of the site.

One protected tree species *Sclerocarya birrea* (Marula), is sparsely distributed at the site. In terms of a part of section 15(1) of the National Forests Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister. Apart from the above Protected plant species no loss of sensitive species is anticipated. The habitat of the Near Threatened plant species Searsia gracillima var. gracillima is avoided in the proposed footprint. No Threatened animal- or plant species are present at the site.

Though the riparian zones and active channels (of non-perennial rivers) are modified and transformed in many areas they remain important conservation corridors. A rehabilitation plan and actions are strongly recommended. In the case of this site the 32 m may not be practical at all areas.

If the development is approved a key aim should be to cultivate indigenous vegetation at the site and in particular at any corridors.

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

7 CONCLUSION

- Extensive excavations and groundworks have transformed large parts of the site including areas at and along the riparian zones at the site. The extent of these excavations and groundworks are beyond comprehension and would warrant an investigation beyond the scope of this report.
- Informal settlements are spreading in the north-western part of the site.
- The degradation of the site is not only clearly visible on land but also in a comparison of Google Earth Pro images of the past (2004) and at present (2023) (Figure 2 and Figure 3).
- Informal dumping has visibly increased in recent years.
- Fences have currently been taken away at the site. Cattle roam at parts of the site. Signs of larger vertebrates such as megaherbivores, appear to have decreased and the presence of larger game at the site, currently, is uncertain. The functioning of the Sterkwater Nature Reserve is in doubt.
- Remaining patches of open savanna contain a diversity of indigenous plant species.
- No wetlands appear to be present at the proposed site for the development. Non-perennial rivers, with their active channels and riparian zones, are present at the site. Artificial waterbodies, mostly in-channel dams, with groundwalls, are also present at the site. Water gathers at numerous excavations at the site. Large scale removal of soil modified or transformed large parts of the active channels and riparian zones of the non-perennial river systems at the site.
- Site is part of the Crocodile (West) and Marico Water Management Area (WMA 3). The site is not part of a Freshwater Ecosystem Priority Area (FEPA) or wetland cluster (Nel *et al.*, 2011a, 2011b).
- Slopes of rocky ridges at the southern parts of the site contains vegetation in fairly good condition, with a diversity of indigenous plant species. Slopes of rocky ridges which enter the southern parts of the site are excluded from the proposed footprint and forms part of a conservation area at the site and south of the site which is imperative and to be commended.
- Site is part of the savanna vegetation type, Central Sandy Bushveld (SVcb 12) which is not listed as threatened according to the National List of Threatened Ecosystems (2011).
- No Threatened animal- or plant species appear to be resident at the site.

- The Near Threatened plant species *Searsia gracillima* var. *gracillima* has been found in the south-eastern parts of the site. This part of the site is avoided in the proposed footprint so that *Searsia gracillima* is not anticipated to be affected.
- The brown hyaena (*Parahyaena brunnea*) could be present at the site from time to time or be resident at the larger area. Brown hyaenas can travel far and also has the ability to survive at or close to urban areas (Skinner & Chimimba, 2005). It is difficult to ascribe a certain part of the site or the larger study area to the brown hyaena or to ascertain whether the species is still present at the site and surrounding areas. No distinct threat to the brown hyaena is anticipated if the development is approved.
- The Declining species *Boophone disticha* occurs at some rocky slopes which are not included in the proposed footprint at the site and therefore unlikely to be impacted.
- One protected tree species *Sclerocarya birrea* (Marula), is sparsely distributed at the site. In terms of a part of section 15(1) of the National Forests Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister.
- A permit at the relevant authorities should be applied for in case of any damage or removal of individual trees of *Sclerocarya birrea* (Marula) trees, if the development is approved.
- Apart from the above Protected plant species no loss of sensitive species is anticipated if the development is approved according to a footprint that excludes the slopes of rocky ridges that enter the southern parts of the site as well as the area at southeastern part of the site where the Near Threatened plant species *Searsia gracillima* var. *gracillima* is found.
- Possible ecological sensitivities at the site were indicated by a report generated from the screening tool of DFFE. These ecological sensitivities that could possibly/ are present at the site, follow.
- *Animal species theme sensitivity*

  Relative animal species theme sensitivity is high at an area associated with the larger dam at the northern parts of the site, as well as the southeastern part of the site. For the larger part of the site the animal species theme sensitivity is medium. At the northwestern part of the site a low animal species theme sensitivity is listed. The avifaunal species *Tyto capensis*, *Mycteria ibis*, *Podica senegalensis*, *Hydroprogne caspia* and *Eupodotis senegalensis*, the mammal species *Dasymys robertsii* and *Neamblysomus julianae* as well as the reptile species *Kinixys lobatsiana* are flagged for the site area. The African Grass-owl, *Tyto capensis* often occurs in

treeless areas associated with damp substrata, mainly marshes and vleis (Hockey, Dean & Ryan, 2005). *Tyto capensis* favours patches of tall, rank grass, sedges or weeds (Armstrong, 1991). Roost sites can develop into “caves” in grass that are interconnected by tunnels and open landing platforms (Hockey, Dean & Ryan, 2005). No signs of *Tyto capensis* that inhabits the site, were observed. It appears unlikely based on the habitat at the site that *Tyto capensis* would be present. The habitat of the Yellow-billed Stork, *Mycteria ibis*, comprises wetlands, including alkaline and freshwater lakes, rivers, dams, flooded grassland and small pools or streams, less often marine mudflats and estuaries (Hockey, Dean & Ryan, 2005). *Mycteria ibis* is widespread over most of sub-Saharan Africa but in southern Africa largely absent from the Namib Desert, Kalahari Basin and Karoo (Hockey, Dean & Ryan, 2005). While *Mycteria ibis* could visit the site there is no distinct indication that the site would impact the species. The African Finfoot, *Podica senegalensis*, mostly occurs at quiet, wooded streams and rivers, flanked by thick riparian vegetation and overhanging trees (Hockey, Dean & Ryan, 2005). Presence of *Podica senegalensis* at the site is unlikely. The Caspian Tern, *Hydroprogne caspia* (Caspian Tern) is found worldwide apart from South America and Antarctica. In southern Africa *Hydroprogne caspia* occurs around entire coast and inland in Botswana, central-eastern South Africa and southern Mozambique (Hockey, Dean & Ryan, 2005). Along the coast *Hydroprogne caspia* is present mostly in sheltered bays and estuaries. Inland in southern Africa *Hydroprogne caspia* occurs at large waterbodies, natural and man-made, with preference for saline pans and large impoundments (Hockey, Dean & Ryan, 2005). Inland the species breeds on small, low islets in pans and dams (Hockey, Dean & Ryan, 2005). The white-bellied bustard, *Eupodotis senegalensis*, is patchily distributed in the Afrotropics from western Africa to South Africa. The subspecies that occurs in South Africa is near-endemic of which many populations appear to be localized. The habitat of *Eupodotis senegalensis* comprises fairly tall, dense grassland, especially sour and mixed grassland, in open or lightly wooded, undulating to hilly country (Hockey, Dean & Ryan, 2005). No *Eupodotis senegalensis* has been observed at the site. There is no distinct reason why *Eupodotis senegalensis* would occur at the site. Juliana’s Golden Mole, *Neamblysomus julianae,* has been recorded few at widely separated localities in South Africa in the past which includes Pretoria, the Nyl floodplain and the Pretoriuskop area of the Kruger National Park (Skinner & Chimimba, 2005). *Neamblysomus julianae* is endemic to the Savanna Biome where it is confined to sourish bushveld on sandy soil (Bronner, 1995). At the Pretoria area it occurs at sandy soils with rocky outcrops in the Bronberg (Willlows) area. There are no indications that *Neamblysomus julianae* occurs at the site. *Dasymys robertsii* is patchily distributed in the lowveld of northern South Africa and Zimbabwe. In South Africa *Dasymys*

robertsii occurs predominantly in the Limpopo, Mpumalanga and Gauteng Provinces (Mullin *et. al.*, 2005). Power (2014) recorded the *D. robertsii* in the North West Province at a tributary of the Waterkloofspruit at Kgaswane. The Lobatse hinged-back tortoise, *Kinixys lobatsiana,.* is found in southeastern Botswana and in South Africa from the north-eastern parts of the North West Province, through northern Gauteng, northwestern parts of Mpumalanga and into the Limpopo Province south of the Soutpansberg (Bates *et. al.*, 2014). *Kinixys lobatsiana* is present in savanna habitats, though absent from the subtropical lowveld, and is also absent from the highveld grassland (Bates *et. al.*, 2014). Vegetation at its habitats ranges from dens, short bushveld to open tree savanna. The tortoise species prefers rocky hillsides and rocky ridges (Boycott & Bourquin, 2000). Habitat which could sustain the tortoise appears to exist at the site. No tortoises have been found at the site. There is no distinct indication that the animal species listed above occur on the site. Some vegetation in good condition remains at the rocky ridges at the southern part of the site as well as some patches at the eastern part of the site. The site is increasingly disturbed, negative urban edge effects are present, large-scale groundworks are taking place and the site is increasingly isolated.

- *Aquatic biodiversity theme sensitivity*

  Relative aquatic biodiversity theme sensitivity at the site is listed as very high owing to the possible presence of wetlands and estuaries. Riparian zones, in-channel dams and artificial dams (that approaches quarries) were found at the site. Large-scale groundworks at and along the riparian zones and active channels have transformed large areas at the site. The scale to which riparian zones have been destroyed is considerable.

- *Plant species theme sensitivity*

  Relative plant species theme sensitivity is low and medium. A species that is prone to harvesting is listed. In this report possible sensitive plant species of which the likely presence or absence have been investigated are listed in Tables 4.2 – 4.9 and include plant species on a local and provincial scale which could be prone to harvesting. One species that is not threatened but which is a nationally protected tree species, *Sclerocarya birrea*, Marula has been noted at the site. For most of the site this protected tree is absent or occurs sparingly. An area at the eastern part of the site contains some areas where larger individuals of these protected trees have been found more concentrated. If the development is approved and the removal/ distruction of these Sclerocarya birrea (Marula) trees cannot be avoided, a permit should be applied for. A locality for the near threatened plant species, *Searsia gracillima* var. *gracillima* has been found at the southeastern part of the site. This locality (which is possibly new for the species) of *Searsia*

gracillima var. *gracillima* underscores the higher sensitivity of the southern part of the site. No Threatened plant species have been flagged for the site area by the screening tool and no Threatened plant species have been found at the site.

- *Terrestrial biodiversity theme sensitivity*
  Relative terrestrial biodiversity at the site is very high. This high sensitivity that is ascribed to the site area, is because of the presence of Critical Biodiversity Area 2, the presence of an Ecological Support Area and the presence of the Sterkwater Private Nature Reserve. During surveys at the site, it was found that the original vegetation type has been transformed or modified at large parts of the site. The southern parts of the site where a rocky ridge is also present ramained in fairly good condition and warrants conservation. Informal residences entered considerable areas of the western part of the site. Riparian zones at large parts of the site have been largely destroyed and transformed. The functioning of the Sterkwater Private Nature Reserve is in doubt at present. Fences have been removed. For large parts of the site the ecological integrity appears to be low or medium but not high.
- Though the riparian zones and active channels (of non-perennial rivers) are modified and transformed in many areas they remain important conservation corridors. A rehabilitation plan and actions are strongly recommended.
- Ecological sensitivity at most of the site is medium. The ecological sensitivity at increasingly larger parts of the site is low. Some of the terrestrial areas are of low sensitivity where these terrestrial areas have been degraded and transformed by extensive excavations and groundworks as well as informal residences. Ecological sensitivitty at the non-perennial rivers, their riparian zones and buffer zones as well as the artificial waterbodies at the site is high (Figure 13). The main reason for the high sensitivity of the active channel and riparian zones is only based on their importance as conservation corridors and not on the poor current state of the active channels and riparian zones. Rocky slopes and their bufferzones at the southwestern parts of the site are also of high ecological sensitivity (Figure 13). The area where the Near Threatened plant species *Searsia gracillima* var. *gracillima* has been found at the site, is of high ecological sensitivity.
- Reconstruction of active channels and riparian zones are imperative in many areas. Where the active channel routes have been destroyed these should be reconstructed to link the riparian systems at the site.
- In the case of this site a 32 m buffer zone is recommended.

- If the development is approved a key aim should be to cultivate indigenous vegetation at the site and in particular at conservation corridors.
- Following the mitigations which will be upheld and planned footprint for development all the impact risks listed above are moderate, low or very low.

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ANNEXURE 1: Plants

List of plant species recorded at the site.

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 (2013), Crouch, Klopper, Burrows & Burrows (2011), Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), McMurtry, Grobler, Grobler & Burns (2008), Smit (2008), Van Ginkel *et al*. (2011), Van Jaarsveld (2006), Van Wyk & Smith (2003).

TAXON	COMMON NAMES	FAMILY
ANGIOSPERMAE: MONOCOTYLEDONS		
Albuca setosa	Fibrous Slime Lily	HYACINTHACEAE
Aloe davyana		ASPHODELACEAE
Aloe pretoriensis		
Aristida adscensionis	Annual Three-awn	POACEAE
Aristida canescens	Pale Three-awn	POACEAE
Aristida congesta	Three-awn	POACEAE
Asparagus laricinus	Common Wild Asparagus	ASPARAGACEAE
Asparagus suaveolens		ASPARAGACEAE
Boophone disticha	Poison Bulb	AMARYLLIDACEAE
Bulbine narcissifolia		ASPHODELACEAE
Cenchrus ciliaris	Foxtail Buffalo Grass	POACEAE
Chloris virgata	Feather-top Chloris	POACEAE
Chlorophytum cooperi	Grass Lily	ANTHERICAECEAE
Commelina africana		COMMELINACEAE
Cymbopogon pospischilii	Narrow-leaved Turpentine Grass	POACEAE
Cynodon dactylon	Couch Grass	POACEAE
Cyperus longus		CYPERACEAE
Digitaria eriantha	Common Finger Grass	POACEAE
Eleusine coracana	Goose Grass	POACEAE
Elionurus muticus	Wire Grass	POACEAE

Enneapogon cenchroides	Nine-awned Grass	POACEAE
Eragrostis chloromelas	Narrow Curly Leaf	POACEAE
Eragrostis curvula	Weeping Love Grass	POACEAE
Eragrostis lehmanniana	Lehmann's Love Grass	POACEAE
Eragrostis rigidior	Curly Leaf Love Grass	POACEAE
Eragrostis superba	Saw-toothed Love Grass	POACEAE
Heteropogon contortus	Spear Grass	POACEAE
Hyperthelia dissoluta		POACEAE
Juncus effusus		JUNCACEAE
Kyllinga alba		CYPERACEAE
Melinis repens	Natal Red Top	POACEAE
Panicum coloratum	Small Buffalo Grass	POACEAE
Panicum maximum		POACEAE
Phragmites mauritianus		POACEAE
Pogonarthria squarrosa	Herringbone Grass	POACEAE
Schoenoplectus corymbosus		CYPERACEAE
**** Sorghum halepense***	Johnson Grass	POACEAE
Themeda triandra	Red Grass	POACEAE
Typha capensis	Bulrush	TYPHACEAE
Tragus berteronianus		POACEAE
Trichoneura grandiglumis	Small Rolling Grass	POACEAE
Urochloa panicoides	Herringbone Grass	POACEAE
Urochloa mosambicensis	Bushveld Signal Grass	POACEAE
**** Yucca filamentosa***		ASPARAGACEAE
ANGIOSPERMS: DICOTYLEDONS		
**** Alternanthera pungens***	Duwweltjie	AMARANTHACEAE
Alternanthera sessilis		AMARANTHACEAE
**** Amaranthus deflexus***	Perrenial Pigweed	AMARANTHACEAE
**** Argemone ochroleuca***	White-flowered Mexican poppy	PAPAVERACEAE
Blepharis integrifolia		ACANTHACEAE
**** Bidens bipinnata***	Spanish blackjack	ASTERACEAE
**** Bidens pilosa***	Common blackjack	ASTERACEAE
Burkea africana		FABACAEAE

**** Cereus jamacaru***	Queen of the Night	CACTACEAE
Chamaecrista mimosoides	Fishbone Cassia	CAESALPINIACEAE
Chamaesyce hirta	Red Milkweed	EUPHORBIACEAE
Chamaesyce inaequilatera	Smooth Creeping Milkweed	EUPHORBIACEAE
**** Chamaesyce prostrata***	Hairy Creeping Milkweed	EUPHORBIACEAE
Chascanum hederaceum		
**** Chenopodium album***	White Goosefoot	CHENOPODIACEAE
Chrysocoma ciliata	Bitterbush	ASTERACEAE
Cleome maculata		CAPPARACEAE
Cleome monophylla	Single-leaved Spindle Pod	CAPPARACEAE
Combretum apiculatum		COMBRETACEAE
Combretum zeyheri		COMBRETACEAE
**** Convolvulus arvensis***	Field Bindweed	CONVOLVULACEAE
Convolvulus sagittatus		CONVOLVULACEAE
**** Conyza bonariensis***	Fleabane	ASTERACEAE
Conyza podocephala		ASTERACEAE
Corchorus asplenifolius		MALVACEAE
**** Datura ferox***	Large Thorn-apple	SOLANACEAE
**** Datura stramonium***	Common Thorn-apple	SOLANACEAE
Dichrostachys cinerea	Sicklebush	FABACEAE
Gazania krebsiana subsp. ***krebsiana***		ASTERACEAE
Geigeria burkei		ASTERACEAE
Gerbera viridifolia subsp. ***viridifolia***		ASTERACEAE
Gomphocarpus fruticosus	Milkweed	APOCYNACEAE
**** Gomphrena celosioides***	Bachelor's Button	AMARANTHACEAE
Grewia flava	Velvet Raisin	SPARRMANNIACEAE
Felicia muricata		ASTERACEAE
Hibiscus pusillus		MALVACEAE
**** Hibiscus trionum***	Bladder hibiscus	MALVACEAE
Hilliardiella oligicephala		ASTERACEAE
Indigofera daleoides		FABACEAE
Kyphocarpa angustifolia		AMARANTHACEAE
Lannea edulis		FABACEAE

Limeum viscosum		MOLLUGINACEAE
**** Malva parviflora***	Small Mallow	MALVACEAE
**** Medicago laciniata***	Little Burweed	FABACEAE
**** Melia azedarach***	Seringa	MELIACEAE
**** Melilotus albus***	Bokhara Clover	FABACEAE
Monsonia angustifolia	Crane's Bill	GERANIACEAE
Nidorella anomala		ASTERACEAE
**** Opuntia ficus-indica***	Sweet Prickly Pear	CACTACEAE
**** Oxalis corniculata***	Creeping Sorrel	OXALIDACEAE
Peltophorum africanum	African Wattle	FABACEAE
Pentarrhinum insipidum	African Heartvine	APOCYNACEAE
**** Plantago lanceolata***	Narrow-leaved plantain	PLANTAGINACEAE
**** Portulaca oleracea***	Purslane	POLYGONACEAE
**** Richardia brasiliensis***	Mexican Richardia	RUBIACEAE
**** Schkuhria pinnata***	Dwarf Marigold	ASTERACEAE
Sclerocarya birrea subsp. ***caffra***	Marula	ANACARDIACEAE
Searsia gracillima var. ***gracillima***		ANACARDIACEAE
Searsia lancea	Karree	ANACARDIACEAE
Searsia leptodictya	Mountain Karee	ANACARDIACEAE
Senecio coronatus	Sybossie	ASTERACEAE
Senecio consanguineus	Starvation Senecio	ASTERACEAE
Senegalia mellifera subsp. ***detinens***	Black Thorn	FABACEAE
Solanum panduriforme	Poison Apple	SOLANACEAE
**** Tagetes minuta***	Khakiweed	ASTERACEAE
Tarchonanthus camphoratus	Camphor Bush	ASTERACEAE
Terminalia sericea		COMBRETACEAE
Teucrium trifidum		LAMIACEAE
Thesium sp.		SANTALACEAE
Tribulus terrestris	Devil's Thorn	ZYGOPHYLLACEAE
Vachellia karroo	Sweet Thorn	FABACEAE
Vachellia nilotica	Scented-pod Thorn	FABACEAE
Vachellia tortilis subsp. ***heteracantha***	Umbrella Thorn	FABACEAE
**** Verbena aristigera***	Fine-leaved Verbena	VERBENACEAE

**** Verbena bonariensis***	Purple top	VERBENACEAE
Vitex zeyheri		LAMIACEAE
Waltheria indica		STERCULIACEAE
Ziziphus mucronata	Buffalo-thorn	RHAMNACEAE