REPORT

Dalmanutha Wind Energy Facility - Terrestrial and Aquatic Biodiversity - Scoping Report

Enertrag

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Executive Summary

Enertrag South Africa (Enertrag SA) is proposing the establishment of a wind energy facility (WEF) and associated infrastructure at Dalmanutha, Mpumalanga (the Dalmanutha Complex). Rather than each wind farm having its own connection to the nearby Gumeni 400/132kV MTS, a Common 132kV substation and a single132 kV double circuit powerline is proposed. The common powerline is approximately 18km in length

Golder Associates Africa (Pty) (Ltd), now a member of WSP (Golder), was appointed to undertake the necessary terrestrial and aquatic baseline studies and impact assessments, in support of the scoping, baseline and impact assessment phases of the environmental regulatory process required to authorise development-related activities and infrastructure. This aquatic and terrestrial biodiversity scoping report describes the available baseline information for the terrestrial, riparian and wetland biodiversity of areas that will be impacted by the proposed infrastructure developments at the proposed Dalmanutha Wind Energy Facility (WEF) and Dalmanutha West WEF. The outcome of the site sensitivity verification assessment, as required by the NEMA gazetted protocols for the specialist assessment and minimum report content requirements for environmental impacts on aquatic and terrestrial biodiversity are presented.

The report also documents the scoping-level assessment of the potential impacts of the proposed Project on terrestrial and aquatic biodiversity, i.e. terrestrial vegetation communities, wetland and riparian ecosystems, and associated species. and flora and fauna species. A suite of preliminary recommended measures for the mitigation of any negative impacts for inclusion in the updated EMPr for the Project, as well as the required scope of any additional baseline data gathering studies for the EIA, are provided.

DETAILS OF THE SPECIALIST

Table 1: Details of specialist

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Declaration of Independence by Specialist

I, Aisling Dower declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed project.
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have nor will have a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan, or document.

ACRONYMS AND ABBREVIATIONS

Abbreviation	Explanation
CARA	Conservation if Agricultural Resources Act
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIS	Environmental Importance and Sensitivity
EMPr	Environmental Management Programme
MRA	Mining Rights Area
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
PES	Present Ecological State
SCC	Species of Conservation Concern
ToPS	Threatened or Protected Species

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1.0 INTRODUCTION AND BACKGROUND

Enertrag South Africa (Enertrag SA) is proposing the establishment of a wind energy facility (WEF) and associated infrastructure at Dalmanutha, Mpumalanga (the Dalmanutha Complex) (Figure 1).

Golder Associates Africa (Pty) (Ltd), now a member of WSP (Golder), was appointed to undertake the necessary terrestrial and aquatic baseline studies and impact assessments, in support of the scoping, baseline and impact assessment phases of the environmental regulatory process required to authorise development-related activities and infrastructure.

1.1 Purpose of the report

This report describes the baseline terrestrial and aquatic ecology of the local and regional study areas (see Section 4.1), and documents the results of the scoping-level screening of the potential impacts of the proposed Project on terrestrial ecosystems and biodiversity, i.e. vegetation communities and flora and fauna species, and aquatic ecosystems (wetland and riparian habitats and species).

The report also provides a preliminary set of recommended measures for the mitigation of any negative impacts for inclusion in the EMPr for the Project, to ensure that the relevant South African biodiversity legislative and policy requirements are satisfactorily met.

2.0 PROJECT LOCATION AND EXTENT

The proposed Complex is composed of the Dalmanutha Wind Energy Facility (Figure 2) and Dalmanutha West Wind Facility (**Error! Reference source not found.**). Each wind farm will have its own onsite substation and powerline (up to 132kv) (Figure 3).

Rather than each wind farm having its own connection to the nearby Gumeni 400/132kV MTS, a Common 132kV substation and a single132 kV double circuit powerline is proposed. The common powerline is approximately 18km in length.

The Dalmanutha Common Substation will consist of multiple feederbays, switching stations, transformers, control building, workshop, offices, telecommunication infrastructure, and access roads. The area for the Common Substation will be up to 5ha. Upgrades to the existing Gumeni 400/132kV MTS will also be required. This includes the installation of additional feeder bays to accommodate the power being evacuated from the Dalmanutha wind facilities. The upgrades will disturb an area of up to 2 ha.

Initially three powerline routes were being explored (white, orange, and green – Figure 3); the white option is now the preferred option as the majority of it is located within the development area and it follows an existing farm road up until it meets with the existing Eskom Transmission lines.

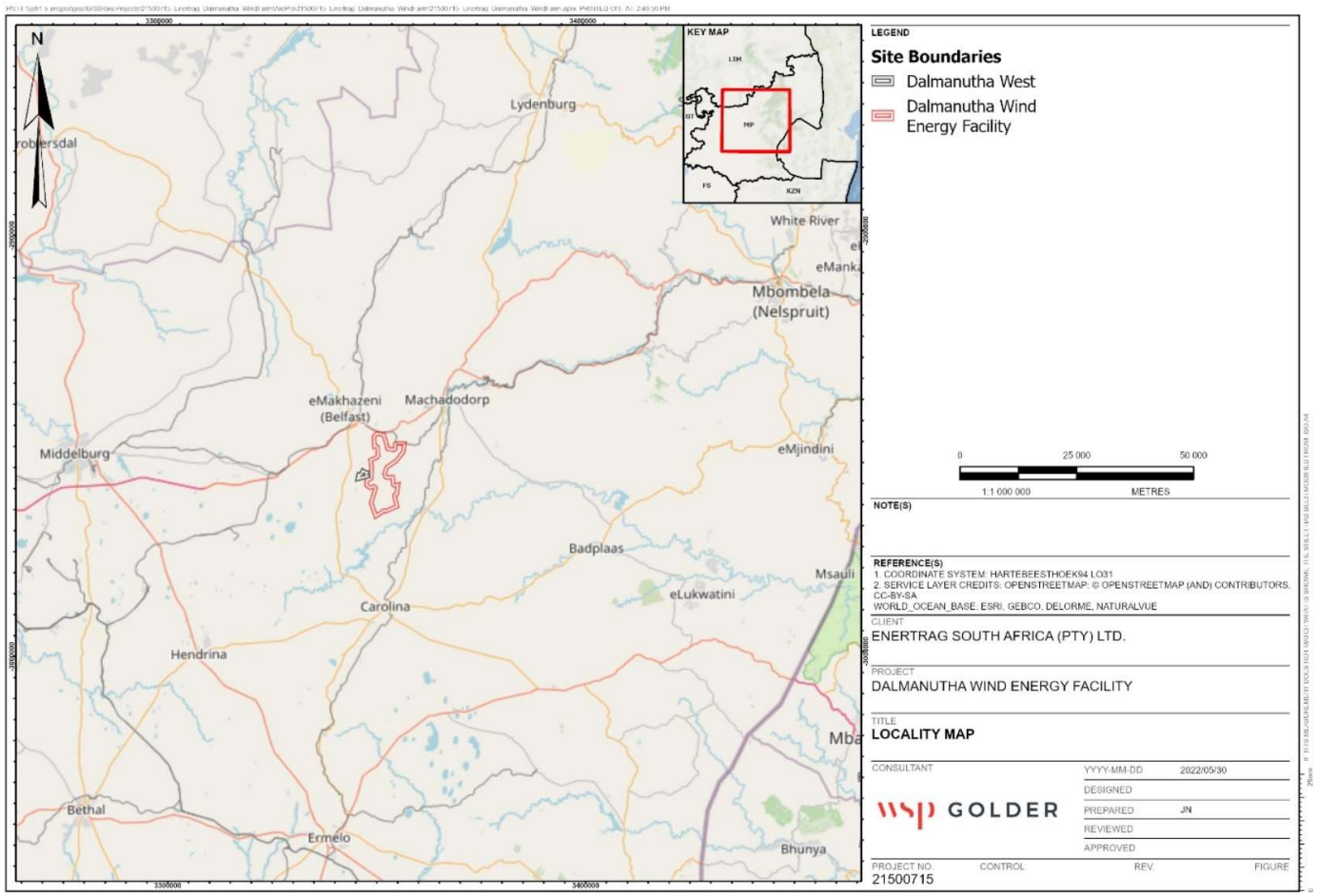

Figure 1: Dalmanutha Complex location

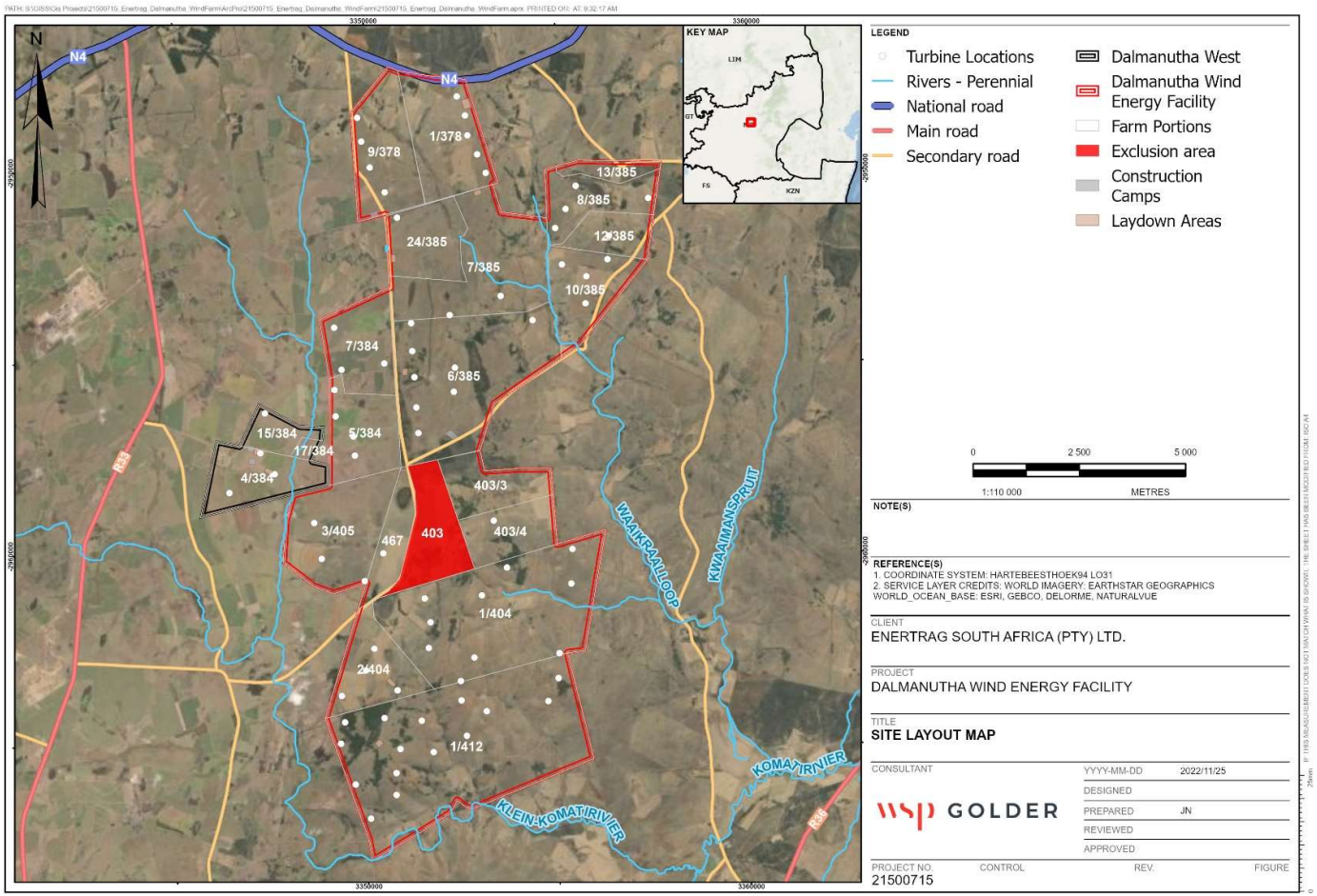

Figure 2: Proposed Dalmanutha WEF infrastructure layout

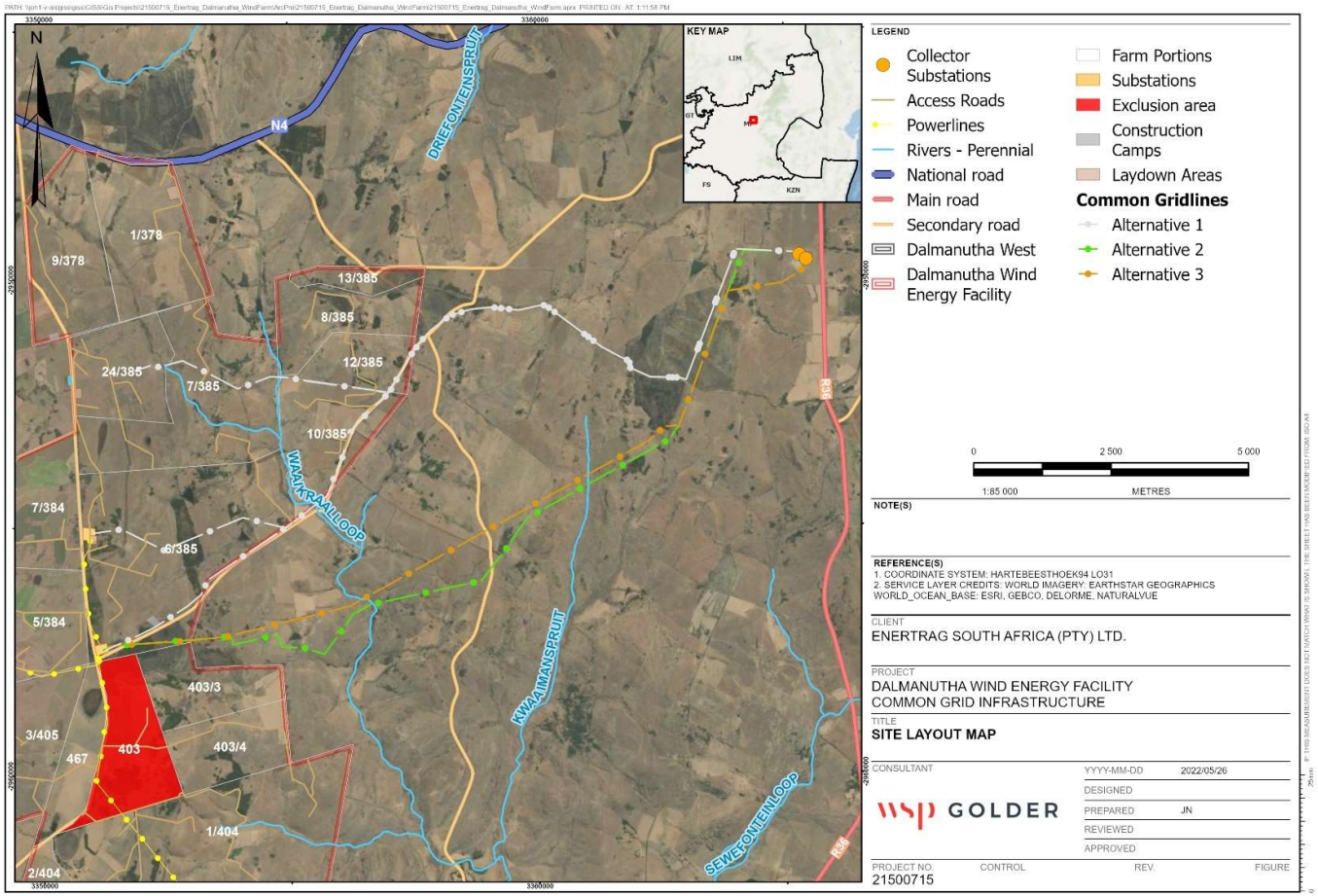

Figure 3: Proposed common grid infrastructure

3.0 APPLICABLE LEGISLATION, POLICY AND STANDARDS

Biodiversity-related South African legislation and policy, and international lender standard requirements that were used to guide this scoping assessment are summarised as follows.

3.1 South African Legislation and Policy

Applicable national and provincial legislation, associated regulations and policies that are pertinent to biodiversity, which were used to guide the EIA, include:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998) including Section 24, concerning Procedures for the assessment and minimum criteria for reporting on identified themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA, when applying for environmental authorisation;
  - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity; and
  - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity;
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA), specifically:
  - ToPS – National lists of critically endangered, endangered, vulnerable and protected species (2007;
  - National list of threatened terrestrial ecosystems for South Africa (2011) (NEMBA Threatened Ecosystems, 2011);
  - National list of alien and invasive species (2016);
- Environment Conservation Act (Act No. 73 of 1989), specifically the Lists of declared weeds and invader plants (CARA, 1983);
- National Water Act (Act No. 36 of 1998);
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998);
- Mpumalanga Biodiversity Sector Plan (Lötter, 2015).
- National Protected Area Expansion Strategy (2016).

Recent, relevant South African national policies and guidance were also taken into consideration, in the development of the baseline description and impact assessment process, including:

- Draft National Biodiversity Offset Policy (2017);
- Draft National Biodiversity Offset Guideline (2022) and
- Species Environmental Assessment Guideline (SANBI, 2020).

4.0 METHODOLOGY

This scoping level aquatic and terrestrial biodiversity baseline description and preliminary impact assessment took cognisance of Government Notice No. 320, published in 2020 under the National Environmental Management Act (1998) concerning ‘Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Theme in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (1998), when applying for Environmental Authorisation’.

In line with the assessment and reporting requirements set out in the protocol, this scoping-level assessment included two main study components; a desktop literature review, which was then supplemented by information gathered during scoping site visits, to inform the site sensitivity verification stage, in line with the NEMA protocols. The objectives and tasks associated with these components are described below.

4.1 Study Area

The study area for scoping was defined as follows (Figure 4):

- Local Study Area (LSA): The proposed development footprint plus all areas encompassed by the project site boundary, within which direct and indirect impacts on terrestrial and aquatic biodiversity receptors (i.e. direct habitat loss, fauna mortality) could occur;
- Regional Study Area (RSA): The catchment within which the proposed development is situated which is considered to be an ecologically appropriate area of analysis, within which indirect and/or induced impacts on biodiversity receptors (e.g. dust deposition, sensory disturbance, hydrological changes) could occur.

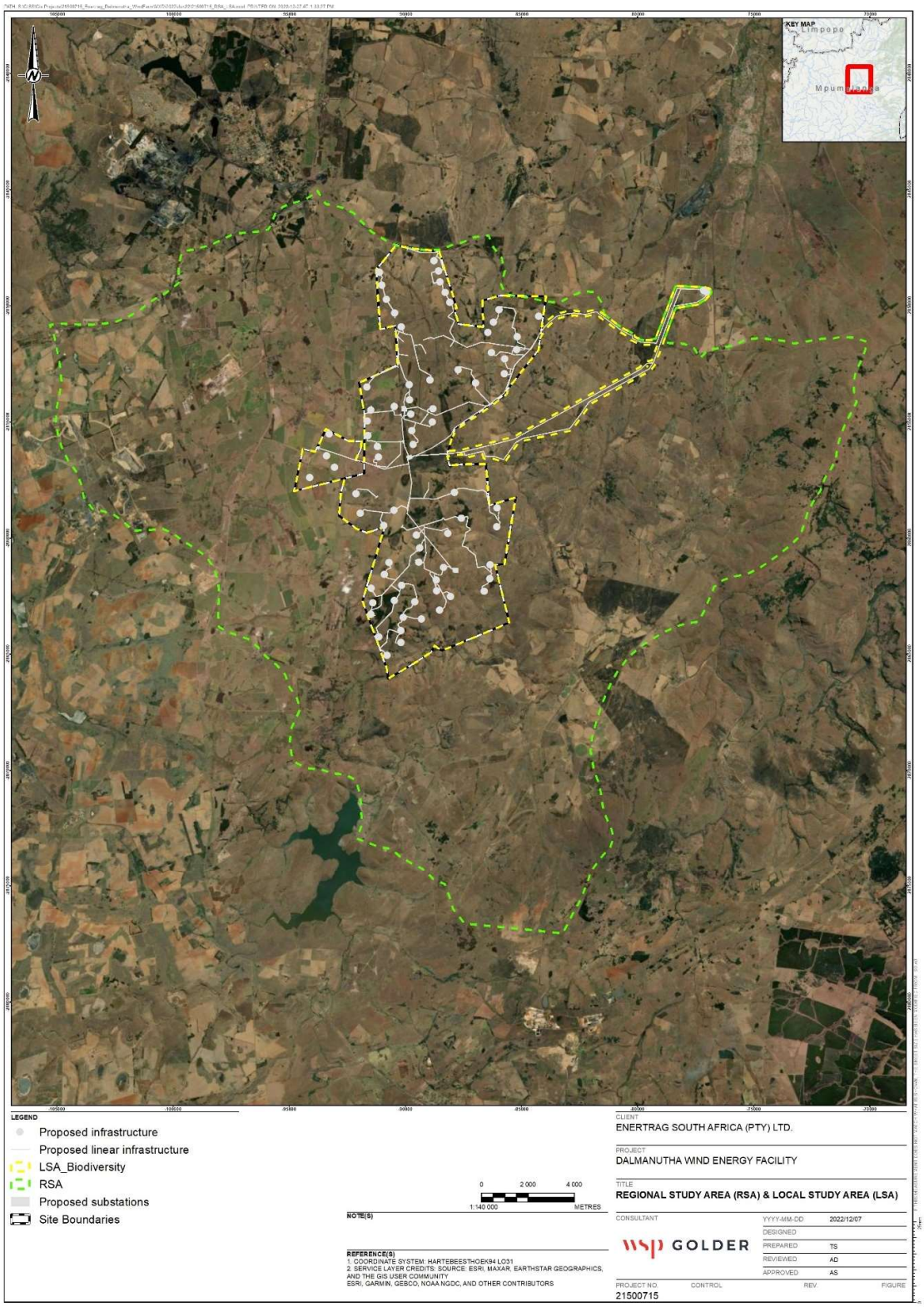

Figure 4: Local and regional study areas

4.2 Literature Review

The aim of the desktop literature review component was to collate and review available ecological information related to important biodiversity and conservation features in the Dalmanutha Complex area of influence, including presence of protected areas or important conservation areas, key ecological processes and functions, and the likely composition and structure of local flora and fauna communities.

The existing available datasets that were reviewed and consolidated to assess aquatic and terrestrial ecosystems and associated fauna, flora and vegetation include:

1) A general vegetation type description relevant to the broader study area was obtained from Mucina and Rutherford (2011);

2) The formal conservation context of the region at a provincial and national level was established based on the Mpumalanga Biodiversity Sector Plan (2019), the National List of Threatened Ecosystems (NEMBA Threatened Ecosystems, 2011), the South African Protected Areas Database (SAPAD), the South African Conservation Areas Database (SACAD) and the national protected area expansion strategy;

3) A preliminary review of land cover and habitat types was undertaken at a desktop level using available satellite imagery and GeoTerraImage national land cover classifications (2020);

4) Nationally-available datasets which were consulted to inform the site sensitivity verification for wetland and riparian habitat include the South African National Wetland Map version 5 (NWM5) (Van Deventer *et al.*, 2019), and the National Freshwater Ecosystem Priority Area database.

5) Department of Water and Sanitation datasets, including available information on surface water resources, water management areas, and quaternary catchments.

4.3 Site Sensitivity Verification

A desktop analysis of available satellite imagery, biodiversity datasets and published literature was conducted to confirm the indicated sensitivity of the site under consideration (i.e. the proposed development footprint), to determine the need for full Terrestrial and/or Aquatic Biodiversity Specialist Assessments, or Compliance Statements.

4.3.1 Scoping Site Visit

The desktop assessment was supplemented by preliminary data gathered during field surveys that were conducted during May 2022, and meetings held with landowners with knowledge of locations of important areas of flora diversity, held during April 2022. The objectives of the scoping site visits/meetings were to:

- Assess the suitability of the study area for the support of faunal species of conservation concern with potential to occur within the proposed infrastructure footprint and surrounds to scope the fauna baseline assessment.
- Identify priority areas for botanical survey during flowering season.

4.4 Baseline Studies

A suite of baseline studies were completed during the wet and dry season survey periods of 2022, including terrestrial fauna, terrestrial flora, aquatic ecosystems and wetland ecosystems. The detailed results of these studies will be presented as part of the ESIA; preliminary findings were taken into account in the finalisation of this scoping report.

4.5 Scoping Level Screening of Impacts and Mitigation

Appendix 2 of GNR 982, as amended, requires the identification of the significance of potential impacts during scoping. To this end, an impact screening tool has been used in the scoping phase (Table 2). The screening tool is based on two criteria; namely probability (Table 3) and consequence (Table 4), where the latter is based on general consideration to the intensity, extent, and duration.

Table 2: Significance screening tool

	CONSEQUENCE SCALE				
PROBABILITY SCALE		1	2	3	4
	1	Very Low	Very Low	Low	Medium
	2	Very Low	Low	Medium	Medium
	3	Low	Medium	Medium	High
	4	Medium	Medium	High	High

Table 3: Probability scores and descriptors

SCORE	DESCRIPTOR
4	**Definite**: The impact will occur regardless of any prevention measures
3	**Highly Probable**: It is most likely that the impact will occur
2	**Probable**: There is a good possibility that the impact will occur
1	**Improbable:** The possibility of the impact occurring is very low

Table 4: Consequence score descriptions

SCORE	NEGATIVE	POSITIVE
4	Very severe: An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	Very beneficial: A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.
3	Severe: A long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming or some combination of these.	Beneficial: A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
2	Moderately severe: A medium to long term impacts on the affected system(s) or party (ies) that could be mitigated.	Moderately beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.

1	Negligible: A short to medium term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	Negligible: A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.

The nature of the impact must be characterised as to whether the impact is deemed to be positive (+ve) (i.e. beneficial) or negative (-ve) (i.e. harmful) to the receiving environment/receptor. For ease of reference, a colour reference system (Table 5) has been applied according to the nature and significance of the identified impacts.

Table 5: Impact Significance Colour Reference System to Indicate the Nature of the Impact

Negative Impacts (-ve)	Positive Impacts (+ve)
Negligible	Negligible
Very Low	Very Low
Low	Low
Medium	Medium
High	High

4.6 Study Assumptions and Limitations

4.6.1 Data used for Specialist Assessments

- The baseline description is based on available national datasets and published literature for the Dalmanutha/Dullstroom Plateau region, supplemented by field survey data (observations and photographs) gathered during 2022. Additional information regarding the presence of flora and fauna species of concern was obtained during a meeting with a landowner and well-known biologist Lockwood, who provided information on locations of sensitive orchid species, wetlands, and bird habitats, and likely mammal/amphibian species using the local study area.
- This scoping report was prepared on the basis of the site sensitivity verification process undertaken in response to the national web-based screening report. The site sensitivity verification was completed via desktop analysis of the extensive existing baseline knowledge of species and habitats in the study area, supplemented by cross-referencing to the most recent species conservation assessments, and data gathered during initial scoping site visits conducted by ecologists.
- It is therefore considered that there are no sampling or information limitations pertaining to terrestrial animal or plant species impacting on this scoping level baseline terrestrial biodiversity description, screening of impacts, and preliminary recommended mitigation measures.

4.6.2 Assumptions, uncertainties, or gaps in knowledge

- The baseline description is qualitative and based on the available desktop information supplemented by preliminary scoping-level data gathered during the site visits.
- The preliminary identification of potential impacts and mitigation measures focus on fauna and flora species of concern with potential to occur in the study area.

- The selection of species of concern for the scoping level screening of impacts was based on the level of knowledge (that is, ecology and conservation status) of the species to act as surrogates for all species in the area, and adopts the hypothesis that conditions which support vertebrates and/or vascular plant species of concern are likely to also support species of concern from other taxonomic groups.

5.0 TERRESTRIAL BIODIVERSITY BASELINE DESCRIPTION

This section summarises the baseline terrestrial biodiversity environment of the local and regional study areas. It draws upon available data, published information, local knowledge and observations made during scoping site visits.

5.1 Environmental Screening Tool

The proposed infrastructure footprint was assessed at desktop level using the National Web-based Environmental Screening Tool.

According to the Tool, the Terrestrial Biodiversity Theme for the LSA is rated as 'Very High Sensitivity', due to its overlap with land mapped as:

- 'Critical Biodiversity Area' (CBA) 1, CBA2, and Ecological Support Area: Landscape Corridor (MBSP, 2019) (see Section 5.2.1)
- FEPA sub-catchments (Section 6.2.3)
- Endangered and Vulnerable ecosystems (Section 5.3.1)
- Protected Areas Expansion Strategy (Section 5.2.3).

The National Web Based Screening Tool also indicated that the majority of the LSA is considered to be of 'Medium sensitivity' in terms of the Plant Species Theme on account of the potential presence of at least 19 flora species of conservation concern (e.g. *Khadia carolinensis, Asclepias dissona, Miraglossum davyi*).

The LSA is considered to be of 'Medium' – 'High' sensitivity in terms of the Animal Species Theme, due to the potential presence of the range-restricted Badplaas Black Millipede (*Doratogonus furculifer*) which is listed as Endangered on the IUCN Red List (Rudolf et al., 2021), and the mammals Robust Golden Mole (*Amblysomus robustus* – VU[1] (Rampartab & Bronner, 2016)), Rough-haired Golden Mole (*Chrysospalax villosus* - VU), Maquassie Musk Shrew (*Crocidura maquassiensis* – VU), Spotted-necked Otter (*Hydrictis maculicollis* – VU), and Oribi (*Ourebia ourebi ourebi* - EN).

5.2 Regional Terrestrial Biodiversity Context

The local study area is situated in a landscape that is characterised by rolling high-altitude grassland interspersed by rocky outcrops, with extensive hillslope seep and valley bottom wetlands, and farmlands that are cultivated to varying degrees, but largely consist of secondary grasslands.

The regional study area coincides with the Steenkampsberg Important Bird Area (IBA) and Dullstroom Plateau Grasslands, which are considered to be of exceptional biodiversity value due to their support of bird species including Blue Crane, Wattle Crane, Grey Crowned Crane, Blue Korhaan, Southern Bald Ibis, Whitewinged Flufftail, Yellowbreasted Pipit and Rudd's Lark, mammals including Robust Golden Mole, Roughhaired Golden Mole, Cape Molerat, Oribi and Welwitch's Hairy Bat; one amphibian, *Bufo gariepensis nubicolus*; twenty plant species including *Eucomis vandermerwei, Gladiolus cataractarum Gladiolus malvinus, Nerine gracilis, Streptocarpus denticulatus* and *Watsonia occulta*; and two vegetation types including the Steenkampsberg

[1] Conservation status are at the national level, unless specified otherwise (i.e. IUCN or regional red lists)

Montane Grassland and Dry Afromontane Forest (MPTA, 2013). The RSA forms part of the Lydenburg Centre of Plant Endemism and also includes important sub-catchments; provides an escarpment corridor; contains important caves, pans and wetlands; and is considered important for grassland and forest processes (MPTA, 2013). These key features are further discussed in the sections that follow.

5.2.1 Terrestrial Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)

The LSA was compared to relevant available spatial biodiversity planning datasets, i.e. the Mpumalanga Biodiversity Sector Plan (2019) (Figure 5), in order to assess the local and regional biodiversity context of the site.

The Mpumalanga Biodiversity Sector Plan (MBSP) technical report (Lotter, 2015) defines five categories of conservation focus; protected areas, critical biodiversity areas (CBA), ecological support areas (ESA), other natural areas, and modified habitats. Definitions for each are listed below. These areas present risks to the Project in terms of impact, as well as opportunities for contribution to achieving provincially-set targets for biodiversity conservation, through focused biodiversity management planning and adherence to the mitigation hierarchy at EIA stage:

- **Protected Areas**: protected areas recognised in terms of the National Environmental Management Protected Areas Act, No. 57 of 2003, that are currently considered to meet biodiversity targets in the MBSP.
- **Critical Biodiversity Area**: areas (outside of Protected Areas) that are required to meet biodiversity targets for biodiversity pattern (species and ecosystems) and ecological processes. They should remain in a natural state that is maintained in good ecological condition.
- **Ecological Support Area**: play an important role in supporting the ecological functioning of critical biodiversity areas or for generating or delivering important ecosystem services. They support landscape connectivity and resilience to climate change adaptation. They need to be maintained in at least an ecologically functional state.
- **Other Natural Areas**: often retain much of their natural character and may contribute significantly to maintenance of viable species populations and natural ecosystem functioning, and may provide important ecological infrastructure and ecosystem services. They are not, however, prioritized for immediate conservation action in the MBSP.
- **Modified**: often referred to as transformed, these areas have lost a significant proportion (or all) of their natural biodiversity and in which ecological processes have broken down (in some cases irretrievably), as a result of biodiversity-incompatible land-use practices such as ploughing, hardening of surfaces, mining, cultivation and the construction of houses or other built infrastructure.

Much of the LSA is mapped as CBAs and ESAs, which are largely aligned with grassland and wetland layers presented in the national landcover dataset (GTI, 2020) (Figure 6). These datasets are based on satellite imagery interpretation and as such the data may be aged, or require in-field verification. A key outcome of the vegetation and flora baseline study which was conducted during the peak (flowering) season (late October 2022) is the vegetation map of the LSA, which defines the location and extent of natural and modified vegetation communities – these will be utilised for CBA/ESA extent verification purposes in the Terrestrial Biodiversity Specialist Assessment at EIA stage.

5.2.2 Priority Areas for Protected Area Expansion

Some of the proposed infrastructure coincides with areas that have been identified as Priority Focus Areas as part of the National Protected Area Expansion Strategy (2016) (Figure 7), which are aligned with the MBSP CBAs and ESAs (Figure 5).

5.2.3 Protected Areas

No nationally protected areas are situated within the LSA, with the closest feature listed on the National Protected Areas Register (DFFE, 2022) being the Nooitgedacht Dam Nature Reserve, which lies at the southern-most extent of the RSA (Figure 4).

The northern extent of the LSA overlaps with the Steenkampsberg Important Bird Area (IBA), which consists primarily of rolling high-altitude grassland interspersed with rocky outcrops, and encompasses the Lakenvlei wetland which hosts the critically endangered White-winged Flufftail (*Sarothrura ayersi*) (BirdLife International, 2022). The IBA also has importance due to its support of other threatened wetland birds including corncrake (*Crex crex*) and various crane species.

5.2.4 Indigenous forests

The most recent landcover dataset (GTI, 2020) for the RSA is shown in Figure 6. No indigenous forest habitat occurs within the study area, which is characterised by secondary and some primary grasslands and hillslope seepage and valley bottom wetlands, interspersed by currently/previously cultivated areas and farmsteads. Woodland in the study area is largely restricted to plantations of typical alien species, including *Eucalyptus* sp., *Poplar* sp. and black wattle (*Acacia mearnsi*).

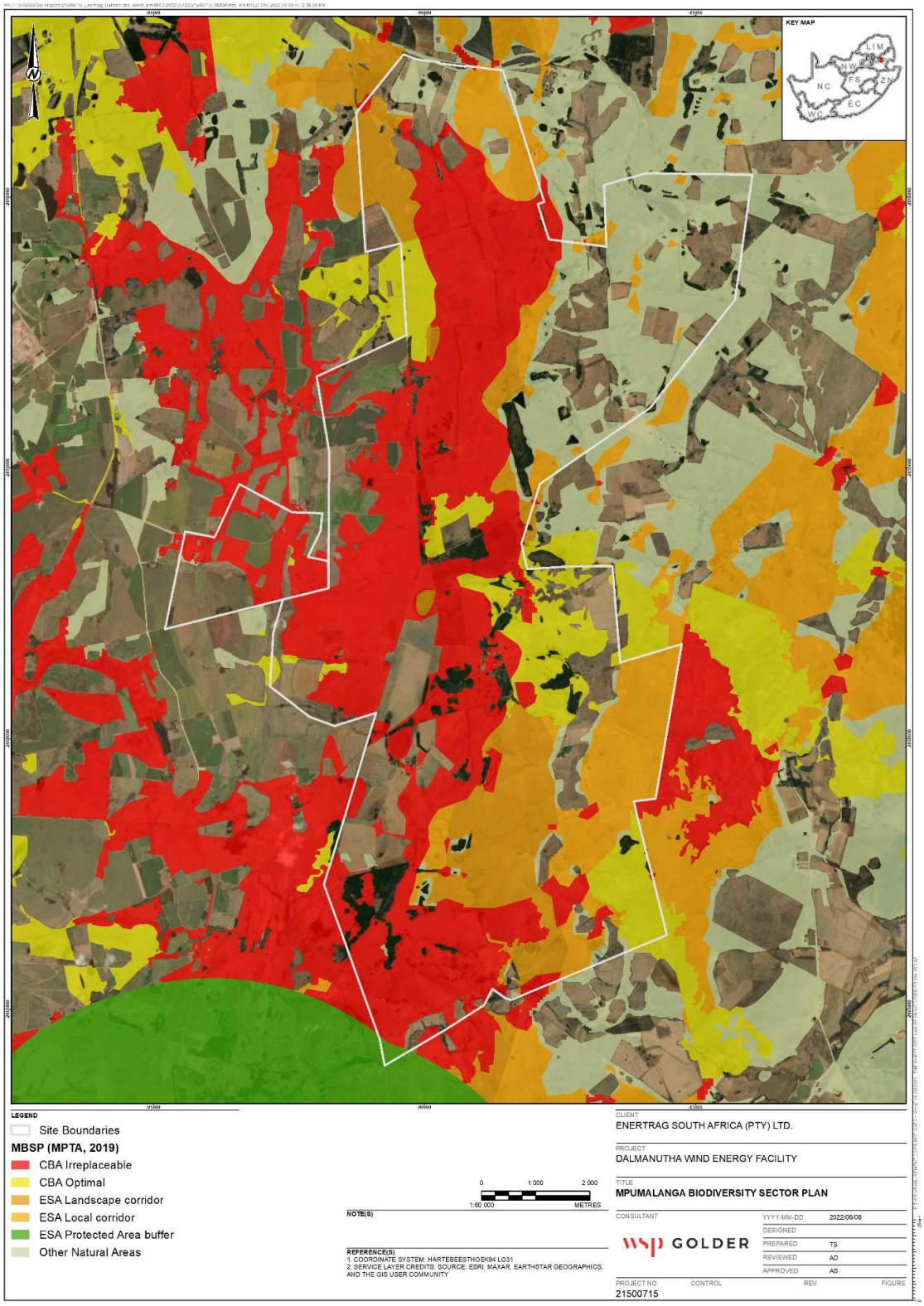

Figure 5: LSA in relation to MBSP (2019)

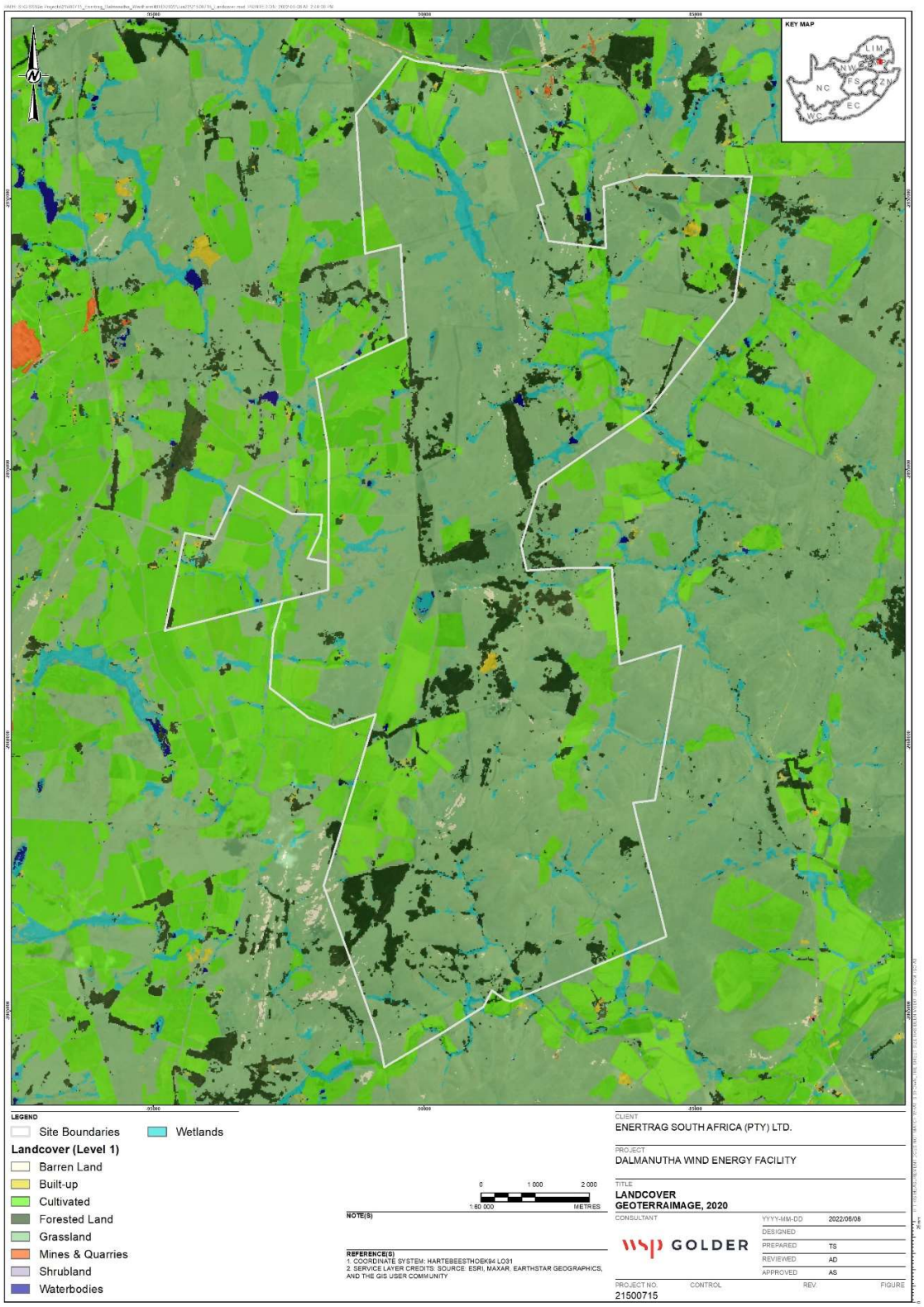

Figure 6: Landcover dataset for LSA (GTI, 2020)

Figure 7: LSA in relation to National Protected Area Expansion Strategy

5.3 Terrestrial Vegetation and Flora

Three major vegetation types occur across the LSA; these include Eastern Highveld Grassland, Steenkampsberg Montane Grassland, and KaNgwane Montane Grassland (Figure 8), the latter two of which are considered least concern in terms of ecosystem threat status at a national level (Figure 9). Due to its assessment as 'Vulnerable', further details are provided for Eastern Highveld Grassland in the section that follows.

5.3.1 Vegetation Features of Conservation Concern

Eastern Highveld Grassland (Gm12) is characterised by short, dense form of grassland, occurring on to moderately undulating plains, low hills and wetland depressions. It is dominated by the typical Highveld grassland flora including *Aristida, Digitaria, Eragrostis, Themeda, Tristachya* etc.); interspersed with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra, Celtis africana, Diospyros lycioides subsp. lycioides, Parinari capensis, Protea caffra, Protea welwitschii*, and *Rhus magaliesmontanum*). It is located almost entirely within the Mpumalanga Province, and a small section of the eastern parts of Gauteng. Eastern Highveld Grassland is considered to be Vulnerable nationally (Government notice 1002/2011, in terms of section 52(1)(a) of NEMBA)), as only a very small fraction is conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and approximately 44% has been transformed, primarily by cultivation, plantations, mines, urbanisation and the building of dams.

5.3.2 Flora Features of Conservation Concern

The majority of the LSA is considered to be of 'Medium sensitivity' in terms of the Plant Species Theme of the National Screening Tool, on account of the potential presence of at least 19 flora species of conservation concern. During a meeting held with one of the Project landowners in April 2022, several areas of importance in terms of support of a diverse range of plant species of interest, including various orchids, were identified. Although not depicted on maps at this stage (in the interests of protecting the locations of species of interest from potential plant poaching), it is understood that most of the indicated areas of importance do not coincide with the proposed Project layout; nevertheless, this will only be confirmed upon completion of Terrestrial Flora Specialist Assessment report.

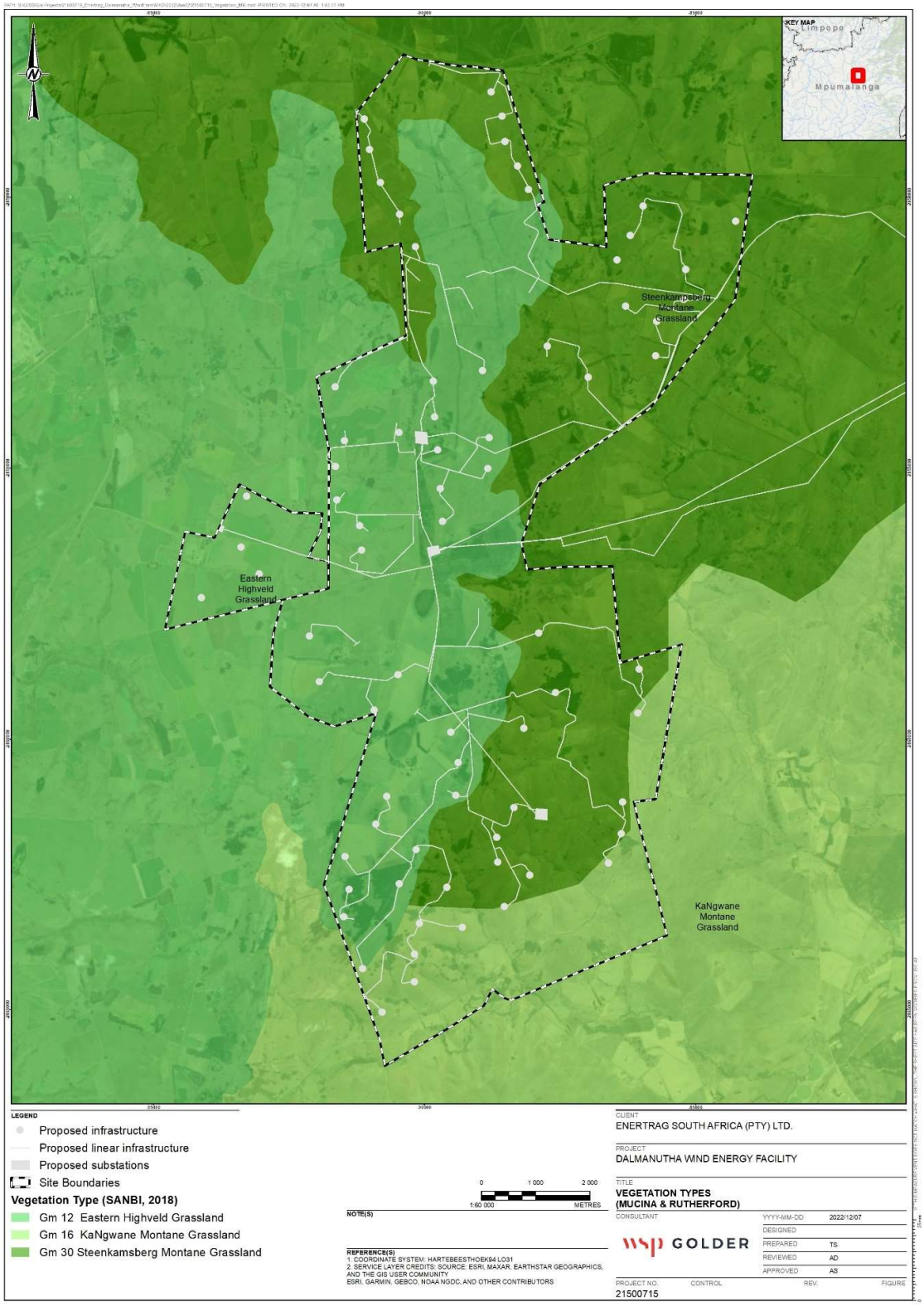

Figure 8: LSA in relation to national vegetation types

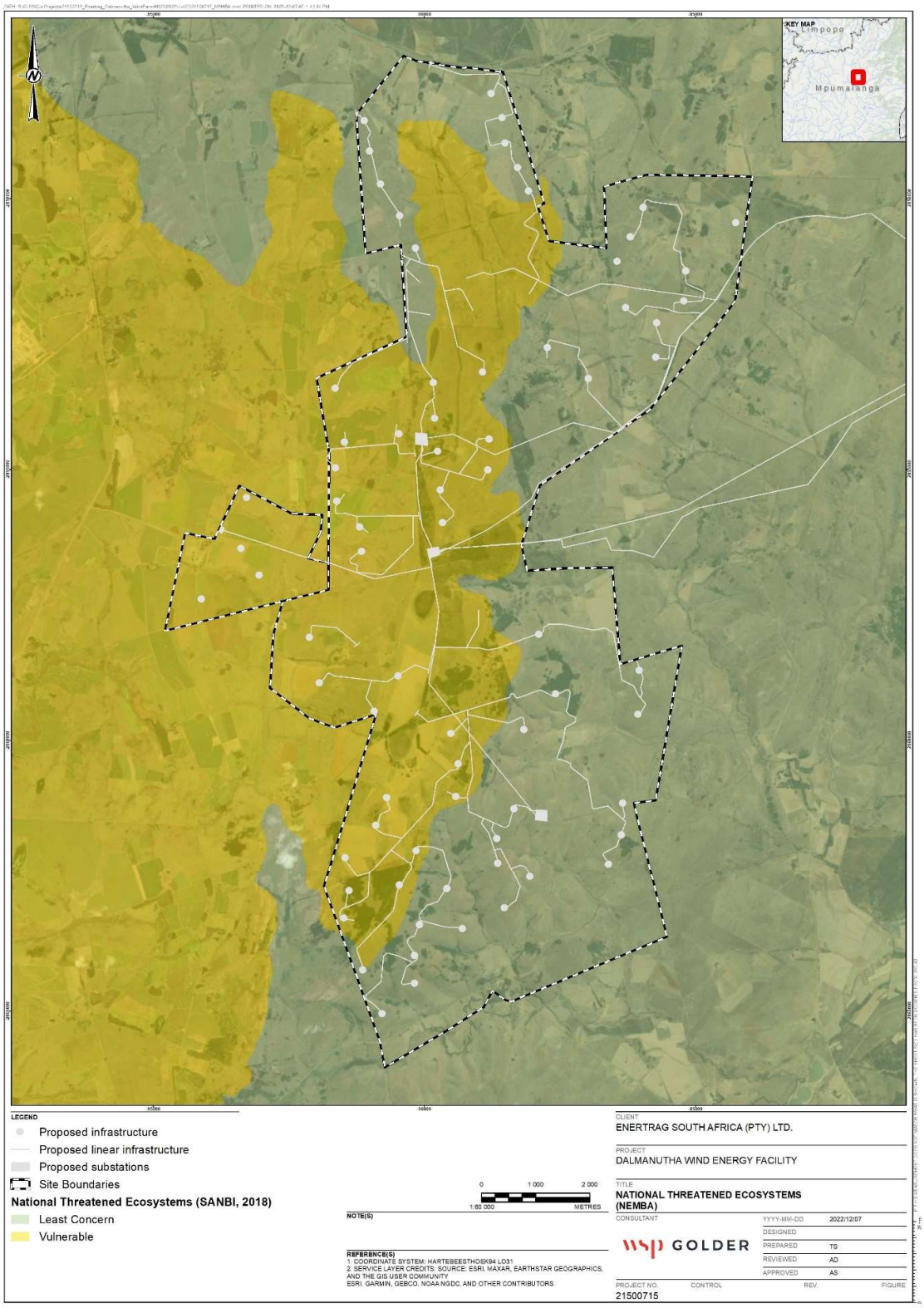

Figure 9: LSA in relation to National Threatened Ecosystems

5.4 Fauna

The fauna biodiversity of the region is relatively well-known. Details of fauna species of conservation concern (SCC) with potential to occur in the LSA are summarised in the sections that follow. Birds and bats are excluded, since these are being dealt with in separate studies.

5.4.1 Mammals

Four mammal species of conservation concern (SCC) are expected to occur in the RSA, including three mole species, and Cape Molerat (*Georychus capensis*) – these could potentially be present in undisturbed areas of primary grassland and wetland within the LSA, but are not expected to be present in cultivated lands.

During the baseline surveys conducted in 2022, mammal SCC including the Near-Threatened species grey rhebuck (*Pelea capreolus*) and serval (*Leptailurus serval*), and the nationally Endangered species southern mountain reedbuck (*Redunca fulvorufula fulvorufula*) were confirmed present within the LSA via direct observation and camera traps.

5.4.2 Herpetofauna

Although the national screening tool indicates no sensitivities in terms of support of amphibian species; one amphibian, *Bufo gariepensis nubicolus*, a sub-species of Karoo Toad, is known to occur in the region and could potentially be present in the wetland habitat of the LSA up to altitudes of c. 3400 m (FrogMAP, 2022). No reptile SCC are anticipated to occur in the LSA.

5.4.3 Invertebrates

The national screening tool flags potential presence of the range-restricted invertebrate species Badplaas Black Millipede (*Doratogonus furculifer*) which is listed as Endangered on the IUCN Red List (Rudolf et al., 2021). No other invertebrate SCC have been flagged in the LSA.

5.5 Existing Impacts on Biodiversity and Drivers of Change

The proposed project infrastructure will be situated in a largely untransformed landscape, interspersed by low density cultivated fields and occasional exotic tree plantations, from which a low level of impact has occurred through habitat transformation. Barriers to faunal movement in the shape of dirt roads and cattle/boundary fencing occur throughout the LSA.

6.0 AQUATIC BIODIVERSITY BASELINE DESCRIPTION

This section summarises, at a mainly desktop level, the baseline aquatic biodiversity environment of the local and regional study areas. It draws upon existing studies, published information, local knowledge and observations made during scoping site visits.

6.1 Environmental Screening Tool

The proposed infrastructure footprint was assessed at desktop level using the National Web-based Environmental Screening Tool. According to the Tool, the Aquatic Biodiversity Theme for the study area is rated 'Very High Sensitivity' due to its situation within areas defined as FEPA quinary catchments, and the presence of 'Aquatic CBAs' and extensive areas of wetland habitat.

6.2 Regional Aquatic Biodiversity Context

The LSA falls within the upper reaches of the Inkomati Water Management Area, and the quaternary catchment X11D (Komati River) (Figure 10). The catchment is situated within the Inkomati Water Management Area (WMA). The mean annual runoff (MAR) for the X11D catchment is 88 mm (WR2012). This catchment receives 744 mm rainfall per year and experiences 1,413 mm of evaporation annually. Numerous non-perennial rivers drain in an easterly direction into the perennial Waalkraalloop river and in a westerly and southerly direction into

the perennial Klein Komati River. The terrain of the proposed WEF lies at an elevation of approximately 1,630 m in the northern section, to 1,888 m in the southern section (Figure 11).

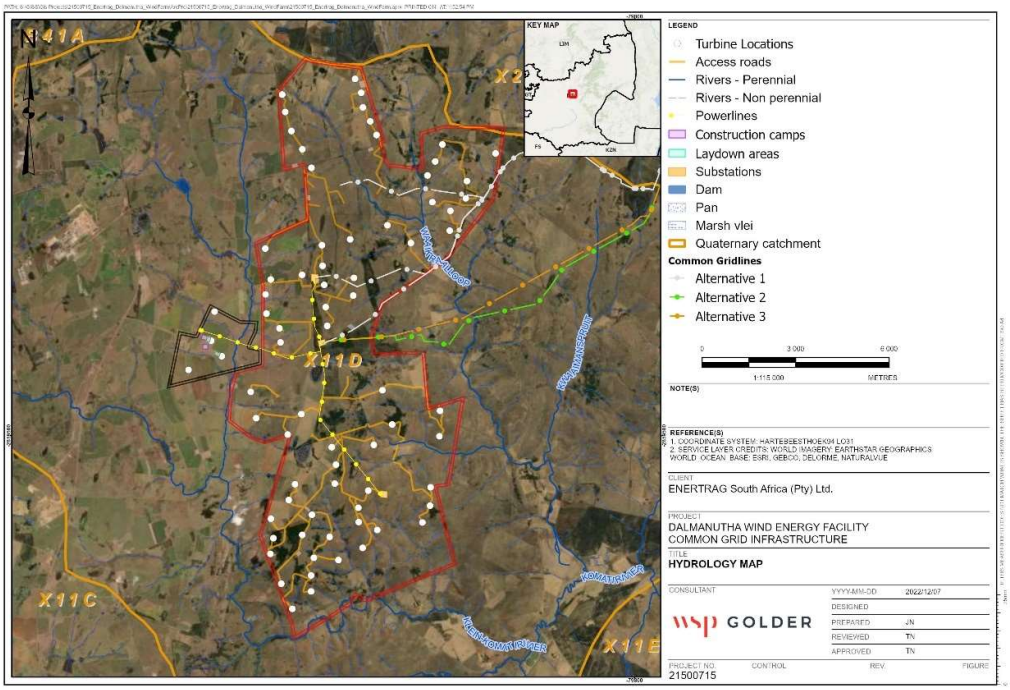

Figure 10: Hydrology map

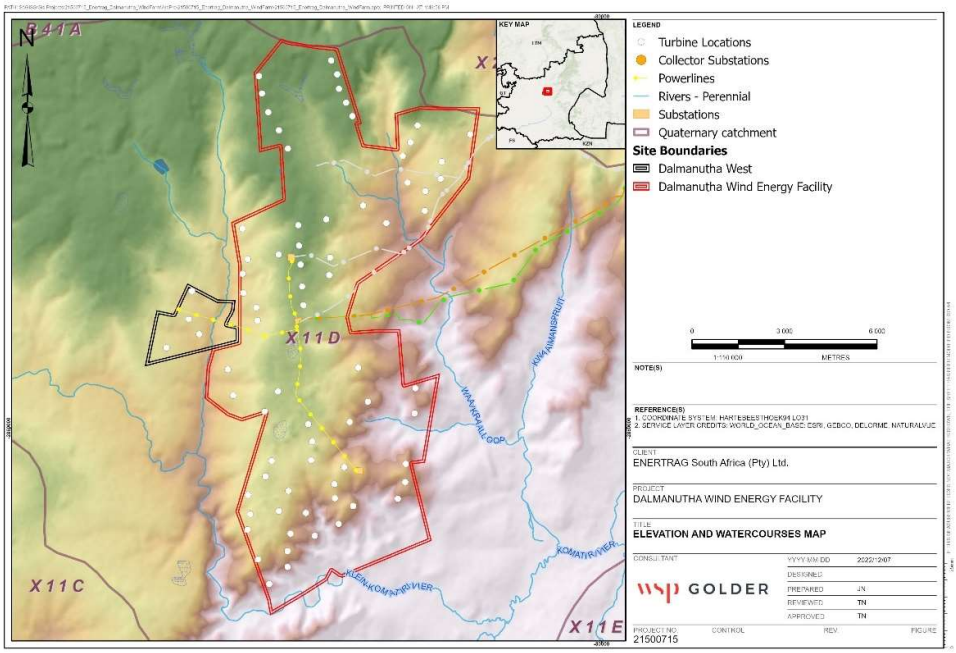

Figure 11: Elevation and watercourses map

The Komati River catchment is ecologically severely stressed due to the water demands imposed by Eskom and agriculture, with various abstraction weirs creating serious obstructions to fish migrations, and return flows from irrigation affecting downstream water quality as a result of input of chemicals such as pesticides, fertilizers and salts (MPTA). Alien invasive fish species that have been introduced into the numerous dams are also present in the rivers (MPTA, 2015). Nevertheless, the ecological status of some sections of the upper Komati River catchment (within which the LSA is situated) is still considered to be in a relatively good condition (MPTA, 2015).

6.2.1 Aquatic Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)

The LSA was compared to relevant available spatial biodiversity planning datasets, i.e. the Mpumalanga Biodiversity Sector Plan freshwater assessment (2017) (Figure 12), in order to assess the local and regional biodiversity context of the site. Depression wetlands that occur throughout the LSA are mapped as CBAs, while the western extent of the LSA, which coincides with the Klein-Komati River FEPA sub-catchment (Figure 13), is mapped as an ESA. The MBSP (2017) freshwater assessment spatial dataset also shows the majority of the eastern extent of the LSA mapped as 'other natural areas'.

It is noted that the MPSBP freshwater assessment was based largely on remotely-sensed satellite imagery, and thus some wetlands are not included (e.g. historic wetlands lost through drainage or ploughing), particularly hillslope seeps which can be difficult to distinguish from grasslands based on satellite imagery alone. Similarly, some features have been mapped as wetlands, which, once examined in the field, are not defined as wetlands. The most up-to-date spatial dataset at the national level is now considered to be the National Wetland Map 5 (see Figure 15), which displays a more accurate representation of actual wetland conditions on site; however hillslope seep wetlands are assumed to be under-represented, and are a focus point for the ongoing baseline data collection to inform the wetland delineation and classification of hydrogeomorphic units located within the LSA.

6.2.2 Strategic Water Source Areas (SWSAs)

No strategic water source areas occur in the RSA.

6.2.3 Freshwater Ecosystem Priority Area (FEPA) sub-catchments

The proposed development footprint in relation to FEPA sub-catchments and NFEPA-listed wetlands is illustrated on Figure 13 and Figure 14 respectively.

6.2.4 National Wetland Map 5 wetlands

The South African National Wetland Map version 5 (NWM5) portrays the most up-to-date spatial data for the extent and types of estuarine and inland aquatic (freshwater) ecosystems of South Africa (Van Deventer *et al.*, 2019). The proposed development footprint in relation to wetlands mapped as part of the National Wetland Map 5 project is illustrated on Figure 15. As mentioned, the extent of hillslope seep wetlands within the LSA are likely to be under-represented in this dataset, as such the key objective of the ongoing wetland baseline data gathering studies is defining the extent and condition of this (and other) wetland habitat in the LSA.

6.2.5 Wetland Delineation and Classification

The delineation and classification of wetlands within the LSA, that were surveyed during April and May 2022, is shown on Figure 16. The majority consist of relatively steep-profiled valley bottom wetlands with linked hillslope seepages in their upper catchment; with a number of depression wetlands situated in the central area of the Dalmanutha Complex.

6.2.6 Baseline Aquatic Biomonitoring Locations

Baseline aquatic biomonitoring locations for the LSA have been selected based on the proposed positioning of WEF infrastructure and access roads, and the future need to measure and monitor potential impacts on the various surface water systems that coincide and interact with the proposed infrastructure and activities. The baseline aquatic monitoring locations are shown on Figure 17. High-flow baseline surveys have already been completed, the results of which will be presented in the overall Aquatic Biodiversity Specialist Assessment that will be produced in support of the EIA.

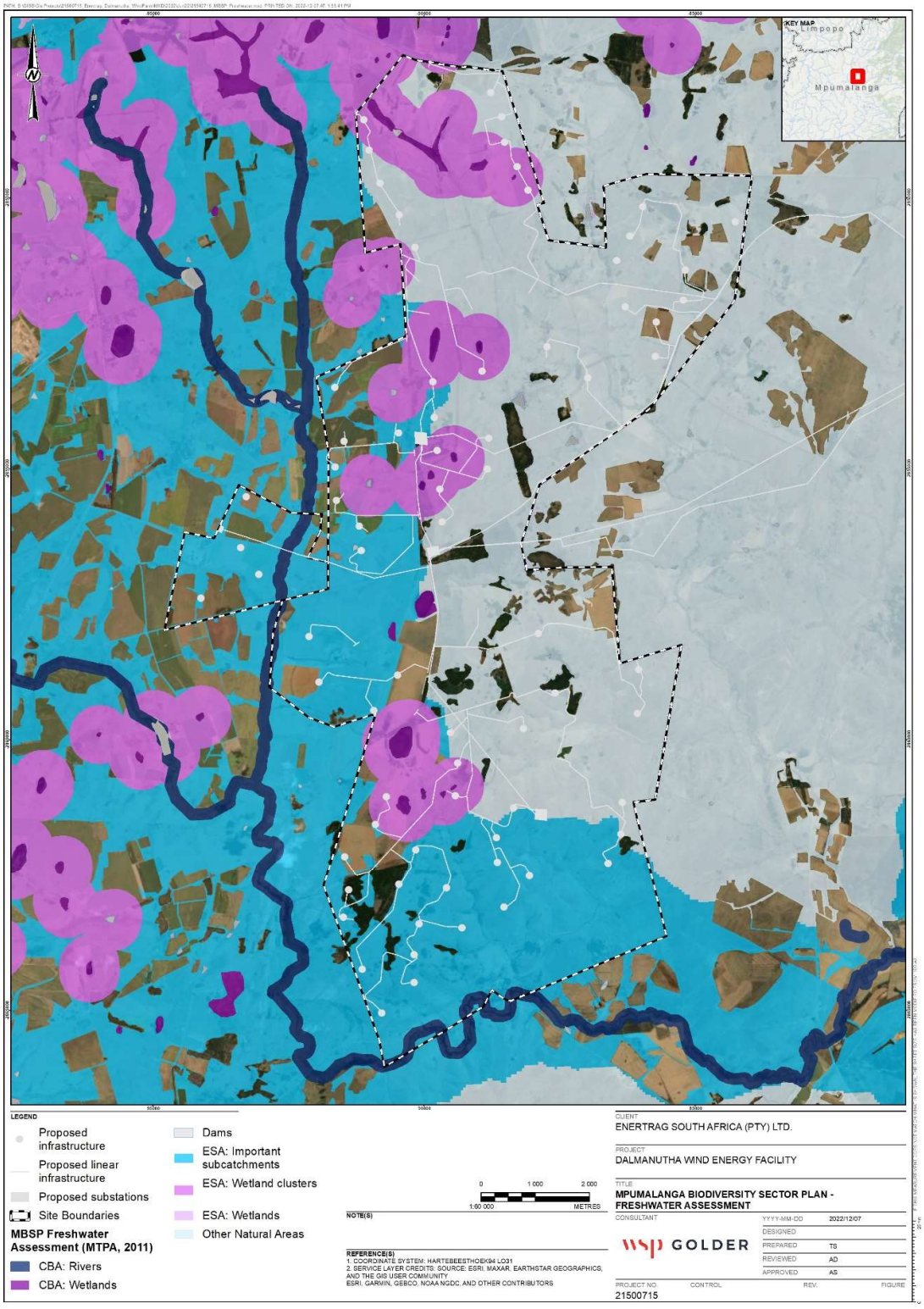

Figure 12: LSA in relation to MBSP freshwater assessment (2011)

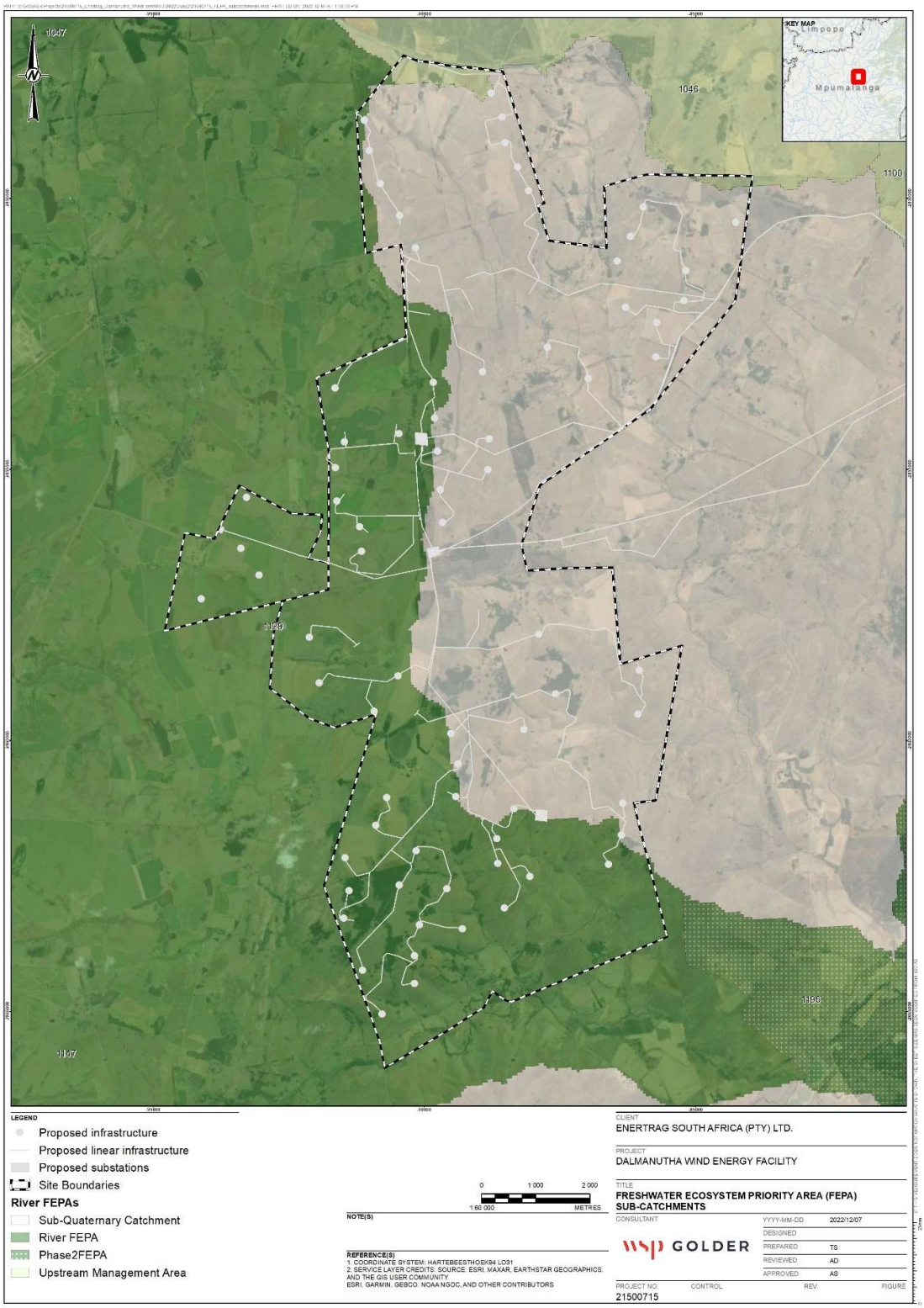

Figure 13: LSA in relation to FEPA sub-catchments

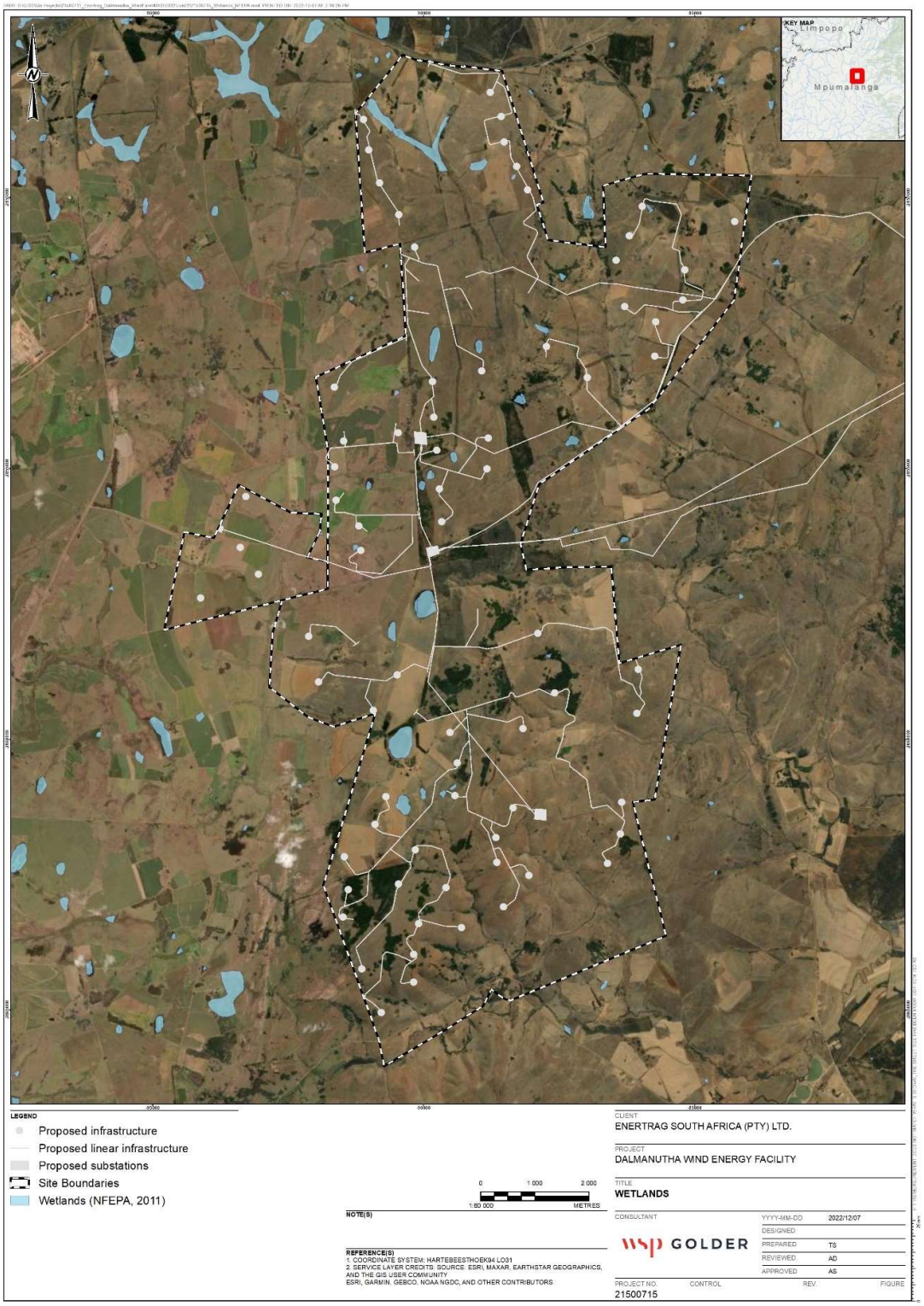

Figure 14: LSA in relation to NFEPA wetlands (2011)

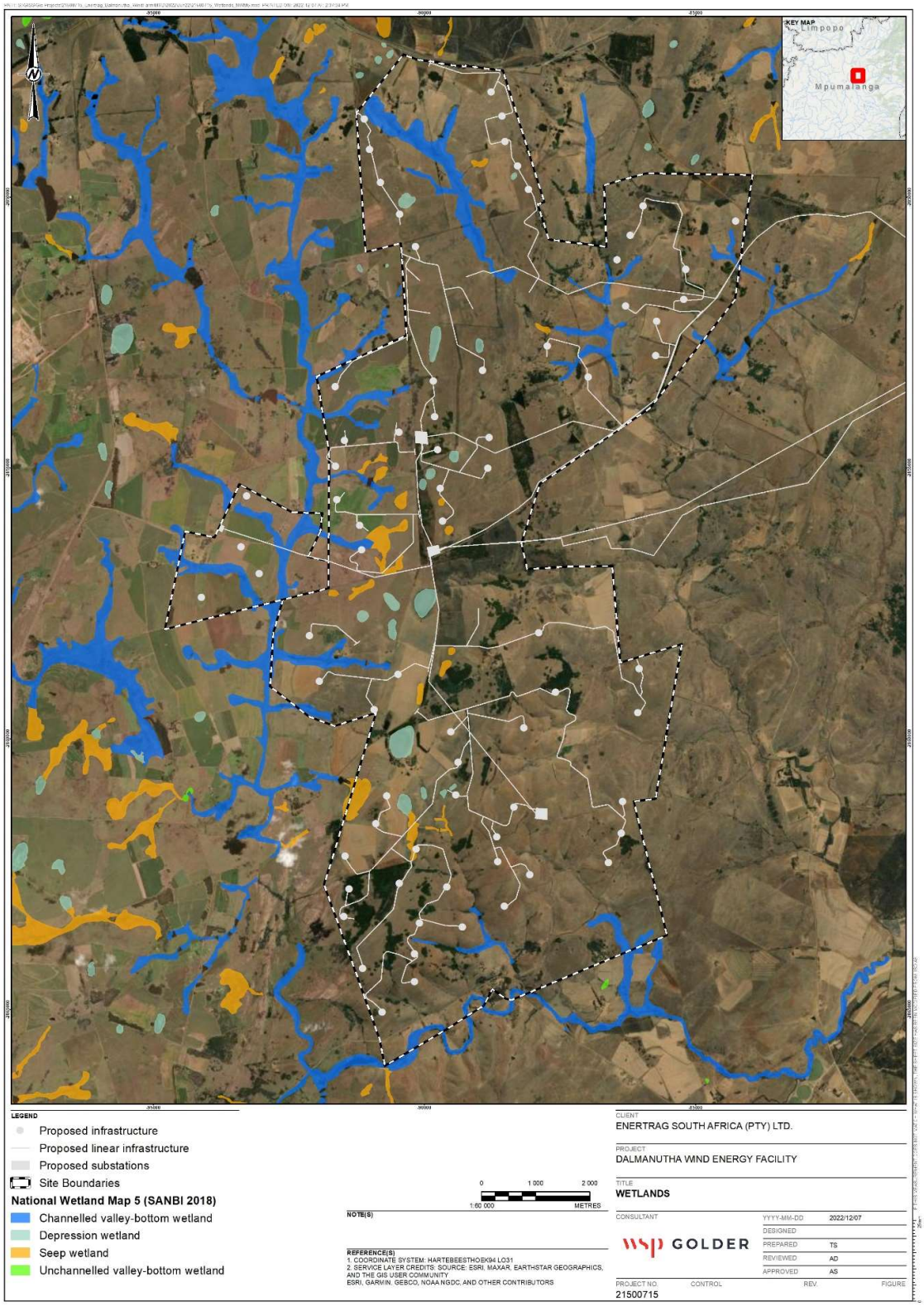

Figure 15: LSA in relation to NWM5 wetlands (2019)

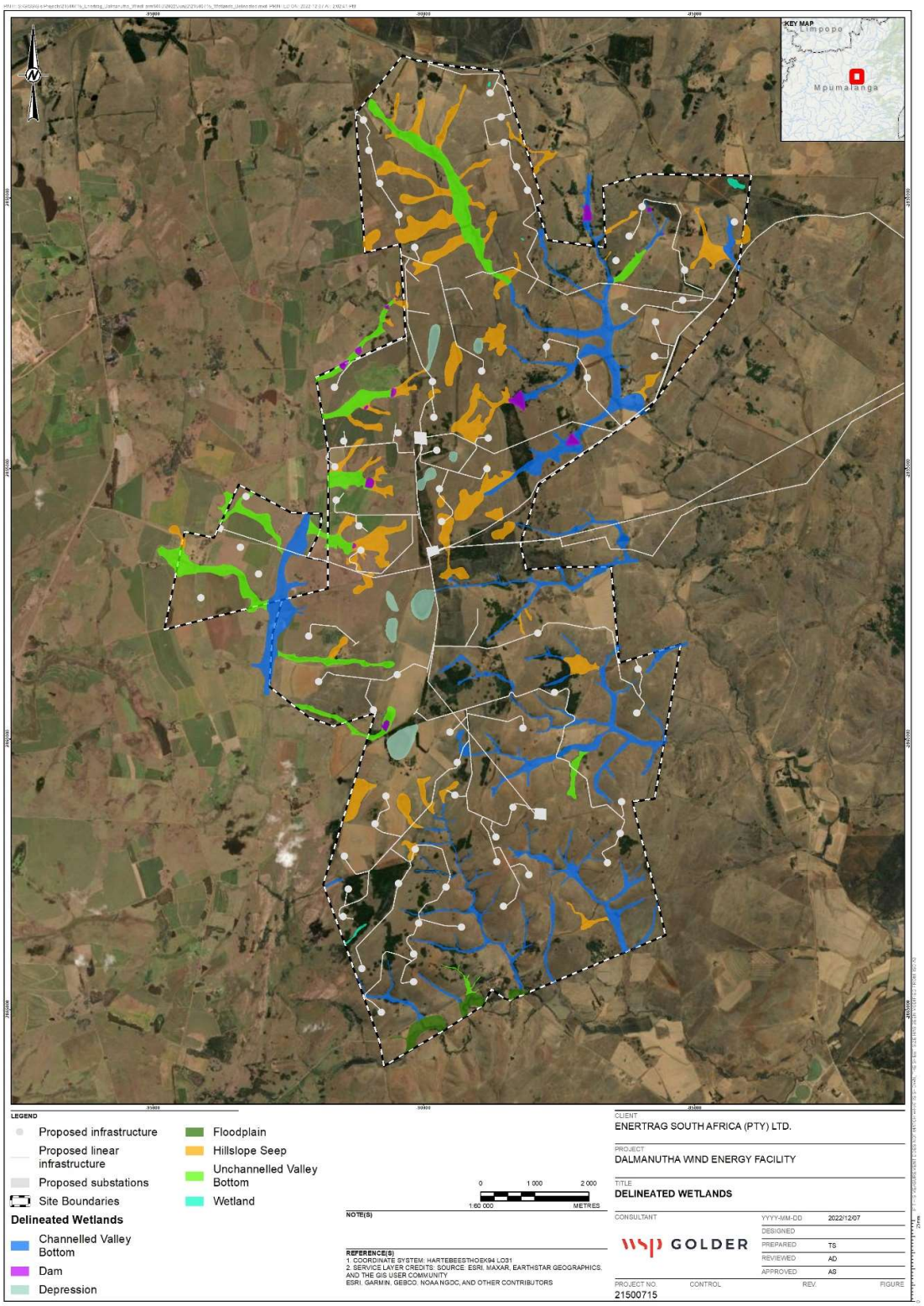

Figure 16: Baseline wetland delineation and classification for the LSA

Figure 17: Baseline aquatic biomonitoring locations

7.0 SITE SENSITVITY VERIFICATION OUTCOME

The findings of the site sensitivity verification exercise, based on the data gathering activities conducted to date (review and consolidation of available desktop data, scoping site visits, meetings with stakeholders), together with the anticipated reporting requirement as stipulated by the various protocols, are summarised in Table 6.

Table 6: Site sensitivity verification results

Theme	Screening tool sensitivity	Actual site-based sensitivity	Motivation	Scoped report requirement
Terrestrial biodiversity	Very high	Very high in primary grasslands, PES A/B wetlands Low in secondary grasslands and modified habitats	Secondary grasslands and modified habitats cannot contribute to provincial conservation targets, which is the intention of CBAs. Only (unavoidable) impacts sustained in primary grasslands and high value wetlands can be considered to affect CBAs, and as such trigger potential offset/compensation requirements.	Terrestrial Biodiversity Specialist Assessment
Aquatic biodiversity	Very high	Very high	Presence of wetland CBA, wetland cluster ESA and Klein-Komati river CBA throughout LSA.	Aquatic Biodiversity Specialist Assessments, covering wetland and riparian systems
Animal species	High	High in primary and secondary grasslands, wetlands	Evidence of presence of fauna SCC including Cape Mole Rat (*G. capensis*), grey rhebuck (P capreolus) and southern mountain reedbuck (*R. fulvorufula fulvorufula*) has been observed during first fauna survey.	Terrestrial Animal Species Specialist Assessment Report
Plant species	Medium	Medium in primary grasslands, PES A/B wetlands,	The presence and extent of primary grasslands and flora SCC to be confirmed during flora survey; however most sensitive areas are situated beyond Project footprint.	Terrestrial Plant Species Compliance Statement

8.0 SCREENING OF POTENTIAL IMPACTS

The construction and operation of the proposed new infrastructure is anticipated to result in the following key impacts on terrestrial biodiversity receptors:

1) Direct impacts through clearing of land and resultant loss of biodiversity (flora and fauna SCC, ecosystems of concern).
2) Establishment and spread of alien and invasive species.
3) Loss and fragmentation of faunal habitats.
4) Injury and mortality of fauna SCC.
5) Contamination and disturbance of aquatic (riparian) ecosystems
6) Loss and disturbance of wetland habitat
7) Changed land-use in affected catchments.

The outcomes of the screening of the potential impacts are summarised in Table 7 and described in detail in the following sections.

8.1 Construction Phase

Construction phase impacts on terrestrial habitats and species largely arise as a result of direct impacts on the receiving environment due to clearing of land in advance of project development, and resultant loss of biodiversity. The earthworks and activities involved during the construction phase of the Project can potentially exert negative impacts on sensitive ecosystems, and flora and fauna species. Potential impacts primarily relate to vegetation clearing, direct species loss/mortalities, establishment and spread of alien and invasive species (AIS), sensory disturbances, and general anthropogenic influences associated with the construction of the proposed infrastructure.

Construction phase impacts on aquatic (wetland and riparian systems) largely arise as a result of direct impacts on the receiving environment due to clearing of land within wetlands or their immediate catchments in advance of project development, and resultant loss of biodiversity. The earthworks and activities involved during the construction phase of the Project can potentially exert negative impacts on sensitive ecosystems including loss of wetland habitat, catchment landcover changes resulting in increased sediment entry to downstream systems, construction of wetland/riparian system crossings causing impoundments/barriers to movement for aquatic species, and contamination of water bodies by construction materials / vehicles (hydrocarbons etc).

The preliminary list of predicted construction phase impacts are outlined in the sections that follow, and summarised on Table 7.

8.1.1 Direct loss and disturbance of natural habitat and associated flora SCC

The construction of the proposed access roads, wind turbine foundations, and temporary laydown infrastructure will result in the direct and permanent loss of areas of natural habitat, including wetlands, and primary and secondary grasslands, some of which support flora SCC. This impact is considered highly probable, and the consequence could be very severe, since permanent loss of natural habitat cannot be mitigated. However, assuming that the mitigation hierarchy is implemented at final design stage to ensure that the potential footprint of infrastructure/activities within natural habitat areas is avoided/minimised to the maximum extent possible, it is expected that high significance impacts will be restricted to a relatively small proportion of the LSA (Figure 6), that is, those areas of primary grassland and/or PES A/B wetlands where loss/disturbance by Project infrastructure is unavoidable. These areas will require additional conservation actions to ensure no net loss of

sensitive habitat occurs; that is, development of a wetland offset strategy for any unavoidable wetland losses, and a biodiversity offset report (as described in the draft National Biodiversity Offset Guidelines) for loss of primary grassland habitats. These will need to be prepared in support of Water Use License Applications and Environmental Authorisation applications respectively.

Disturbance of adjacent areas of sensitive habitats is also considered highly probable, although the severity will likely be moderate, or negligible, and more easily mitigated.

8.1.2 Establishment and spread of alien and invasive species

Disturbances caused by vegetation clearing and earth works during construction will exacerbate the establishment and spread of alien invasive species (AIS), particularly in the vicinity of existing plantations of wattle and eucalyptus. Alien plant infestations can spread exponentially, suppressing, or replacing indigenous vegetation. This may result in a breakdown of ecosystem functioning and a loss of biodiversity.

Without mitigation, the consequence of the potential impact is considered moderately severe, while the possibility of the impact occurring is highly probable, amounting to a potential impact of Medium significance.

With the development of an auditable AIS Management Plan for the project, and the strict implementation of the recommended active control and monitoring measures throughout the construction phase, the probability of the impact occurring can be reduced, resulting in a residual impact of Low significance.

8.1.3 Injury and mortality of faunal species of conservation concern

The bulk earthworks involved in site development have the potential to injure/kill individual faunal species of concern. In particular, this impact could affect Badplaas Black Millipede, Cape Molerat, and the three species of mole with potential to occur in the LSA, all of which are ground-dwelling and relatively slow moving, and as such are vulnerable to heavy machinery movements and site clearance activities. The bulk earthworks and associated heavy machinery activity could also affect any breeding fauna SCC through sensory disturbances which may reduce the quality/desirability of the currently established breeding sites/dens in nearby areas.

Without mitigation, the consequence of the potential impact on moles and mole rats could be severe, and the likelihood highly probable, amounting to an impact of medium significance. Once mitigation measures are implemented, principally avoiding/minimising construction/excavation in high-risk habitats for ground-dwelling species, the probability of the impact occurring can be reduced, resulting in a residual impact of Low significance.

In the case that the Endangered Badplaas Black Millipede is affected, the consequence would be considered very severe; and significant residual impacts would need to be addressed via appropriately designed offsets.

8.1.4 Disturbance and fragmentation of faunal habitats

The construction phase of the Project will result in fragmentation of areas of natural habitat that may be of importance on a local level for foraging, breeding and refugia for fauna species of concern (particularly ground-dwelling species in the case of roads, and larger species where fencing is proposed), as well as the maintenance of landscape connectivity for their movements. The potential for sensory disturbances to fauna arising from noise and human/mechanical presence resulting in reduced habitat availability, is considered high during the construction phase, in the context of the existing low levels of disturbance associated with the grasslands of the LSA.

Without mitigation, the consequence of the potential impact could be moderately severe, and the likelihood highly probable, amounting to an impact of medium significance. Once mitigation measures are implemented, the probability of the impact occurring can be reduced, resulting in a residual impact of Low significance.

8.1.5 Changes in wetland health/functioning

Bulk earthworks involved in site development in the immediate catchment of wetlands have the potential to cause indirect impacts on nearby wetland habitat through compaction/removal of recharge or interflow soils, as well as increased sediment deposition to downslope wetland ecosystems in stormwater runoff. If not carefully managed, the potential impact could be moderately severe, and the likelihood highly probable, resulting in an impact of Medium significance. Mitigation measures to address the potentially reduced wetland functioning, such as distribution of flow around turbine foundations and road crossing to affected downslope wetland systems could reduce the consequence of the potential impacts and likelihood of occurrence of the potential impact.

8.1.6 Contamination of riparian systems

Stripping of topsoil and civil works activities, resulting in a decrease in water quality due to erosion, sedimentation and the alteration in the distribution and quantity of surface water runoff, is considered highly probable during the construction phase, and could be moderately severe, resulting in an impact of Medium significance. The residual impact can be reduced to Low significance with the application of the recommended mitigation measures, which would reduce the likelihood of the impact occurring as predicted.

8.2 Operation Phase

Operation phase impacts relate to the ongoing risk of spread of the alien and invasive plant species that may have been spread into new areas during the construction phase; fragmentation of fauna habitats/barriers to movement, vibration from operational wind turbines, and the risk of injury/mortality presented to fauna by vehicular traffic utilising the access roads.

8.2.1 Indirect loss and disturbance of natural habitat

Changes in catchment land-use including increased presence of roads and hard-standing (turbine pads) and stormwater management practises could cause erosion of terrestrial and wetland habitats, and contamination of aquatic ecosystems. It is anticipated that appropriate stormwater management systems that make provision for the diffuse release of clean water to the environment will be incorporated in the project design; however, these can become problematic in the absence of regular maintenance, particularly after rainfall events.

Without mitigation, the consequence of the potential impact is considered moderately severe, while the possibility of the impact occurring is highly probable, amounting to a potential impact of Medium significance; the probability can be reduced to probable and the residual impact subsequently reduced to one of low significance.

8.2.2 Spread of alien and invasive species

The potential establishment of alien invasive species in, and immediately adjacent to, the proposed development footprint will continue to be an impact of concern during the operational phase. Without mitigation, the consequence of the potential impact is considered moderately severe, while the possibility of the impact occurring is highly probable, amounting to a potential impact of Medium significance. With the continued implementation of an active alien species control programme during the operational phase, the probability of the impact occurring can be reduced, resulting in a residual impact of Low significance

8.2.3 Fragmentation of fauna habitats/barriers to movement

The presence of new roads and access tracks throughout the operational period could present a barrier to movement for ground-dwelling fauna such as millipede, moles and mole rat in particular. The implementation of mitigation measures to limit the extent of potentially sensitive habitats for these species that will be traversed by access tracks at design phase is expected to reduce the likelihood of this impact remaining at operation phase to improbable; while the consequence would remain at least moderately severe, resulting in an impact of

Low significance throughout the operation period. No additional mitigation measures to maintain landscape connectivity for ground-dwelling fauna are currently considered to be feasible, highlighting the importance of flexibility in determination of the final road access track layout.

8.2.4 Injury and mortality of faunal species of conservation concern

Increased vehicular traffic in the study area during the operation phase may pose a risk of injury and mortality of fauna species of conservation concern (and non-SCC). The consequence of the potential impact on fauna during the operational phase is expected to be low given the existing levels of traffic movements and sensory disturbance at the site, and the effect of the preceding construction works. The impact would occur throughout the operation phase, affect fauna at a local scale and is considered highly probable, resulting in an impact of Moderate significance prior to mitigation.

The application of the recommended mitigation measures reduces both the potential consequence and the probability of the impact occurring as predicted, resulting in a residual impact of 'low' significance.

8.2.5 Vibration from operating wind turbines

Ground vibrations from operating wind turbines could potentially reduce available habitat for ground-dwelling species such as moles, mole rats and invertebrates, within affected areas. The maximum distance at which these vibrations may be experienced, and whether this has a limiting effect on ground-dwelling fauna, does not appear to be well-studied; therefore for the purposes of this screening of impacts it is assumed that there is a good possibility that the impact could occur (probable), and the consequence could be severe, since it would be difficult to mitigate (unless sensitive fauna habitats are completely avoided) and would persist in the long-term, amounting to a potential impact of Medium significance. If turbines can be placed outside of potentially sensitive habitats, the possibility of the impact occurring could be reduced to Low (improbable), and the residual impact would then be of Low significance.

Table 7: Terrestrial Biodiversity Impact summary

ACTIVITY	POTENTIAL IMPACT	AFFECTED RECEPTORS	PHASE In which impact is anticipated	Probability	Consequence	Significance without Mitigation	Probability	Consequence	Significance with Mitigation
Bulk earthworks and clearance of vegetation in construction footprint	Direct Loss of natural habitat and associated flora SCC	Sensitive habitats, flora SCC	Construction	3	4	High	2	4	Medium
	Disturbance of natural habitat and associated flora SCC	Sensitive habitats, flora SCC	Construction	3	2	Medium	2	2	Low
	Establishment and spread of AIS	Sensitive habitats, flora SCC	Construction	3	2	Medium	2	2	Low
	Injury and mortality of fauna SCC	Fauna SCC – moles, mole rat	Construction	3	3	Medium	2	3	Medium
	Injury and mortality of fauna SCC	Badplaas Black Millipede	Construction	3	4	High	2	4	Medium
	Disturbance and fragmentation of faunal habitat	Fauna SCC – moles and mole rat	Construction	3	2	Medium	2	2	Low
	Catchment land use changes and activities	Changes in wetland health/ functioning	Construction, operation	3	2	Medium	2	2	Low
		Contamination of riparian systems	Construction, operation	3	2	Medium	2	2	Low
Indirect loss/disturbance of natural habitat	Habitat quality reductions due to stormwater runoff, land use changes	Sensitive habitats, flora SCC	Operation	3	2	Medium	2	2	Low

ACTIVITY	POTENTIAL IMPACT	AFFECTED RECEPTORS	PHASE In which impact is anticipated	Probability	Consequence	Significance without Mitigation	Probability	Consequence	Significance with Mitigation
Presence of new access roads and traffic	Spread of AIS	Sensitive habitats, flora SCC	Operation	3	2	Medium	2	2	Low
	Fragmentation of habitats, barriers to movement	Fauna SCC – moles and mole rat	Operation	3	2	Medium	1	2	Low
	Injury and mortality of fauna SCC	Fauna SCC	Operation	3	2	Medium	2	1	Very low
Vibrations from operating turbines	Reduced habitat quality and availability for fauna SCC	Fauna SCC	Operation	2	3	Medium	1	3	Low
Implementation of BMP	Improved biodiversity management	Sensitive habitats Flora SCC Fauna SCC	Construction Operation	-	-	-	2	2	Low

8.3 Mitigation Measures

Mitigation measures that are designed to avoid and minimise the severity and consequence of the potential impacts on aquatic and terrestrial biodiversity receptors within the LSA and RSA are summarised in the sections that follow.

8.3.1 Identification of areas to be avoided

- Areas where Badplaas Black Millipede has been confirmed or is suspected to be present due to presence of suitable habitat should be avoided. This species is considered Endangered at the international level, is range restricted, and any anticipated Project-related loss cannot be considered sustainable and as such would not be offsetable. At present, suitable habitat is expected to consist of undisturbed natural grassland; this habitat should therefore be avoided by the finalised project layout to the extent possible. Consultation with species experts to confirm habitat suitability is being undertaken so that any potentially sensitive areas can be demarcated and avoided, or subjected to dedicated species-specific surveys if they cannot be avoided.
- Areas of undisturbed, natural grassland and wetland habitat should be avoided to the extent possible. Areas of direct loss must be addressed via additional conservation actions/offsets as required.
- A loss/disturbance buffer zone of at least 100 m should be maintained between the maximum extent of construction works and the outer boundary of wetlands and riparian zones.

8.3.2 Minimisation

- To prevent loss of natural habitat (grasslands, wetlands) and flora SCC beyond the direct disturbance footprint, prior to any vegetation clearing, the development footprints should be clearly marked out with flagging tape/posts in the field. Vegetation clearing should be restricted to the proposed project footprints only, with no clearing permitted outside of these areas.
- The extent of disturbance should be limited by restricting all construction activities to the servitude as far as practically possible.
- Locate all stockpiles, laydown areas and temporary construction infrastructure at least 100 m from the edge of delineated wetlands.
- A search and rescue survey for all flora SCC should then be conducted within these marked footprints prior to the commencement of construction to determine the number of potentially impacted plant species of conservation concern. Based on the findings of the survey, clearing and/or relocation permits should be obtained from the relevant authority to clear or rescue and relocate potentially impacted plant SCC.
- Rescued plants should be relocated to an adjacent area of natural habitat.
- Wetland/river crossings should be constructed utilizing designs that ensure that hydrological integrity of the affected wetlands is preserved, and natural flow regimes are maintained (i.e. no impoundment upstream of crossings, or flow concentration downstream of crossings.
- Ideally construction activities within wetlands should take place in winter (during the dry season). Where summer construction is unavoidable, temporary diversions of the streams might be required.
- Install erosion prevention measures prior to the onset of construction activities. Measures should include low berms on approach and departure slopes to crossings to prevent flow concentration, sediment barriers along the lower edge of bare soil areas, placement of hay bales around the within wetland construction areas, and re-vegetation of disturbed areas as soon as possible

- Should some areas where Badplaas Black Millipede is confirmed/suspected be unavoidable, a search and rescue survey for Badplaas Black Millipede should be done immediately in advance of site clearance activities, in consultation with the relevant authorities (MTPA) and with the appropriate permits. Translocation activities should be done within the framework of an approved translocation plan.

8.3.3 Alien and Invasive Species Management

- An alien and invasive species management plan should be developed for the Project, which includes details of strategies and procedures that must be implemented on site to control the spread of alien and invasive species. A combined approach using both chemical and mechanical control methods, with periodic follow-up treatments informed by regular monitoring, is recommended.
- Existing stands of alien and invasive species should be removed from the LSA prior to commencement of construction.

8.3.4 Biodiversity Management/Action Plan

- Specific provision for biodiversity conservation, including details of any required offsets, should be made in the project BMP/BAP, in alignment with the objectives of the MBSP (2019).
- Inclusion of a practical framework and schedule, details of key performance indicators, recommended monitoring protocols for the delivery of mitigation measures, and costs for implementation in the BMP/BAP is recommended.

8.4 Monitoring Requirements

The following monitoring requirements are anticipated:

- The presence of alien and invasive flora species should be documented prior to the commencement of the development of the infrastructure and rehabilitation activities, and the baseline case used as a benchmark against which the spread of these species can be monitored. Annual monitoring inspections should identify target areas for clearing and subsequent rehabilitation/re-vegetation programmes.
- A record of fauna mortalities/injury due to interactions with Project infrastructure/activities should be kept on site and regularly reviewed to inform the need for implementation of any additional mitigation measures.
- Bi-annual aquatic ecosystem monitoring for duration of construction, and possibly during operation should significant impacts be predicted.
- Monitoring of wetland health to be conducted within one year of completion of construction, to measure any changes to the baseline status and ensure that recommended mitigation measures are sufficient to address any significant impacts.

9.0 SCOPE OF PLANNED TERRESTRIAL AND AQUATIC BASELINE BIODIVERSITY DATA GATHERING STUDIES AT EIA STAGE

- **Wetlands:** field studies are complete; PES and EIS scores will be reported for delineated wetland habitat in the Aquatic Biodiversity (Wetlands) Specialist Study which is currently being compiled.
- **Aquatic ecosystems**: both the high flow and low flow surveys are complete. The survey results, together with the low-flow survey results (conducted in Sept/Oct 2022) will be detailed in the Aquatic Biodiversity (riparian ecosystems) Specialist Study.
- **Terrestrial flora and fauna**: terrestrial fauna surveys (focussing on mammals, reptiles and invertebrates) were completed in June 2022 (dry season),and October 2022 (wet season) (mammals, reptiles, invertebrates and amphibians); and vegetation mapping and flora surveys were done during late

October/early November 2022 (wet season). The results will be detailed in the Terrestrial Biodiversity Specialist Study.

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Golder Associates Africa (Pty) Ltd.

Aisling Dower
Senior Ecologist

Brent Baxter
Project Director

AD/BB/nbh

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APPENDIX A

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APPENDIX B

Specialist CV

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Education

Master of Science (Hons) Applied Environmental Science , University College Dublin, Dublin, Ireland, 2007

Bachelor of Science (Hons) Zoology, University College Cork, Cork, Ireland, 2005

Certifications

Professional Natural Scientist (South African Council for Natural Scientific Professions) , (114477/15)

Languages

English – Fluent

French – Intermediate B1

Golder Associates Africa (Pty.) Ltd. – Johannesburg

Biodiversity and Ecosystem Services Specialist

Aisling is an ecologist and biodiversity specialist with over 13 years consulting experience in Europe and sub-Saharan Africa. Experienced in designing, costing and conducting baseline flora and fauna surveys, ecosystem services assessments, ecological impact assessment and development of mitigation, compensation and offsetting measures for projects in the mining, O&G, waste, transport, land development and power generation sectors.

She has completed baseline biodiversity studies and ecosystem service reviews for numerous projects in Southern Africa, East Africa, and Central and West Africa, and is experienced in conducting such assessments to satisfy both national environmental regulations and international financing requirements particularly those demanded by the International Finance Corporation's 2012 Performance Standards. To date she has worked on biodiversity-related projects in Ireland, UK, Kosovo, Gabon, Guinea, Guinea-Bissau, Kenya, DRC, Mozambique and Uganda, in addition to numerous projects in South Africa, covering northern temperate, Mediterranean, tropical rainforest, desert, savanna and coastal environments.

She has specific expertise in bat survey and population assessment, having completed her MSc research on bat population correlates, carried out bat assessments for mining and wind power developments in Ireland and the UK, and conducted baseline studies of bat populations and subsequent impact assessments for both mining and power generation projects in West Africa, Central Africa, South Africa and Europe.

Employment History

Golder Associates Africa (Pty) Ltd. – Johannesburg
Terrestrial Ecologist (February 2013 to Present)

Biodiversity specialist with responsibility for Project Management and implementation of baseline biodiversity studies and impact assessments for development projects in the mining, transport, land development, power and waste sectors, in both South Africa and sub-Saharan Africa. Role responsibilities include: Project management, including budget preparation and management, task allocation, and technical review of proposals and reports; Technical review of consultant's draft reports; biodiversity study design to satisfy national legislation and international financing requirements; Biodiversity baseline and impact assessment reporting; Biodiversity offset strategies; Biodiversity action/management plans; Ecosystem services review and impact assessment; Wetland delineation surveys and assessments; Large and small mammal surveys.

Golder Associates Ireland – Naas, Ireland
Ecologist (April 2008 to Present)

Responsible for ecological input on a range of resource development, mining, power and transportation projects, both in Ireland and Internationally. Typical project activities were undertaking baseline ecological surveys including surveys of bat activity, reptile population size and composition, newt presence/absence and population size, badger and otter presence/absence and territory size assessment, small mammal surveys, aquatic invertebrate species composition, vegetation surveys and habitat mapping. Authored numerous Ecological

Baseline, Ecological Impact Assessment and Appropriate Assessment reports, in fulfilment of regulatory requirements.

Golder Associates UK – Oxford, UK
Ecologist (April 2010 to Present)

Responsible for the ecological input on a range of resource development, mining and transportation projects, both internationally and in the U.K. to inform planning applications and Ecological Impact Assessments (EcIA), and uphold monitoring regimes. Project activities included: Route options constraints study and baseline ecological survey & mapping, statutory authority consultation and stakeholder engagement for production of baseline ecology report and ecological impact assessment chapter of ESIA for Kosovo Motorway alignment; EU-protected species survey and monitoring, including great crested newts (GCN) and bat species, for several large-scale landfill and quarry sites; Reptile, amphibian, mammal and Phase 1 habitat surveys for a suite of composting/ biogas developments, subsequent baseline ecology reports and Ecological Impact Assessment; Provision of Provision of Ecological clerk of works services at development sites

NATURA Environmental Consultants – Wicklow, Ireland
Ecologist (September 2007 to March 2008)

Responsible for report writing, data interpretation and analysis, and project management. Contributed extensively to the production of the publication "The Status of EU Protected Habitats and Species in Ireland" (NPWS, 2008).

University College Dublin – Dublin, Ireland
Field Assistant (July 2007 to September 2007)

Field assistant for salmonid fish population assessment and crayfish surveys, including electrofishing, fish handling and scale sampling, sorting and ID of freshwater invertebrates and plants.

Thomson Scientific & Healthcare – Limerick, Ireland
Scientific Information Specialist (May 2005 to August 2006)

Researcher responsible for writing article abstracts, proof-reading and editing newly published scientific research papers.

PROJECT EXPERIENCE – IFC PERFORMANCE STANDARD 6 PROJECTS

Kamoa Copper BMP (2021) Katanga, DRC	Lead biodiversity specialist responsible for development of a biodiversity management plan for species, ecosystems and ecosystem services of concern within the Kamoa MRA. Field studies included responsibility for the identification of peat-forming systems and refinement of vegetation mapping through ground-truthing.
Camalco Biodiversity Capacity building (2020) Adamawa, Cameroon	Lead biodiversity specialist providing guidance and technical review to in country consultants, for survey design, implementation and reporting biodiversity baseline data gathering activities to achieve the requirements of IFC PS6.
Kamoa Copper powerline ESIA (2020) Katanga, DRC	Review and update of biodiversity impact assessment for powerline ESHIA
Kamoa Copper Cumulative Impact Assessment (2020) Katanga, DRC	Lead author for the cumulative impact assessment study for the Kamoa Copper project.
SMFG Nimba Fauna Baseline (2020) Nimba Mountains, Guinea	Compiled baseline fauna report for the ESIA, including update of baseline information with results of various taxonomic studies done since the original 2013 baseline, and critical habitat-triggering species descriptions.
Large Infrastructure Barging Route - Marine Ecology Impact Assessment (2020) Vilanculos, Mozambique	Lead biodiversity specialist for marine baseline surveys including sea grass and coral reef extent and condition assessments, to inform microrouting of a proposed barging route in close proximity to Bazaruto Archipelago National Park.
Konza Techno City - Biodiversity Baseline and BMP Review (2019) Machakos, Kenya	Acting as biodiversity expert on behalf of the lending institution, was responsible for review of the intial biodiversity baseline study and BMP, and development of recommendations for additonal work required to ensure that the baseline and BMP are of the standard necessary to satisfy the requirements of Performance Standard 6.
Proposed Oil Field Development (Confidential) (2014 - 2019) Turkana, Kenya	Screening for Critical Habitats as defined by IFC PS6 and IFC GN6, 2012. Desktop biodiversity description and remote land cover sensing to inform scoping report and fieldwork planning for biodiversity and ecosystem services baseline data gathering phase. Authored Biodiversity baseline report and impact assessment to Kenyan and IFC standards.
Ahafo North Mine Biodiversity Baseline and IA (2018) Brong-Ahafo, Ghana	Consolidated biodiversity data from previous studies with up-to-date baseline data on aquatic ecosystems and vegetation into an updated biodiversity baseline report and impact assessment for the proposed mining of Ahafo North
Beach Landing Sites (Confidential) - Marine and Coastal baseline and Critical Habitat Assessment (2018) Vilanculos, Mozambique	Authored marine and coastal baseline study report based on available reports and data. Determined species and ecosystem triggers of Critical Habitat in the study area and assessed impacts and developed bespoke mitigation measures to ensure NNL of natural habitat and NG of critical habitats.

Kinsevere Copper Mine (2018) Haut-Katanga, DRC	Consolidated biodiversity data from previous studies with up-to-date baseline data on flora and birds into an updated biodiveristy baseline report and impact assessment for the proposed expansion of TSF to adjoining tenement
Oil Exploration Block - Biodiversity Baseline and Impact Assessment (2018) Hoima, Uganda	Baseline biodiversity description to inform the overall Environmental Baseline Report for that exploration block. Updated biodiversity impact assessment chapter and authored cumulative impact assessment report for the project.
Proposed Copper Mine (Confidential) (2017) Katanga, DRC	Ecosystem services review and impact assessment to satisfy the requirements of IFC PS6 for a proposed copper mine development.
Bokpoort Solar PV & CSP Tower (2016) Northern Cape, South Africa	Conducted specialist bat baseline study and impact assessment for solar PV and CSP tower project. Authored ecosystem services review and impact assessment for the full project.
Kingfisher Development Area (2015) Hoima, Uganda	Ecosystems goods and services assessment to IFC PS6 standards, for a proposed oil development project on the shore of Lake Albert.
Proposed Mine (Confidential) (2013) KwaZulu-Natal, South Africa	Ecosystems goods and services assessment to IFC PS6 standards, for a proposed magnetite mine in an area of tribal lands in KZN, also known for its rich biodiversity.
Proposed Iron Ore Mine (2012) Nimba, Guinea	Led specialist bat survey of proposed mine site in Guinea. Conducted extensive wet and dry season bat presence and activity surveys and established population status of a Critically Endangered bat species within proposed site. Produced Critical Habitat mapping and reporting in accordance with requirements of IFC Performance Standard 6.
Proposed Rare Earth Mine (Confidential) (2012) Gabon	Led specialist bat survey of proposed mine site in a remote rainforest area in Gabon. Conducted wet and dry season bat presence and activity surveys to get a baseline bat species list for the proposed site, which included new bat records for Gabon.

PROJECT EXPERIENCE – ECOSYSTEM SERVICES ASSESSMENT

Oil Development Block (2018) Turkana, Kenya	Ecosystem services review and impact assessment to IFC PS6 for a proposed oil field development including proposed overland haulage route.
Kingfisher Development Area (2018) Hoima, Uganda	Ecosystem services review and impact assessment to IFC PS6 standards, for a proposed oil development project on the shore of Lake Albert.
Kipoi/Luputo Mine (2016) Katanga, DRC	Ecosystem services review and impact assessment to IFC PS6 for a copper/cobalt mine in DRC.
Metalkol (2016) Kolwezi, DRC	Ecosystem services review and impact assessment to IFC PS6 for a copper/cobalt mine in DRC.

Proposed Mine, Melmoth (2015) KwaZulu-Natal, South Africa	Ecosystems goods and services assessment to IFC PS6 standards, for a proposed magnetite mine in an area of tribal lands in KZN, also known for its rich biodiversity.
Gas to Liquid Plant (2013) Tashkent, Uzbekistan	Produced ecosystem goods and services assessment based on information garnered from ecology, surface water and social baseline assessments, in order to fulfil International Finance Corporation Performance Standard 6 requirements for the project funding and ESIA.

PROJECT EXPERIENCE – BATS

Proposed Iron Ore Mine - ESIA to IFC Standards Nimba Mountains, Guinea	Led specialist bat survey of proposed mine site in Guinea. Conducted extensive wet and dry season bat presence and activity surveys and established population status of a Critically Endangered bat species within proposed site. Produced Critical Habitat mapping and reporting in accordance with requirements of IFC Performance Standard 6.
Proposed rare earth mine - ESIA to IFC Standards (Confidential), Gabon	Led a six-week specialist bat field survey of proposed mine site in a remote rainforest area in Gabon. Conducted wet and dry season bat presence and activity surveys to compile a baseline bat species list for the study area, which included new bat records for Gabon. Authored baseline and impact assessment reports to inform the overall ESIA.
Phalaborwa Mine - Artificial Roost Creation Guidance Phalaborwa, Limpopo, South Africa	Provided design guidance to our client who proposed to construct an artificial bat roost on their property using old mining vehicle tyres and overburden materials.
Kosovo Wind Farm ESIA to World Bank Standards Kosovo	Analysed passive acoustic monitoring data for bats to compile a baseline report on bat species assemblage, diversity and spatial distribution of bat activity within the wind farm area of influence.
Varkensvlei Mine ESIA Waterberg, Limpopo, South Africa	Baseline study of bat species assemblage, diversity and spatial distribution of bat activity within the surface mining rights area, including identification of sensitive habitats and terrain features on site that could constitute important roosting or foraging habitat for various species. Authored baseline and impact assessment reports to inform the overall ESIA.
Rio Tinto Tete Tete, Mozambique	Bat monitoring surveys (passive acoustic monitoring supplemented by trapping surveys) in compliance with environmental authorisation conditions and in line with the recommended mitigation measures of the ESIA.
Farim Phosphate Project ESIA Farim, Guinea-Bissau	Ecologist on Terrestrial Ecology team. Responsible for undertaking wet and dry season field survey work to establish baseline bat diversity, including passive acoustic monitoring and identification of sensitive habitats and terrain features on site that could constitute important roosting or foraging habitat for various species. Authored baseline study report to inform the ESIA.
Bokpoort Solar PV & CSP Tower (2016) Northern Cape, South Africa	Conducted specialist bat baseline surveys including passive acoustic monitoring and identification of sensitive habitats and terrain features on site that could constitute important roosting or foraging habitat for various species. Authored the baseline report and the impact assessment for a solar PV and CSP tower project, to IFC PS6 standard.

PROJECT EXPERIENCE – WETLAND ECOLOGY

Kamoa Copper BMP (2021) Katanga, DRC	Wetland ecologist responsible for the identification of peat-forming systems and refinement of vegetation mapping through ground-truthing.
AGA Pipeline wetland assessment (2019) Gauteng, South Africa	Wetland delineation, baseline PES, EIS and EcoServices scores and impact assessment for proposed water return pipeline.
Twinsaver Water Use License (2018) Gauteng, South Africa	Wetland delineation, baseline PES, EIS and EcoServices scores and impact assessment for ESIA for water use license application
Belfast Implementation Project (2015 - 2018) Mpumalanga, South Africa	Wetland baseline monitoring to inform environmental impact assessment, including multi-seasonal surveys and updates of PES, EIS and WET-Ecoservices scores for each HGM unit concerned.
Kangra Kuisipongo Overland Conveyor ESIA (2017) Kwazulu Natal, South Africa	Conducted wetland delineation and baseline assessment (PES, EIS, WetEcoservices) and impact assessment of overland coal conveyor.
Mafube LifeX Project (2015 - 2017) Mpumalanga, South Africa	Wetland mitigation strategy fieldwork and assessments. Ongoing project support during construction through monitoring and management of construction activities, and overseeing implementation of WUL conditions on the ground.
BECSA Middelburg (2015) Mpumalanga, South Africa	Wetland delineation and assessment of proposed sludge pipeline river crossings, and wetlands lying within 500m of proposed slurry dump pits to inform Water Use Licence application and EIA.
Metmar, Steelpoort (2014) Limpopo, South Africa	Delineation and assessment of floodplains of the Steelpoort River, upstream, within and downstream of the proposed site of an open cast pit.
Mooifontein, Arnot (2014) Mpumalanga, South Africa	Bird and amphibian surveys of pans and wetlands within mining rights area to update PES and EIS, for use in determining wetland reserve.
Interwaste Amadwala (2014) Gauteng, South Africa	Delineated wetlands and assessed Present Ecological Status, Ecological Importance and Sensitivity, and Ecosystem services provided by each wetland within project area of influence. Conducted impact assessment and devised mitigation measures and monitoring regimes.

PROJECT EXPERIENCE – MINING

Bankable Feasibility Study (confidential) (2019) Mpumalanga, South Africa	Responsible for authoring environment chapter of BFS.
Belfast Implementation Project (2015-2018) Mpumulanga, South Africa	Led three years of pre-construction wetland monitoring including assessment of PES, EIS and EcoServices for mining right area
Phalaborwa Mine - Biomonitoring (2015) Limpopo, South Africa	Biological monitoring of the Oliphants and Selati Rivers, including assessment of fish populations, aquatic macroinvertebrates and riparian vegetation to monitor the condition of habitat in the vicinity of the mine, observing any significant changes and providing advice to PMC on biodiversity management. This ongoing project continues to be conducted in compliance with the most rigourous health and safety standards, due to the frequent presence of dangerous large mammal fauna including elephant, buffalo and lion in and around the mine site.
Tshikondeni Mine (2014) Limpopo, South Africa	Ecologist on Terrestrial Ecology team. Responsible for undertaking wet and dry season field survey work to determine baseline large and small mammal, bat and bird diversity and vegetation community mapping for development of a rehabilitation plan for mined areas.
Bat Baseline Study to IFC Standards (2012) Gabon	Led specialist bat survey of proposed mine site in a remote rainforest area in Gabon. Conducted wet and dry season bat presence and activity surveys to get a baseline bat species list for the proposed site, which included new bat records for Gabon.
Bat Baseline Study to IFC Standards (2012) Nimba, Guinea	Led specialist bat survey of proposed mine site in an upland region of Guinea. Conducted extensive wet and dry season bat presence and activity surveys and established population status of a Critically Endangered bat species within proposed site. Produced Critical Habitat mapping and reporting in accordance with requirements of IFC Performance Standard 6.
Farim Phosphate Project ESIA (2011) Farim, Guinea Bissau	Ecologist on Terrestrial Ecology team. Responsible for undertaking wet and dry season field survey work to establish baseline bat, mammal and bird diversity, and vegetation mapping for subsequent ecological impact assessment.
Rio Tinto Tete Project (2013 - 2015) Tete, Mozambique	Ecologist on Terrestrial Ecology team. Responsible for undertaking wet and dry season field survey work to determine baseline small mammal and bird diversity and vegetation community mapping for subsequent ecological impact assessment.

PROJECT EXPERIENCE – POWER

Eskom Mier PV developments (2021) Northern Cape, South Africa	Bat baseline study and impact assessment as part of overall ESIA for a PV development.

IFC PS6 due diligence review for hydropower project (2021) Ivory Coast	Performed due diligence review of project compliance with IFC PS6 biodiversity mitigation and management requirements, on behalf of lenders.
Wind Energy Facility, Kosovo (2020) Kosovo, Europe	Bat data analysis and baseline reporting as part of overall ESIA for a WEF development
Bokpoort CSV and PV developments (2017) Northern Cape, South Africa	Biodiversity and ecosystem services baseline and impact assessment as part of overall ESIA for two PV and one CSV development on adjoining properties.
Solar Park - Gordonia Park substation powerline (2016) Northern Cape, South Africa	Conducted survey of powerline route to identify cluster of protected trees, other plants of conservation importance, and areas potentially important to bird species of concern to inform the final routing and placement of pylons and bird deterrents
Kendal Power Plant (2013) Mpumalanga, South Africa	Terrestrial vegetation, bird and mammal monitoring to assess impacts of existing ash dump, and compile baseline data for proposed new ash dump.
Ndumo-Gezisa Powerline Route Corridor - Impact Assessment (2013) KwaZulu-Natal, South Africa	Terrestrial flora and fauna assessment of route corridor options for proposed powerline approx. 30 km long. Studies included small and large mammals, birds, reptiles and vegetation mapping.
Vaalbank 88 Kv Powerline - Basic Assessment (2014) Gauteng, South Africa	Terrestrial and wetland baseline study and impact assessment reports to assess the impacts of a proposed powerline corridor and switching station footprint.
Begg Farm Wind Cluster EIA (2012) Fife, Scotland	Responsible for production of Environmental Impact Statement for a 3MW wind farm at Begg Farm, Kirkcaldy, Fife. Authored chapters including Project Description, Scoping, Existing Environment, Summary of Effects and Non-Technical Summary. Also responsible for authoring baseline chapter on Local Land Use and Recreational Access.
Barrel Law Wind Farm EIA (2012) Scottish Borders, Scotland	Responsible for co-ordinating front-end production of Environmental Impact Statement for a 21MW wind farm at Barrel Law, Hawick. Authored chapters including Project Description, Scoping, Policy Framework and Existing Environment.

PROJECT EXPERIENCE – TRANSPORTATION

Kosovo Motorway ESHIA (2010)
Prizren-Pristine, Kosovo

Golder was commissioned by Bechtel/Enka to prepare Route Corridor Selection Study and Environmental and Social Impact Assessment for approx. 70 km of proposed motorway. As Project Ecologist, role included undertaking ecological constraints mapping for three route options, and multi-disciplinary walkover survey of selected route - coordinating a team of local zoological and botanical experts. Produced Ecological Impact Assessment chapter and devised design mitigation recommendations. Developed tool-box talk regarding dealing with protected species on site during construction.

PROJECT EXPERIENCE – EU HABITATS DIRECTIVE - APPROPRIATE ASSESSMENT

Report on Cumulative Impacts of Proposed Gold Mine (2010)
Krumovgrad, Bulgaria

Golder were commissioned to technically review a report outlining an Assessment of the compatibility of Natura 2000 site conservation objectives with an investment proposal for the extraction and processing of gold-bearing ore from the Krumovgrad Exploration Area. Role on this project included technical review of the report, identification of information gaps in the cumulative impact assessment, and recommendations for addressing these issues within the report.

Stage 2 Appropriate Assessment of WWTP (2011)
Kildare, Ireland

Undertook Stage 2 Appropriate Assessments of the discharges from a number of waste water treatment plants (WWTP) on Pollardstown Fen SAC, a groundwater-fed fen habitat which is the largest of its type in Ireland. WWTP that discharged to both surface water systems and groundwater systems were examined for their potential to impact on groundwater quality of the fen and subsequent impacts on the vegetation community composition of the fen, and other water-dependent protected species including the rare, EU-protected whorl snails Vertigo spp. Cumulative impact assessment reports regarding Pollardstown Fen SAC and Mouds Bog SAC were also subsequently prepared

Stage 2 Appropriate Assessment - Lidl Supermarket Extension (2011)
Tipperary, Ireland

Project Ecologist for Stage II Appropriate Assessment of proposed upgrade works to retail unit in Clonmel, Co. Tipperary, which is situated adjacent to the River Suir SAC. Role included desktop research and consultations with statutory authorities, Phase I habitat survey of lands between the retail unit and the river, Ecological Impact Assessment and subsequently Stage II Appropriate Assessment report production.

Appropriate Assessment of Quarry discharge to SAC (2011)
Carlow, Ireland

Project Ecologist responsible for undertaking an Appropriate Assessment screening of the potential impacts of a treated quarry wash-water discharge to the River Slaney, which is an SAC protected under the EU Habitats Directive. Surveys included an Extended Phase I habitat survey of the quarry site, and aquatic invertebrate sampling of the River Slaney upstream and downstream of the discharge point to assess any potential impacts of the discharge on the river water biological quality. Consultation with the regional Fisheries Board and the National Parks and Wildlife Service was undertaken and mitigation measures regarding the reduction of silt load in the discharge were recommended.

Proposed Leisure Facility Adjacent to Blessington Lake SPA
Wicklow, Ireland

Undertook Appropriate Assessment Stage 1 (Screening) and subsequent Stage 2 Appropriate Assessment of proposed leisure facility. Acquisition of additional ornithological data in consultation with local NPWS ranger and local birders in progress and final report to be submitted to NPWS for comment.

Appropriate Assessment Screening of Local Area Development Plans (2011) Kildare, Ireland	Undertook Appropriate Assessment Stage 1 (Screening) for a number of local area plans that could potentially impact significantly on nearby protected sites including SACs and SPAs. Surveys considered features for which these sites are designed including Annex I habitats, wintering bird populations, otter, kingfisher and aquatic species such as brook lamprey.

PROJECT EXPERIENCE – UK & IRELAND: ECOLOGICAL BASELINE STUDIES AND IMPACT ASSESSMENT

Future Biogas - Various sites (2010) Norfolk, UK	Project Ecologist responsible for undertaking Extended Phase I habitat surveys of three sites in Norfolk for which the construction of biogas plants is proposed. Each site (including a 250m buffer area surrounding the sites) was surveyed and the habitats mapped. Other features considered included hedgerow assessments, bat foraging/commuting/roosting potential assessment, and great crest newt habitat suitability assessments. During this project I was also responsible for training a third-level summer student in botanical identification and habitat mapping techniques; and desk top research and baseline data aquisition
Biffa Landfill Extension (2010) Cambridgeshire, UK	Project Ecologist responsible for undertaking great crested newt surveys, including presence/absence, evidence of breeding, and population size, age and sex distribution enumeration.
British Sugar Site Extension (2010, 2011) Norfolk, UK	Project Ecologist responsible for undertaking baseline ecological surveys of three large areas of arable cropland, intersected by numerous drainage ditches, where British Sugar intends to expand their processing plant. Surveys undertaken included Phase I habitat surveys, reptile surveys, and aquatic vegetation assessment and water vole surveys of approximately 3km of drainage ditches.
Proposed Bioenergy and Composting Facility (2011) Essex, UK	Project Ecologist responsible for coordinating and undertaking baseline ecological surveys of a former army airbase site, which is to be developed as a quarry and subsequently a bioenergy and composting facility. Surveys included bat roost emergence and re-entry surveys in a number of abandoned farmyard and army base buildings undertaken by 6 surveyors, and great crested newt population presence/absence, evidence of breeding and population assessment surveys undertaken by 5 surveyors within 250m of the site to inform European Protected Species Licence Application; and Extended Phase I Ecology survey of the site including badger surveys to inform the Ecological Impact Assessment of the EIS.
Otter Survey - Johnstown Flood Relief Works (2011) Kildare, Ireland	Project ecologist responsible for carrying out an intensive otter survey along the banks of a river channel which is within the range of the local otter population, and which is to be dredged and widened for flood relief works. Otter usage of the site was assessed by sprainting frequency, and spraints were examined for evidence of seasonal dietary habits.
Ornithological Surveys for Proposed Wind Farm (2009) Mayo, Ireland	Undertook monthly vantage point and walkover bird surveys on an upland site in the west of Ireland for 6 months, to gather bird site usage data in order to ultimately assess collision risks and other impacts of the construction of a wind farm across the mountainside. Surveys included walkover surveys and vantage point watches; where species, flight height and direction, and behaviour was noted for 3 hour periods at each vantage point on each survey occasion.

Leixlip Hot Springs/ Spa and Toll House (2009) Kildare, Ireland	Project ecologist responsible for assessing common newt presence/absence in hot spring, and provision of advice to Parks Department on most appropriate season for works, and requirements for Appropriate Assessment in line with the EU Habitats Directive. Also undertook bat roost dusk emergence and dawn re-entry surveys of a derelict toll-house structure adjacent to the Royal Canal to assess the presence/absence of roosting bats.
Sallins Flood Relief Works (2010) Kildare, Ireland	Undertook Extended Phase 1 Habitat Survey and ecological constraints mapping for proposed flood relief works. Surveys included river habitat assessment, fisheries potential assessment, and survey of trees and structures for potential bat roosts.
Coastal Habitats Survey and Mapping (2009) Dublin, Ireland	Golder Associates were retained by Dún Laoghaire-Rathdown County Council to collect, collate and review all available biodiversity data relating to coastal and marine habitats of the 17km coastline of Dún Laoghaire Rathdown. Preliminary habitat maps were derived from aerial photography and in-house Level II habitat classification data holdings, and were ground-truthed by field survey of all accessible areas of the coastline to produce Level III classification habitat mapping. Role included desk top study and collation of available biodiversity data on the locality, and preparation and ground truthing of preliminary habitat maps to refine the habitat mapping of the coastline to Level III habitat classifications.
Geotextile Assisted Dewatering of Lakes, Naas Town Council (2008) Kildare, Ireland	Golder was commissioned by Naas Town Council to prepare a Feasibility Study for the removal of silt from Naas Lakes, Naas, Co. Kildare, and subsequently assisted Naas Town Council in the production of tender documents for the required works. Project Ecologist responsible for undertaking a survey of nesting waterfowl on the lake and provision of recommendations regarding optimum timing of the works, in order to avoid the main bird breeding season and any significant negative impacts on local bird populations; and consulted with the Regional Fisheries Board as to their requirements for the preservation of crayfish and brook/river lamprey populations within the lakes, in order to inform the tendering process.

TRAINING

Tools for Wetland Assessment (WET-Health, WET-Ecoservices)
Rhodes University, August 2016

Mainstreaming Biodiversity into Business
National Business and Biodiversity Network, South Africa, November, 2014

First Aid Level 1
Action Training Academy, July, 2014

Wetland Management: Introduction and Delineation
University of the Free State, November. 2013

Flora of Witwatersrand
Botany Dept, University of Witwatersrand, October, 2013

Mammal Identification
The Mammal Society, May 2009

Bat Detector Workshop
Bat Conservation Ireland, June 2007, June 2008

Irish Botany
National Botanic Gardens, Glasnevin, Dublin, 2008

Outdoor Safety & First Aid
Mountain Rescue Trainer, November 2007

PROFESSIONAL AFFILIATIONS

Professional Natural Scientist (Pr. Sc. Nat. 114477/15)

Member of South African Bat Assessment Association

Member of South African Wetland Society

PUBLICATIONS

Journal Articles

Monadjem, A., L. Richards, P. J. Taylor, C. Denys, A. Dower and S. Stoffberg. Diversity of Hipposideridae in the Mount Nimba massif, West Africa, and the taxonomic status of Hipposideros lamottei. *Acta Chiropterologica*, 15(2) (2013), 341-352.

Other

The Status of EU Protected Habitats and Species in Ireland. National Parks & Wildlife Service, 2008.