

WETLAND ASSESSMENT

Aalwyndal, Mossel Bay, Western Cape



Flowers and foliage of alien invasive *Acacia cyclops* at small low-lying (possibly hitherto excavated) area at northwestern part of the site.
Photo: R.F. Terblanche

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COMPILED BY:

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

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I) SPECIALIST EXPERTISE

SYNOPTIC CV: REINIER. F. TERBLANCHE

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

Qualifications:

Qualification	Main subject matter	University
M.Sc Cum Laude, 1998: Botany: Ecology	Quantitative study of invertebrate assemblages and plant assemblages of rangelands in grasslands.	North-West University, Potchefstroom
B.Sc Honns Cum Laude, 1992 Botany: Taxonomy	Distinctions in all subjects: Plant Anatomy, Taxonomy, Modern Systematics, System Modelling, Plant Ecology, Taxonomy Project. Also completed a Statistics Attendance Course. Project about taxonomy of the plant genus <i>Haworthia</i> .	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. Most recent award: 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. Appointed as Research Fellow at College of Agriculture and Environmental Sciences, Department of Environmental Sciences, University of South Africa, from 1 January 2020.

EXPERIENCE

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

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

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

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

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

II) SPECIALIST DECLARATION

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

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

Name of Specialist: Reinier F. Terblanche



Signature of the specialist

Date: 9 January 2020

1 INTRODUCTION

A wetland assessment is required for a site at Alwyndal, Mossel Bay, Western Cape, South Africa (elsewhere referred to as the site). If wetlands would be present at the site the assessment further focuses on the hydro-geomorphic setting, an estimate of the properties of the wetlands, an assessment of the functional aspects of wetlands and an impact assessment to wetlands, should the development be approved. If riparian zones would be present an indication of the active channel and riparian zone is given.

1.1 Wetlands in South Africa

Wetlands are defined by the National Water Act (Act 36 of 1998) as:

“land which is transitional between terrestrial and aquatic ecosystems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil”.

According to *A practical field procedure for identification and delineation of wetlands and riparian areas* (DWAF 2005) wetlands must have one or more of the following attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation
- The presence, at least occasionally, of water loving plants (hydrophytes)
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil

Wetlands, according to the definition of DWAF (2005) are at the interface of aquatic systems and the terrestrial environment. As such the characteristics of the surface water or near surface water in space and time at this interface between the terrestrial and aquatic environment are fundamental to understand the functioning of a particular wetland. At the higher elevations of South Africa surface water at wetlands are characterised by considerable contrasts between seasons and periodic precipitation events. Generally accepted definitions of wetlands which focus on the wetland attributes of soil and vegetation are therefore useful because of its consistency despite seasonal fluctuations.

The Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013) includes wetland ecosystems defined by the National Water Act (Act 36 of 1998) as well as those “wetland systems” defined by the Ramsar Convention. The broader definition of wetlands, according to the Ramsar Convention is that wetlands are areas of marsh,

fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water to the depth of which at low tide does not exceed six metres (cited by Ramsar Convention Secretariat 2011). This Ramsar definition of “wetlands” overlaps broadly with the definition of aquatic systems according to the South African system of classifying wetlands and other aquatic ecosystems. In South Africa an aquatic ecosystem is an ecosystem that is permanently or periodically inundated by flowing or standing water, or which has soils that are permanently or periodically saturated within 0.5 m of the soil surface (Ollis *et al.*, 2013). Therefore an important consideration of the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013) is that a wetland (narrow definition according to water act and not Ramsar definition) is taken to be a unique type of aquatic system.

1.2 Importance of wetlands

The importance of wetlands for human well-being and the conservation of biodiversity are recognised world-wide. Ecosystem services which directly or indirectly benefit human well-being are of particular importance when wetlands are considered. Wetlands play a major role to enhance supporting services such as nutrient cycling and primary production, which in turn is the basis for other ecosystem services. Wetlands are very important to regulating services such as maintaining water flow and water quality by processing water and regulating water run-off, provisioning services such as providing freshwater, cultural services such as appreciating the landscape and biodiversity. Overall wetlands play a major role in the sustainability of land use from socio-economic and biodiversity conservation perspectives. The setting and function of wetlands at each site should therefore be evaluated to inform land use management.

Wetland vegetation is of significant importance for wetlands to play a role in valuable ecosystem services. Vegetation plays an important role in natural wetland ecosystems. It holds soil together and slows down the flow of water, reducing the risk of erosion and promoting sediment deposition. Plants are the source of organic material in wetland soils, and form the organic soil in peat wetlands. Vegetation also has an impact on the quality of surface and subsurface water as it (1) provides organic soil matter required by microbes in order to assimilate nutrients and toxicants (2) provides habitat for the microbes in the soil immediately surrounding the roots, and (3) contributes through direct uptake of nutrients and toxicants and incorporation of these into plant tissues (Sieben *et al.* 2009).

1.3 Aims and objectives of the survey

A survey to investigate key elements of habitats on the site, relevant to the conservation of wetlands is conducted. The importance and significance of the site with special emphasis on the current status of biodiversity and ecological services

of the wetland are evaluated. Literature investigations are integrated with field observations to identify potential ecological impacts that could occur as a result of the development and to make recommendations to reduce or minimise impacts, should the development be approved.

The objectives of the wetland habitat assessment are to provide:

- An indication of the existence of wetlands at the site and if so:
- An identification of major aspects of the hydro-geomorphic setting and terrain unit at which the wetland occur;
- An estimate of the size and roughness of the wetland
- An indication of the hydric soils at the site;
- An indication of erodability;
- An indication of the presence or absence of peat at the site;
- An outline of hydrological drivers that support the existence and character of the wetland;
- An assessment of the possible presence or absence of threatened or localised plant species, vertebrates and invertebrates of the region, at the site;
- A description of the functions provided by the wetland at the site;
- An interpretation of the priority of the wetland for local communities in the area;
- An interpretation of the priority of the wetland to biodiversity at the site;

2 STUDY AREA

The study area is at Aalwyndal, Mossel Bay in the Western Cape Province, South Africa (elsewhere referred to as the site). Site is situated at the Fynbos Biome which is represented by Groot Brak Dune Strandveld (FS 9) vegetation type (Mucina & Rutherford, 2006). A brief overview of the vegetation type follows.

Groot Brak Dune Strandveld FS 9

Distribution: Groot Brak Dune Strandveld is present in the Western Cape Province of South Africa. It is found at coastal stretches between the mouth of the Gouritz River as far east as Victoria Bay near Wilderness, with by far the largest area covering the flats north of Mossel Bay (along the lower reaches of the Groot Brak, Klein Brak and Hartenbos Rivers) and extending up to 17 km from the coast. Altitude 0 – 180 m (Mucina & Rutherford, 2006).

Vegetation & Landscape Features: Flats, undulating landscapes (stabilized dunes) and steep coastal slopes, covered by dense and tall (up to 3 m), spiny, sclerophyllous scrub with gaps supporting shrublands with ericoids or succulent-leaved shrubs. The graminoid layer is sparse and short (Mucina & Rutherford, 2006).

Geology & Soils: Mostly underlain by the clastic sedimentary rocks of the Kirkwood Formation (Mesozoic Uitenhage Group). In the east, quartzite, schist, and phyllite of the Kaaimans Group (Namibian Erathem) and Cape Granite (edges of high coastal cliffs) are also present. In parts along the coast, these rocks are covered by the unconsolidated dune sand of the Strandveld Formation (Bredasdorp Group). Most important land types Db and Dc (Mucina & Rutherford, 2006).

Climate: MAP varies between approximately 350 mm in the west to 750 mm in the east, with approximately 40% of the rain falling in the summer (October-March) and 60 % falling in the winter (April – September) (Mucina & Rutherford, 2006).

Important Taxa: Small Trees: *Chionanthus foveolatus*, *Clausena anisata*. Tall Shrubs: *Azima tetraacantha*, *Cussonia thyrsoiflora*, *Diospyros dichrophylla*, *Euclea racemosa* subsp. *racemosa*, *Grewia occidentalis*, *Gymnosporia buxifolia*, *Maytenus procumbens*, *Metalasia muricata*, *Morella cordifolia*, *Myrsine africana*, *Mystroxydon aethiopicum*, *Olea exasperata*, *Pterocelastrus tricuspidatus*, *Putterlickia pyracantha*, *Searsia crenata*, *Searsia glauca*, *Searsia longispina*, *Searsia lucida*, *Schotia afra* var. *afra*, *Sideroxylon inerme*, *Tarchonanthus littoralis*. Low Shrubs: *Asparagus suaveolens*, *Ballota africana*, *Carissa bispinosa* subsp. *bispinosa*, *Chironia baccifera*, *Clusia daphnoides*, *Eriocephalus africanus* var. *africanus*, *Helichrysum teretifolium*, *Lauridia tetragona*, *Phyllica axillaris*, *Polygala myrtifolia*. Succulent Shrubs: *Aloe*

arborescens, *Cotyledon orbiculata* var. *dactylopsis*, *Crassula perforata*, *Crassula pubescens* subsp. *pubescens*, *Euphorbia burmannii*, *Euphorbia mauritanica*, *Tetragonia fruticosa*, *Zygophyllum morgsana*. Woody Climbers: *Asparagus aethiopicus*, *Cissampelos capensis*, *Rhoicissus digitata*. Woody Succulent Climber: *Sarcostemma viminale*. Semiparasitic Shrubs: *Osyris compressa*, *Thesidium fragile*. Soft Shrub: *Hypoestes aristata*. Herb: *Commelina africana*. Geophytic Herbs: *Brunsvigia orientalis*, *Chasmanthe aethiopicus*, *Hesperantha falcata*. Succulent Herbs: *Carpobrotus edulis*, *Crassula expansa* subsp. *expansa*, *Senecio radicans*. Herbaceous Climbers: *Astephanus triflorus*, *Cynanchum obtusifolium*, *Kedrostis nana*. Herbaceous Succulent Climber: *Pelargonium peltatum*. Graminoids: *Cynodon dactylon*, *Ehrharta erecta*, *Ficinia indica*, *Panicum deustum*, *Stipa dregeana*.

Note: Not all of the above listed plant species for the vegetation type occur at the site in the study area.

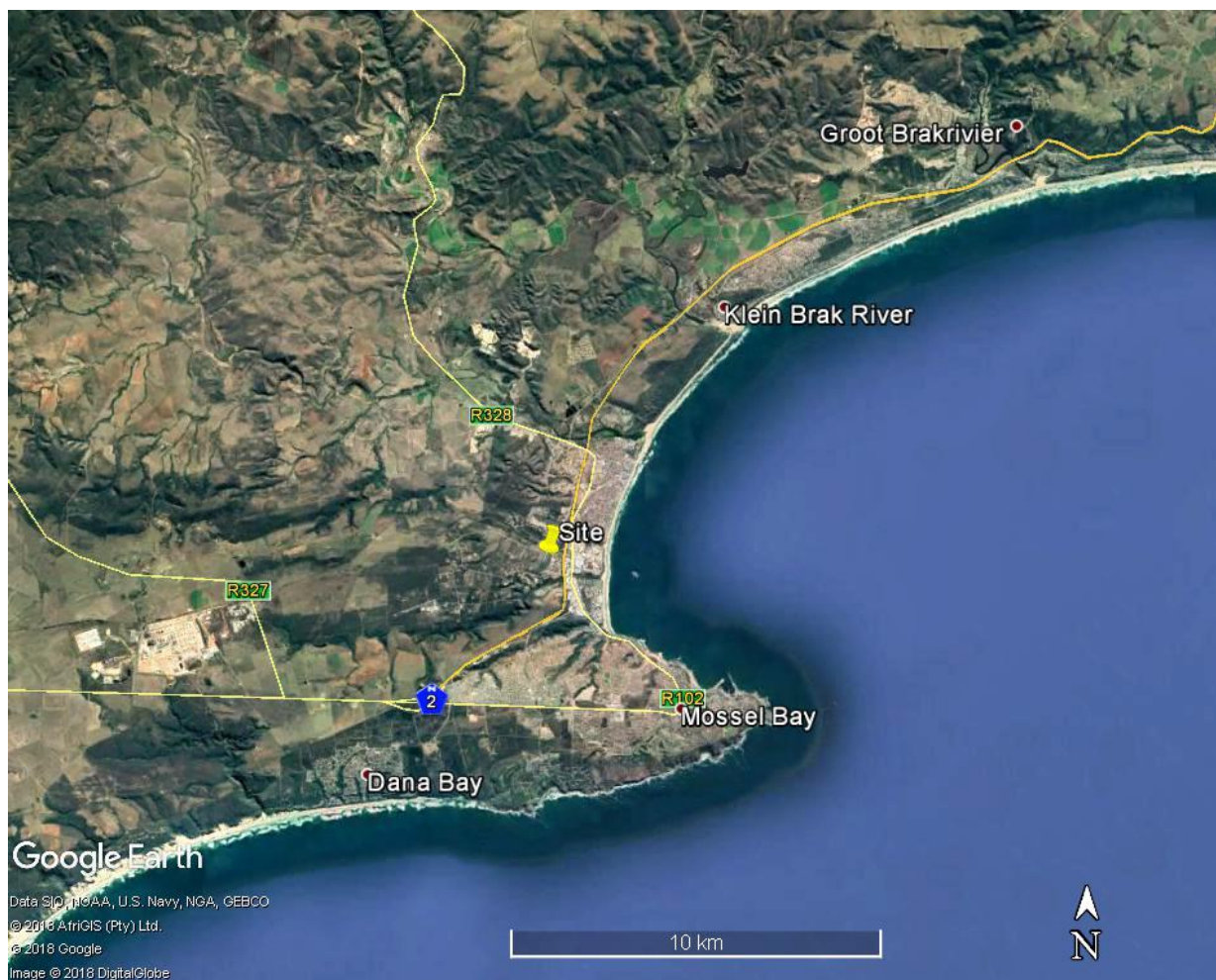


Figure 1 Map of larger area with indication of the location of the site (yellow marker).

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, 2020).

3 METHODS

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

A survey consisted of visits by R.F. Terblanche during October 2018 and December 2019 to note key elements of habitats on the site, relevant to the conservation of wetlands and riparian zones.

Classification of any inland wetland systems that could be present at the site is according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013). One of the major advantages of the Classification System for South Africa (Ollis *et al.*, 2013) is that the functional aspects of wetlands are the focal point of the classification. Wetlands are very dynamic systems and their functionality weighs high against the rapid changes in their appearance, as could be seen from wetland butterfly studies (Terblanche *In prep*). In this document the main guideline for the delineation and identification of wetlands where present is the practical field procedure for identification and delineation of wetlands by DWAF (2005).

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

3.1 Classification of wetlands (SANBI: Ollis *et al.*, 2013)

3.1.1 System, regional setting and landscape unit (Levels 1, 2 and 3)

Three broad types of Inlands Systems are dealt with in the Classification System namely rivers, open waterbodies and wetlands. These Inland Systems are then classified according to a six-tiered structure that includes six levels.

At the systems level (Level 1) of wetland classification, a distinction is made between Marine, Estuarine and Inland ecosystems using the level of connectivity to the open ocean as discriminator of the biophysical character of each (Ollis *et al.*, 2013). Inland wetland systems are aquatic ecosystems with no no existing connection to the ocean (i.e. characterised by the complete absence of marine exchange and/ or tidal influence (Ollis *et al.*, 2013). In this case if any wetland is present it obviously qualifies as an Inland wetland system.

At Level 2 the regional setting is a spatial framework that is preferred by the investigator to allow for gaining an understanding of the broad ecological context within which an aquatic system occurs (Ollis *et al.*, 2013). A regional setting can be identified according to the DWA ecoregion classification of Kleynhans *et al.* (2005).

A distinction is made between four landscape units at Level 3 of the Classification System for Inland Systems on the basis of the landscape setting (i.e. topographical position) (Ollis *et al.*, 2013). Four landscape units are recognized: slope, valley floor, plain and bench.

3.1.2 *Hydrogeomorphic units (Level 4)*

Seven primary hydrogeomorphic (HGM) units are recognised for Inland Systems at Level 4A of the Classification System for Wetlands and other Aquatic Ecosystems in South Africa, on the basis of hydrology and geomorphology (Ollis *et al.*, 2013). These are a River, Channeled valley-bottom wetland, Unchannelled valley-bottom wetland, Floodplain wetland, Depression, Seep and Wetland flat.

3.1.3 *Hydrological regime (Level 5)*

While the hydrogeomorphic unit (HGM) is influenced by the source of water and how it moves into, through and out of an Inland System, the hydrological regime (as categorised by the Classification System) describes the behaviour of the water within the system and, for wetlands, in the underlying soil (Ollis *et al.*, 2013). Together with the hydrogeomorphology the hydrological regime are used to describe the wetland as a functional unit (Ollis *et al.*, 2013). In the case of Inland wetlands which are classified as rivers, perennality is an important characteristic to describe the hydrological regime. For Inland Systems other than rivers, five categories relating to the frequency and duration of inundation have been provided: Permanently inundated, Seasonally inundated, Intermittently inundated, Never inundated/ rarely inundated and unknown (Ollis *et al.*, 2013). Period of saturation within the upper 0.5 m of the soil is a very important discriminator that also links to the wetland delineation system of DWAF (2005). The following categories for saturation of wetland soils are recognised: Permanently saturated, Seasonally saturated, Intermittently saturated and unknown. These categories of period of saturation correspond to the permanent, seasonal and temporary zones of wetlands respectively.

3.1.4 *Wetland descriptors (Level 6)*

At Level 6 several “descriptors” are included for the structural/ chemical/ biological characterisation of Inland Systems (Ollis *et al.*, 2013). These descriptors are non-hierarchical to one another and can be applied in any order depending on the purpose of a study and the availability of information. Descriptors include natural vs. artificial, salinity, substratum type, pH, geology and vegetation cover (Ollis *et al.*, 2013). Various definitions are given for the descriptors which are likely to increase the consistency and use of the system.

3.2 Delineation of wetland

Together with terrain unit, indirect indicators of prolonged saturation by water: wetland plants (hydrophytes) and wetland (hydromorphic) soils are identified and used to delineate the wetland (DWAF 2005). Three zones, which may not all three be present in all wetlands, namely the permanent zone of wetness, the seasonal zone and the temporary zone are identified. The temporary zone is the outer zone and is saturated for only a short period of the year that is sufficient, under normal circumstances, for the formation of hydromorphic soils and the growth of wetland vegetation (DWAF 2005). Hydromorphic soils must display signs of wetness within 50cm of the soil to qualify as wetland soil that can support hydrophytic vegetation. Grid references and altitudes are taken on site with a GPS Garmin E-trex 20 ® instrument. Map information are analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2012).

3.3 Vegetation at and near wetland

Though vegetation is a key component of the wetland definition in the Water Act, using vegetation as a primary indicator requires undisturbed conditions and expert knowledge (DWAF 2005). Modern wetland classification systems in South Africa therefore place more emphasis on the soil wetness indicators. It remains however, that plant assemblages undergo distinct changes in species composition from the centre of a wetland to the edge, and into adjacent terrestrial areas (DWAF 2005). This change in species composition of vegetation provides valuable clues for determining the wetland boundary and wetness zones (DWAF 2005).

Apart from botanical aspects which are integrated into the description of a wetland it is imperative to note the existence or not of threatened plant species or other plant species of conservation concern, such as near-threatened, data deficient or declining species at a wetland. Floristic composition is therefore also considered during the wetland assessment. Voucher specimens of plant species are only taken where the taxonomy is in doubt or where the plant specimens are of significant relevance for invertebrate conservation. Field guides such as those by Germishuizen (2003), Manning (2003), Manning (2009), Van Oudtshoorn (1999), Van Wyk (2000), Van Wyk & Malan (1998) and Van Wyk & Van Wyk (1997)

were used to confirm the taxonomy of the species. Works on specific plant groups (often genera) such as those by Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), McMurtry, Grobler, Grobler & Burns (2008), Smit (2008), Van Jaarsveld (2006) and Van Wyk & Smith (2003) were also consulted to confirm the identification of species. An important source of identifications of plant species for the wetland survey is Van Ginkel, Glen, Gordon-Gray, Cilliers, Muasya & Van Deventer (2011). In this case no plant specimens were needed to be collected as voucher specimens or to be send to a herbarium for identification. For the most recent treatise of scientific plant names and broad distributions, Germishuizen, Meyer & Steenkamp (2006) or Raimondo *et al.* (2009) or updated lists on SANBI websites are followed to compile the lists of species.

3.4 Fauna at and near wetland

Species composition of fauna is not used in wetland characterization and assessments. However, it is important to note species that favour wetlands and especially whether threatened animal species are present at a wetland or not.

Mammals are 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 are 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 are recorded. Walker (1996), Stuart & Stuart (2000) and Liebenberg (1990) are consulted for additional information and for the identification of spoor and signs. Trapping is only done if necessary. Habitat characteristics are 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 even then some species needs examination of skulls, or even chromosomes (Apps, 2000).

Birds are 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) are consulted. Ringing of birds falls beyond the scope of this survey. Sites are walked, covering as many habitats as possible. Signs of the presence of bird species such as spoor and nests are additionally been recorded. Habitat characteristics are surveyed to note potential occurrences of birds.

Reptiles are 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) are followed. Sites

are 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.

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.

Invertebrates of which enough information is available to be integrated into an assessment, such as butterflies, are recorded as sight records, photographic 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*, *Erikssonina*, *Lepidochrysops* and *Orachrysops* species (Lepidoptera: Lycaenidae), which live in association with a specific ant species, require a unique ecosystem for their survival (Deuschländer & Bredenkamp, 1999; Terblanche, Morghental & Cilliers, 2003; Edge, Cilliers & Terblanche, 2008; Gardiner & Terblanche, 2010). Known food plants of butterflies are therefore also recorded. Other invertebrate groups such as fruit chafer beetles and mygalomorph spiders are also investigated where relevant.

3.5 Present Ecological Status

Ecological status of wetlands are based on models such as the modified Habitat Integrity approach developed by Kleynhans (1996, 1999). Present ecological status PES methodology is then largely based on criteria for assessing the habitat integrity of floodplain wetlands and notes for allocating a score to attributes and rating the confidence level associated with each score (DWAF 1999). Such criteria are selected on the assumption that anthropogenic modification can generally be regarded as the primary causes of degradation of the ecological integrity of a wetland (see DWAF 1999). This is done by using Table W4-1 given by DWAF (1999):

- Score each attribute according to the guidelines provided in the footnote.
- Calculate a mean score for Table W4-1 using the individual scores for all attributes.

- Provide a confidence rating for each score according to the guidelines provided in the footnote to indicate the areas of uncertainty in the determination.

Table W4-2 provides guidelines for the determination of the Present Ecological Status Class (PESC), based on the mean score determined for Table W4-1. If any of the attributes scores < 2 (i.e., it is considered to be seriously or critically modified) this score and not the mean should be taken into consideration. This approach is based on the assumption that extensive degradation of any of the wetland attributes may determine the Present Ecological Status Category (PESC). In any case, the mean on which the assessment of the PESC is based should be regarded as a guideline and should also be tested against the opinion of local experts (DWAF 1999).

Biological integrity is not directly estimated through this approach though in some systems or parts of systems, information on biological integrity is available. In such cases, the information on biological integrity can be used as a check of the PES Category determination. The mean is used to relate the ecological state of the wetland to a particular PES Category (Table W4-2) (DWAF 1999).

3.6 Ecological Importance and Sensitivity

The assessment of the ecological importance and sensitivity is according to DWAF (1999) which in turn is adapted from Kleynhans (1996) and Kelynhans (1999). "Ecological importance" of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. "Ecological sensitivity" refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The Ecological Importance and sensitivity (EIS) provides a guideline for determination of the Ecological Management Class (EMC) DWAF (1999).

In the method outlined here, a series of determinants for EIS according to Table W5-1 of DWAF (1999) are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The method is used as a guideline for the professional judgement of individuals familiar with an area and its wetlands. The assessors must substantiate and document their judgement as far as possible for future reference and revision (DWAF 1999).

3.7 Limitations

Wetlands or riparian zones are very dynamic systems and owing to time constraints a glimpse of conditions at wetlands are taken, even though the hydrogeomorphological setting, soil wetness characteristics and established vegetation constitute some long-term features of a wetland. For each site visited, it should then be emphasized that surveys can by no means result in an exhaustive list of wetland plants and animals present on the site, because of the time constraint. 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.

The survey at the site was conducted during October 2018 and December 2019 to note key elements of habitats on the site, relevant to the conservation of wetlands and riparian areas. The focus of the survey remains a habitat survey that concentrates on the hydrogeomorphological, hydrological and additional descriptors to classify and assess wetlands where present and to assess for the likelihood of occurrence or not of any wetland fauna and flora of particular conservation concern.

4 RESULTS AND DISCUSSION

4.1 Assessment of presence of wetlands or rivers at the site

4.1.1 Presence of small depression (possibly hitherto excavated) where water may gather during high rainfall events at northwestern corner of the site

A small depression (not a wetland depression/ pan) of approximately 0.03 ha, possibly excavated in the past and also cut off by tar road elevation, ha is present at the northwestern corner of the site. This small low-lying area appears to be hitherto excavated, though shallow. The northern edge of the small area where water may gather during substantial rainfall events is a slightly elevated tar road which in effect cuts off waterflow under normal conditions. In the case when excessive water runs down from a shallow valley west of the site and from the surface of tar road and road verge north of the site, water could potentially gather at the shallow depression. Under what would likely be extraordinary circumstances this depression would overflow over the tar road in a northern direction to feed into the non-perennial river north of the site. Technically the depression could be described as a very small artificial waterbody which could sporadically be inundated. Historically this area where the depression occurs was part of a drainage line that ran through the extreme northwestern part of the site. This drainage line which starts at the head of the small shallow valley west of the site, has been conspicuously modified in the past by a groundwall (dam), buildings, fences, cleared areas and a tar road, the latter seemingly without culverts in the immediate area.

Excessive sheet flow from the shallow valley west of the site and also into the small excavated area could lead to water running over the tar road north of the site. If the development is approved a proper stormwater system could perhaps free and restore some waterflow to the non-perennial river north of the site.

Typical wetland plant species at the depression at the northwestern corner of the site appear to be absent. Alien invasive weeds are conspicuous at this small low-lying area while the aggressive alien invasive tree *Acacia cyclops* is visible at some of the edges of the depression. Steep slopes with poor vegetation cover are found at the southern edges of the depression whereas the slopes at a fence north of the depression next to the tar road are covered by grasses such as the alien invasive *Pennisetum clandestinum* (Kikuyu) with some herbs and shrubs. The indigenous grass species *Cynodon dactylon* is also present at the depression. Extensive cover of pioneer plant species and alien invasive weeds such as *Atriplex semibaccata* (Australian Saltbush) and *Chenopodium* species at this possibly sporadically inundated area is noticeable. Other alien invasive weeds at the small low-lying area include *Sonchus oleraceus* and *Plantago*

lanceolata. Typical wetland vegetation such as sedges, marsh-grasses and hydrophytic herbs, appears to be absent. Overall the small depression appears conspicuously degraded and to have limited function. This small depression does not qualify as a wetland or a functional watercourse and no wetland plant or animal species of conservation concern are likely to be threatened by any developments in this area. Given the modified context of the entire drainage system west of the site it is recommended that a proper stormwater system should be planned so that drainage could be enhanced and water of good quality could release into the non-perennial river north of the site.

4.1.2 Presence of non-perennial river and small in-channel dam north of the site

A non-perennial river is present north of the site and south of a substation. A small in-channel dam is present at this watercourse north of the site. Riparian vegetation at this non-perennial river consists of a mixture of indigenous and alien vegetation. Alien invasive *Acacia cyclops* (Redeye/ Rooikrans) occurs in numbers at the riparian zone. Indigenous *Vachellia karroo* occurs as small trees at the riparian zone as well as few *Chrysanthemoides monilifera*. An indigenous sedge *Cyperus textilis* (culms used for weaving baskets, mats) is found in clumps at and along the active channel north of the site (this species has not been noted at the site). Thick covers of alien invasive grass species *Pennisetum clandestinum* (Kikuyu) are found at the outer parts of the riparian vegetation. This non-perennial which is converted into furrows/ canals downstream before reaching an estuary that feeds into the Indian Ocean. Despite modifications this non-perennial river north of the site remains an important conservation corridor in the larger area. Therefore, once again a key issue would be to plan a proper stormwater system at the site that could release good quality water downstream.

4.1.3 Presence of artificial waterbody and poorly defined drainage line west of the site

An artificial waterbody, a dam with a groundwall, exists west of the site and appears to be seasonal and dry for much of the time. This seasonal dam appears to limit waterflow down the shallow valley beneath it. Over decades since the groundwall of this dam has been built and significant ecological disturbances below the groundwall took place the hydrology of the drainage line has probably been substantially modified in particular in an area with relatively low rainfall and limitations to water that reaches downhill.

Conspicuous ecological disturbances are present below the groundwall of the dam. The area where the groundwall is present is visibly poor in vegetation cover. Hitherto cleared areas, fences, buildings and implements are present below the damwall to the extent that the drainage is difficult to recognise. Aggressive alien invasive *Acacia cyclops* is

conspicuous at the fringes of the artificial dam west of the site. A spillway outlet is present at the northeastern limit of the dam.

4.2 Absence of wetlands

Wetlands such as floodplain wetlands, channelled valley-bottom wetlands, unchannelled valley-bottom wetlands, depressions (pans), seeps and wetland flats appear to be absent at the site. In conclusion no wetlands are found at the site.



Photo 1 View towards the east of the depression (technically a very small artificial waterbody where water may gather spordically) at northwestern corner of the site. Tar road (Aalwyn Road) visible in background is north of the site.

Photo: R.F. Terblanche.



Photo 2 View towards the west at low-lying small depression where water appears to gather only sporadically. Note mats of low growing herbs such as alien invasive *Atriplex semibaccata* (Australian Saltbush) in middle of pond.

Photo: R.F. Terblanche



Photo 3 Bare area and alien invasive *Acacia cyclops* at slope at southern edge of small depression at the northwestern limits of the site.

Photo: R.F. Terblanche.



Photo 4 View of tar road north of the site taken from near the northwestern boundary of the site. View is approximately towards the west.

Photo: R.F. Terblanche



Photo 5 Flowers and foliage of aggressive alien invasive *Acacia cyclops* at the site.

Photo: R.F. Terblanche.



Photo 6 Soil at small depression at the northwestern limits of the site. Some mottles (seasonal inundation) and what appear to be foreign particles are present.

Photo: R.F. Terblanche



Photo 7 View towards groundwall of dam (artificial waterbody) at neighbouring area west of the site.
Photo: R.F. Terblanche.



Photo 8 View of dam (artificial waterbody) with groundwall at area adjacent to the western boundary of the site.
Photo: R.F. Terblanche



Photo 9 Shallow disturbed valley below groundwater at area adjacent to the western boundary of the site.
Photo: R.F. Terblanche.



Photo 10 View of part of site and area adjacent to the northwestern part of the site from elevated position at western boundary of the site.
Photo: R.F. Terblanche



Photo 11 Road, watercourse (non-perennial river), riparian vegetation and substation north of the site.
Photo: R.F. Terblanche.



Photo 12 In-channel dam (artificial waterbody) north of the site.
Photo: R.F. Terblanche



Photo 13 Outlet of in-channel dam north of the site.
Photo: R.F. Terblanche.



Photo 14 Watercourse, a non-perennial river, north of the site crossed by a dirt road.
Photo: R.F. Terblanche



Photo 15 Indigenous and endemic *Cyperus textilis* at riparian zone of non-perennial river north of the site.
Photo: R.F. Terblanche.



Photo 16 Small indigenous tree species *Vachellia karroo* (Sweet Thorn) at riparian zone of non-perennial river north of the site.
Photo: R.F. Terblanche

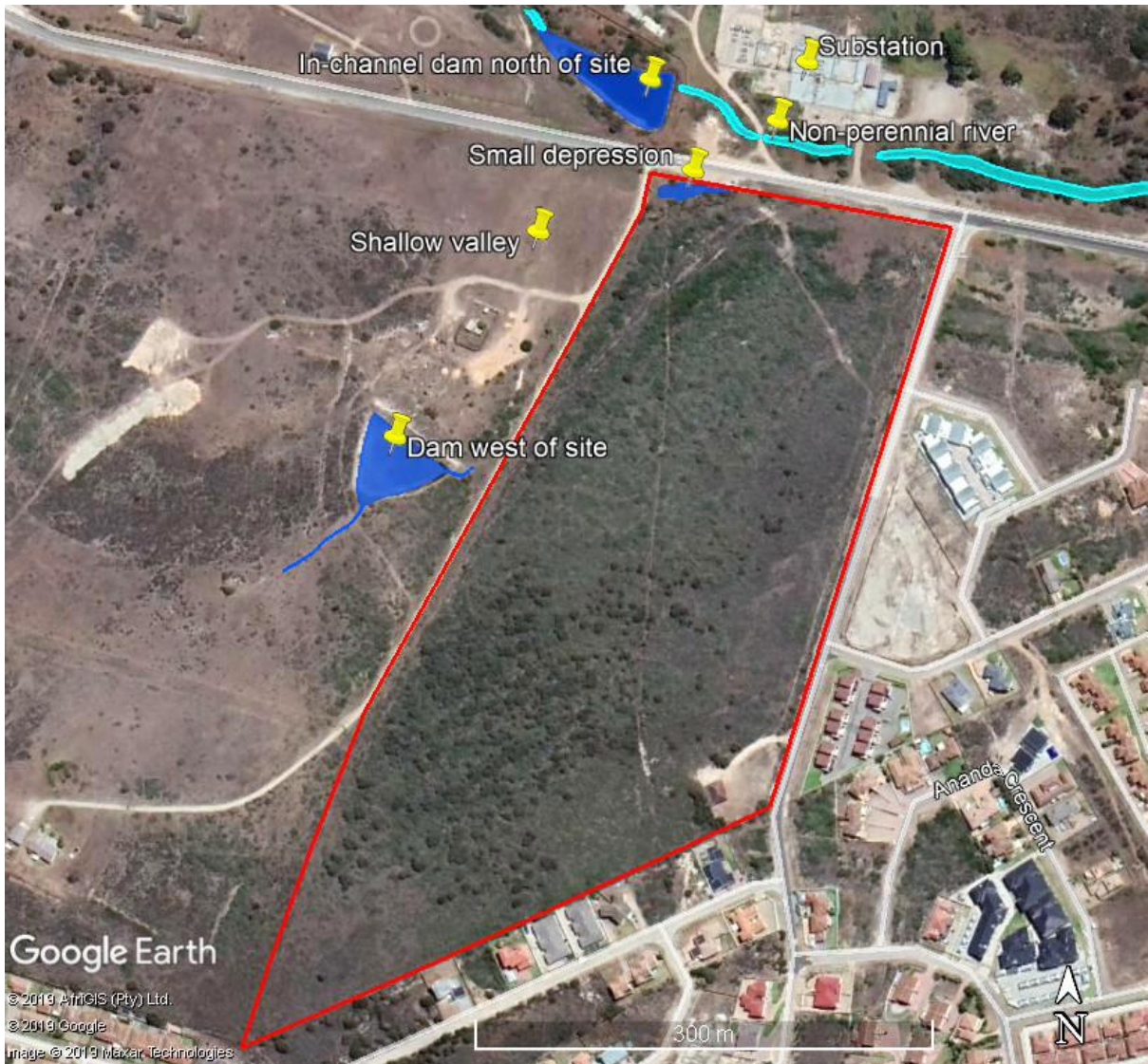


Figure 2 Indications of watercourses at and near the site.

- | | |
|---|--|
| <p>— Light blue outline and shading</p> <p>— Blue outline and shading</p> | <p>Non-perennial river north of site</p> <p>Artificial waterbodies/ areas where water could gather</p> |
|---|--|



Figure 3 Indications of watercourses at and near the central and northern parts of the site.

- Light blue outline and shading Non-perennial river north of site
- Blue outline and shading Artificial waterbodies/ areas where water could gather



Figure 4 Indication of small depression at northwestern corner of the site as well as watercourses outside the site.

- Light blue outline and shading Non-perennial river north of site
- Blue outline and shading Artificial waterbodies/ areas where water could gather



Figure 5 Indications of watercourses at and near the site in relation to the larger area in which they are located.

- Light blue outline and shading Non-perennial river north of site
- Blue outline and shading Artificial waterbodies/ areas where water could gather seasonally

5 CONCLUSION

- Wetlands such as floodplain wetlands, channelled valley-bottom wetlands, unchannelled valley-bottom wetlands, wetland depressions (pans), seeps and wetland flats appear to be absent at the site. In conclusion no wetlands are found at the site.
- A small depression, which is technically similar to a very small artificial waterbody (not a wetland depression/ pan) of approximately 0.03 ha, possibly excavated in the past and also cut off by tar road elevation, ha is present at the northwestern corner of the site. This small low-lying area appears to be hitherto excavated, though shallow. The northern edge of the small area where water may gather during substantial rainfall events is a slightly elevated tar road which in effect cuts off waterflow under normal conditions. In the case when excessive water runs down from a shallow valley west of the site and from the surface of tar road and road verge north of the site, water could potentially gather at the shallow depression. Under what would likely be extraordinary circumstances this depression would overflow over the tar road in a northern direction to feed into the non-perennial river north of the site. Technically the depression could be described as a very small artificial waterbody which could be inundated sporadically. Historically this area where the depression occurs was part of a drainage line that ran through the extreme northwestern part of the site. This drainage line which starts at the head of the small shallow valley west of the site, has been conspicuously modified in the past by a groundwall (dam), buildings, fences, cleared areas and a tar road, the latter seemingly without culverts in the immediate area.
- Excessive sheet flow from the shallow valley west of the site and also into the small excavated area could lead to water running over the tar road north of the site. If the development is approved a proper stormwater system could free and restore some waterflow to the non-perennial river north of the site.
- Typical wetland plant species at the depression at the northwestern corner of the site appear to be absent. Steep slopes with poor vegetation cover are found at the southern edges of the depression. Pioneer indigenous plant species and alien invasive weeds are conspicuous at the depression at the northwestern corner of the site. Currently this small depression does not ascribe to a wetland type or a functional watercourse.
- A non-perennial river is present north of the site and south of a substation. A small in-channel dam is present at this watercourse north of the site. Riparian vegetation at this non-perennial river consists of a mixture of indigenous and alien vegetation. This non-perennial river is converted into furrows/ canals downstream before reaching an estuary at the Indian Ocean. The non-perennial river outside the site remains an important conservation corridor in the larger area which emphasises the importance of a proper stormwater system at the site.
- An artificial waterbody, a dam with a groundwall, exists west of the site and appears to be seasonal and dry for much of the time. This seasonal dam appears to limit waterflow down the shallow valley beneath it. Over decades since

the groundwall of this dam has been built and significant ecological disturbances below the groundwall took place the hydrology of the drainage line has probably been substantially modified in particular in an area with relatively low rainfall and limitations to water that reaches downhill.

- Conspicuous ecological disturbances are present below the groundwall of the dam west of the site. The area where the groundwall is present is visibly poor in vegetation cover. Hitherto cleared areas, fences, buildings and implements are present below the damwall to the extent that the drainage is difficult to recognise. Aggressive alien invasive *Acacia cyclops* is conspicuous at the fringes of the artificial dam west of the site. A spillway outlet is present at the northeastern limit of the dam.
- Given the modified context of the entire drainage system in the area it is recommended that a proper stormwater system should be planned for if the development is approved, free drainage could be enhanced and water of good quality could release into the non-perennial river north of the site.
- No wetland plant or wetland animal species of particular conservation concern appear to be resident at the site.
- Site is part of the Gouritz Water Management Area (WMA 16). The sub-quaternary catchment of which the site is part, is part of a River FEPA catchment (Nel *et al.*, 2011a, 2011b). The non-perennial north of the site is a River FEPA (Freshwater Ecosystem Priority Area) in between wetland clusters. River FEPAs achieve biodiversity targets for river ecosystems and threatened/near threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources (Nel *et al.*, 2011a; 2011b).
- For river FEPAs the whole sub-quaternary catchment is usually shown in a wetland atlas, although FEPA status applies to the actual river reach within such a sub-quaternary catchment. The shading of the whole sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach. It is important to note that river FEPAs currently in an A or B ecological category may still require some rehabilitation effort, e.g. clearing of invasive alien plants and/or rehabilitation of river banks. From a biodiversity point of view, rehabilitation programmes should therefore focus on securing the ecological structure and functioning of FEPAs before embarking on rehabilitation.
- Restoration and rehabilitation of the watercourse systems north of the site seem to be necessary but specific recommendations fall beyond the scope of this report.
- If the development is approved key issues at the site would be the release of good quality water downstream, a proper stormwater system and eradication of alien invasive species.
- If the development is approved there is therefore an opportunity to implement proper stormwater systems at the site, along roads at the boundary of the site as well as for eradication of alien invasive plant species.

* Kindly note that an ecological habitat survey report with a summary of risks and impacts accompanies this report.

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