Offset Needs Analysis for the proposed Loxton Wind Energy Facility 3 and associated infrastructure near Loxton, Northern Cape Province:

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1. SCOPE & BACKGROUND

Loxton Wind Facility 1 (Pty) Ltd, Loxton Wind Facility 2 (Pty) Ltd and Loxton Wind Facility 3 (Pty) Ltd (hereafter referred to as the Applicant) is proposing to develop a cluster of three wind energy facilities located near Loxton, known as the Loxton Wind Energy Facility 1-3. The EIA process is currently underway and an outcome of the Scoping Phase is that an offset needs analysis is required to inform the development application. This was driven primarily by the Loxton Wind Energy Facility 3, which includes a large extent of CBA and NC-PAES Focus Area within the development project area. However, while the current study and analysis focusses to a large degree on the Loxton Wind Energy Facility 3, the study does not confine itself to this project as there is the possibility that the three separate developments in conjunction with other wind energy projects already authorised in the area would generate significant cumulative impacts on biodiversity.

In terms of the draft Biodiversity Offset Guideline (Government Gazette 46088 (Notice No. 1924) on 25 March 2022 in terms of Section 24J of the National Environmental Management Act, 1998 (Act No. 107 of 1998), *"A biodiversity offset is required when a proposed listed or specified activity, or activities, is/are likely to have residual negative impacts on biodiversity of moderate or high significance. These negative impacts could affect biodiversity pattern (e.g. threatened ecosystems, species or special habitats), ecological processes (e.g. migration patterns, climate change corridors enabling shifts in species distributions over time,14 or wetland function), ecosystem services (e.g. provision of clean water) or a combination of all three."* The central question of the current study is therefore the degree to which the Loxton Wind Energy Facilities would generate residual impacts on biodiversity either singly or in combination that are considered to be of moderate or high significance. A secondary question that would follow on from the above would then be, if there are indeed medium or high residual impacts, what type and nature of offset would be most appropriate for the development in context of the site, the surrounding landscape and associated biodiversity patterns and processes operating in the area?

This Ecological Offset Needs Analysis has the following broad aims:

- Summarise and outline of the current framework for biodiversity offsets. A summary of the most relevant sections of the Draft National Biodiversity Offset Guideline is provided, highlighting the relevant sections as they pertain to the current development.
- Provide a summary of the biodiversity features present within the Loxton Wind Energy Facility cluster, highlighting unique, threatened or otherwise significant species, ecosystems and processes within the area that may be negatively impacted by the development.
- Provide an analysis of the residual and cumulative impacts of the development on specific species of concern, ecosystems and general biodiversity patterns and processes, as well as the impact of the development of the ability to meet conservation targets for the affected ecosystems.

- If relevant, explore potential offset areas in terms of the draft national offset guidelines and the regional conservation context to ensure that identified offset areas meet the like for like offset criterion, but also occur in an area where their long-term sustainability can be ensured.
- Identify any further actions and priorities required for taking the offset process forward.

2. FRAMEWORK FOR BIODIVERSITY OFFSETS

The draft National Biodiversity Guideline provides recognition of the importance and economic value of the biodiversity of the country. The need for an offset policy framework is predicated on the recognition that this biodiversity is being negatively impacted by human activity with negative consequences both for the environment and human well-being. The guidelines suggests that "*biodiversity offsetting has the potential to encourage more rigorous consideration of feasible development alternatives which avoid and minimise negative impacts on biodiversity, to help remedy and counterbalance the degradation and loss of biodiversity through increased protection and appropriate management, and to help South Africa to meet its international biodiversity and protected area targets. Biodiversity offsetting can therefore play a role in ensuring that biodiversity and ecological infrastructure can continue to provide the ecosystem services on which people depend for their livelihoods, and contribute to the achievement of the environmental right in section 24 of the Constitution*."

The desired outcome of biodiversity offsets is to ensure the following:

1. That biodiversity is secured in the long term through the protection and appropriate management of ecosystems and species.
2. That efforts to secure biodiversity in the long term contribute to the expansion of South Africa's protected area network, and are focussed in areas identified as biodiversity priorities, with particular emphasis on the consolidation of priority areas and securing effective ecological links between priority areas.
3. That ecological infrastructure and the services and benefits it provides are maintained and where necessary restored.
4. That the cumulative impact of the authorised activity, or activities, and land and resource use change does not –
   - result in the loss of irreplaceable biodiversity or jeopardise the ability to meet biodiversity targets;
   - lead to any ecosystem with a threat status of Vulnerable or Least Concern becoming Endangered, or any Endangered ecosystem becoming Critically Endangered;
   - cause an irreversible decline in the conservation status of species and the presence of special habitats; and
   - cause a significant loss in ecosystem services

The basic principles and tenets that underlie offsets and their practical implementation required to achieve the above goals are outlined below. The majority of this is taken directly or synthesised from the draft National Biodiversity Offset Guidelines (2022).

- **Offsets are the final option in the mitigation hierarchy** - Biodiversity offsets must only be considered once all the foregoing steps in the mitigation hierarchy have been considered to their full and feasible extent. The mitigation hierarchy dictates that the degradation and loss of biodiversity must be avoided, or where impacts cannot altogether be avoided, they should be minimised and the area adversely impacted by relevant activity should be rehabilitated. When, after taking the aforementioned mitigation measures, there are likely to be residual negative impacts on biodiversity of medium to high significance, they must be offset.
- **Ecological equivalence (like-for-like) is the preferred offset type** – Only when offsets remain the only mechanism to manage residual negative impacts and in order to counterbalance a residual impact, biodiversity offsets should comprise - or benefit - the same or similar biodiversity components as those components that would be negatively affected by the development. Trading-up offset types, or biodiversity offsets which secure priority areas of greater importance or priority to biodiversity conservation than the area being impacted, may however be considered under certain circumstances in order to contribute to conservation objectives.
- **Residual impacts on irreplaceable biodiversity cannot be offset** – Where there are no options left in the landscape to counterbalance a residual impact in accordance with the ecological equivalence (like-for-like) principle (see above), that residual impact cannot be offset. That is, there would be a residual impact on irreplaceable biodiversity, which would prevent national biodiversity targets from being met. In these cases development would generally not be acceptable and the impacts should be avoided. Ecological compensation for residual impact which cannot be offset should only be considered only in highly exceptional circumstances, when there are imperative reasons for overriding public interest. Ecological compensation requirements should be punitive in scale and cost
- **Additionality** - Biodiversity offset interventions must be additional to, or over and above, biodiversity conservation measures that are already required by law, or that would have occurred had the biodiversity offset not taken place.
- **The quality and quantity of residual impacts on biodiversity must be considered in decision making involving biodiversity offsetting** – When considering the significance of the residual impact to be counterbalanced by an offset intervention, the nature of the impacted biodiversity (e.g. whether it is part of a priority area), its threat status and protection level, ecological condition, and the size of the impacted area must be considered at the very least.
- **Biodiversity offsets should embody the ecosystems approach and promote connectivity in the wider landscape** - Biodiversity offsets should ideally involve the integrated management of land, water and living resources in a way that promotes ecological functionality and persistence. Biodiversity offsetting should therefore take a landscape-scale, rather than a site-specific view, to enable

consideration of cumulative impacts, to promote connectivity between biodiversity priority areas.

- **Biodiversity offsets must result in long-term security and management of priority biodiversity** - Biodiversity offsets should contribute to the long-term security of biodiversity priority areas and maintain or improve their ecological condition, thereby resulting in tangible and measurable positive outcomes for biodiversity conservation 'on the ground'. Biodiversity that is in good ecological condition promotes human well-being in the long term.
- **Biodiversity offset design must be defensible and transparent** - The measure of the size and significance of the residual impacts on biodiversity caused by a proposed activity, as well as the design and implementation of biodiversity offsets, should be based on the best available biodiversity information and sound science, and should incorporate local, traditional and conventional knowledge and values as appropriate. Offsets must consider all significant residual impacts on biodiversity including direct, indirect and cumulative impacts. The scope of assessment must include the due consideration of impacts on priority biodiversity areas; impacts on biodiversity pattern (compositional and structural aspects of biodiversity, at the genetic, species or ecosystem level) and ecological processes (the functions and processes that operate to maintain and generate biodiversity); and impacts on ecosystems or species on which there is high dependence for health, livelihoods, safety and wellbeing. The Biodiversity Offset Report and audits of the offset performance, as well as biodiversity offset registers, should be made publicly available.
- **Offsets must follow a risk averse and cautious approach** - A biodiversity offset must be designed in a risk-averse and cautious way to take into account uncertainties about the measure of the extent and significance of the residual impacts (including uncertainties about the effectiveness of planned measures to avoid, minimize and rehabilitate impacts), and the uncertainties relating to the successful outcome and/ or timing of the biodiversity offset intervention.
- **Offsets must be fair and equitable** - The determination of residual impacts, and the design and implementation of biodiversity offsets to counterbalance these impacts, must be undertaken in an open and transparent manner, providing for stakeholder engagement, respecting recognised rights, and seeking positive outcomes for affected parties. Biodiversity offsets should not displace negative impacts on biodiversity to other areas, or cause significant negative effects that in turn would need to be remedied.
- **Offset intervention timing** - Implementation of a biodiversity offset should preferably take place before the impacts of the activity occur, or as soon thereafter as reasonable and feasible.
- **Biodiversity offsets must be measurable, auditable and enforceable** - The required outcomes of a biodiversity offset must be practically measurable on the ground. Once the development is underway, residual impacts should be monitored and measured to ensure that the counterbalancing offset remains adequate. The offset's counterbalancing adequacy must, in turn, be monitored and audited in terms of clear and measurable management, performance and desired outcome

targets, and provision must be made for corrective or adaptive actions where needed to ensure that targets are achieved.

3. WHEN IS AN OFFSET REQUIRED?

A biodiversity offset is required when a proposed listed or specified activity, or activities, is/are likely to have residual negative impacts on biodiversity of moderate or high significance. These negative impacts could affect biodiversity pattern (e.g. threatened ecosystems, species or special habitats), ecological processes (e.g. migration patterns, climate change corridors enabling shifts in species distributions over time, or wetland function), ecosystem services (e.g. provision of clean water) or a combination of all three.

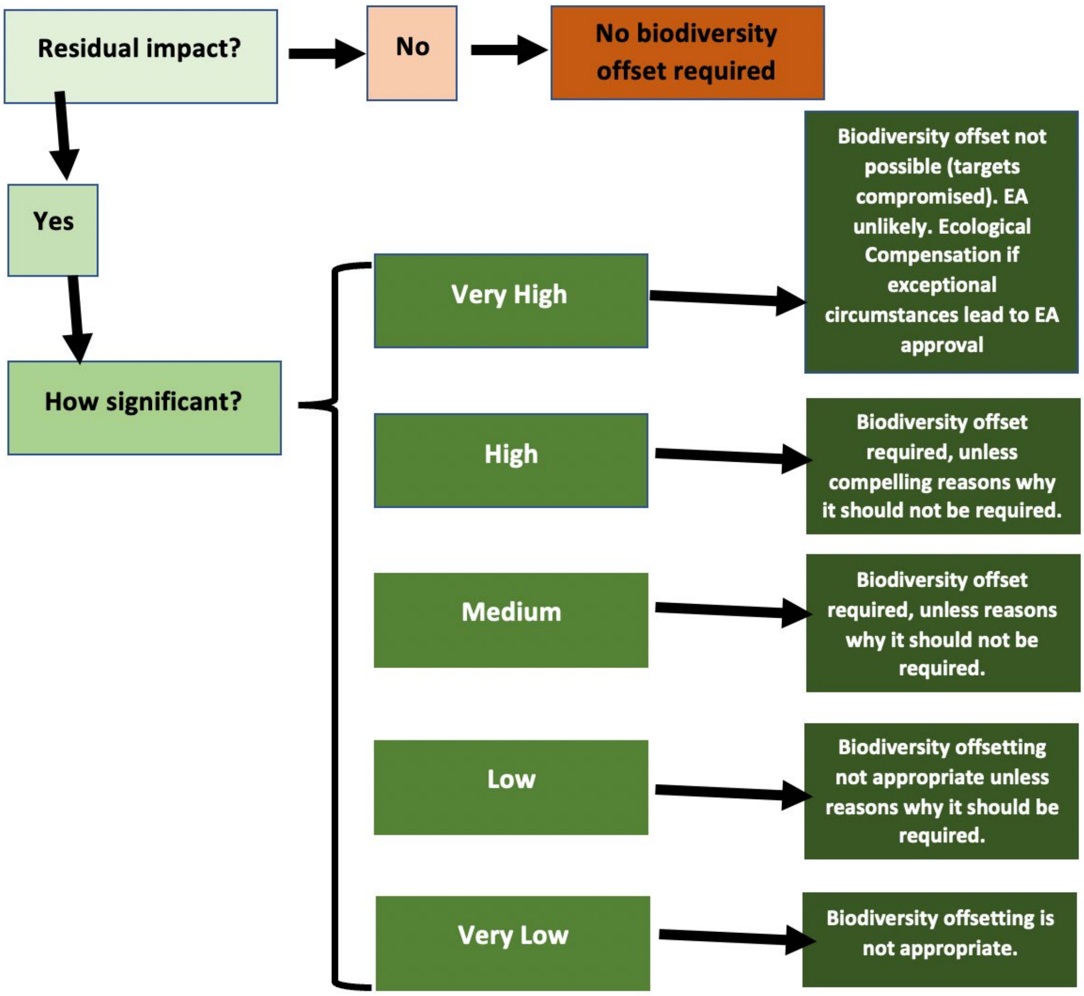

Figure 1. Flow diagram illustrating the process to determine whether an offset should be considered for a development or not.

3.1 RESIDUAL IMPACTS

A residual biodiversity impact is the impact of an activity, or activities, on biodiversity that remains after all efforts have been made to avoid and minimise the impacts of the activity, or activities, and to rehabilitate or restore the affected area to the fullest extent possible.

As part of an EIA, an EAP or a specialist is required to predict the possible negative impacts of an activity, or activities, on biodiversity, including direct impacts, indirect impacts, and cumulative impacts. After those impacts have been identified, the EAP or specialist must investigate alternative project locations, designs, technologies, scales and layouts to determine if and how potentially significant negative impacts on biodiversity could be avoided or minimised. The EAP or specialist must also determine if, and how successfully, impacted areas could be rehabilitated or restored.

If predictions in the EIA state that all negative impacts on biodiversity cannot be avoided, and/or that impact minimisation and rehabilitation or restoration of the affected area cannot, with a high degree of certainty, fully mitigate the impacts of the activity, or activities, on biodiversity, the proposed development would have residual negative biodiversity impacts.

3.2 IMPACT SIGNIFICANCE & THRESHOLDS

Where residual negative biodiversity impacts are evaluated to be of medium or high significance, a biodiversity offset would be required. Biodiversity offsets are unlikely to be required when the residual negative impacts of a proposed activity, or activities, on biodiversity are evaluated to be of low significance. Biodiversity offsets are not appropriate when an activity, or activities, will have residual impacts on biodiversity of very high significance, including when residual negative impacts will result in loss of irreplaceable biodiversity.

Sufficient rigour and adherence to specific guidance on assessing biodiversity impacts and evaluating their significance must be demonstrated to the CA, drawing in particular on the applicable biodiversity and species protocols, used in conjunction with the National Environmental Web-based Screening Tool (Screening Tool). The report generated through the Screening Tool could give an early indication of the significance of the possible negative impacts of an activity, or activities, on biodiversity.

The approach for assessing impact significance for the purposes of this guideline is firstly, determining the biodiversity importance of the area negatively impacted by a proposed activity, or activities and the implications of the impacts – expressed in the guideline as a set of biodiversity thresholds, and secondly, determining if other factors related to impact significance render the impact of higher or lower significance than the threshold suggests.

There are no hard and fast rules for determining the biodiversity importance of an area and the implications of negative impacts on those areas. The thresholds given in Table 1 contain broad guiding factors to make such a determination. However, more nuance may well be required in the circumstances of a particular application for EA. Significance assessments should also take into account, for instance, the extent to which impacts would be reversible (i.e. if the pre-impact biodiversity could be reinstated within at most a 30-year period) and/ or would lead to irreplaceable loss of resources (i.e. a permanent loss of biological diversity).

Table 1. Biodiversity thresholds, impact significance and implications for mitigation and biodiversity offsets as provided in the Draft National Biodiversity Offset Guidelines.

Threshold: the importance of biodiversity and/ or ecological infrastructure	Impact Significance Rating	Implications for mitigation and offsets

'Exclusionary' threshold: residual impacts in this category cannot be fully compensated by offsets because of the high threat status or irreplaceability of affected biodiversity or ecosystem services. Impacts in this category would generally be unacceptable and could lead to –
 	
• irreversible and irreplaceable loss of ecosystem or species, such as impacts on –
  ◦ Critical Biodiversity Areas: Irreplaceable (CBA 1), especially where the feature(s) driving the designation as a CBA 1 is significantly negatively affected or will be compromised beyond its Biodiversity Target;
  ◦ Critically Endangered ecosystems outside of CBAs;
  ◦ confirmed habitats of Critically Endangered species,
  ◦ where those areas have not been included in CBA 1s; and
  ◦ Ramsar sites; and
• irreplaceable loss of key ecological corridors recognised as important for evolutionary processes and climate change adaptation where no spatial options to safeguard these processes exist; and
• irreversible or irreplaceable loss of highly valued ecological infrastructure at national or provincial scale and/or where there is a high level of dependence on the associated ecosystem services by local communities for livelihoods and health, and no feasible substitutes.
	Very High	Activity should not be Authorised except in exceptional circumstances. If an application is authorised, ecological compensation is required unless there are reasons why ecological compensation should not be required.

Threshold of major potential concern: residual impacts in this category could lead to – • loss of vulnerable or potentially irreplaceable biodiversity in areas of recognised importance, such as – ◦ Critical Biodiversity Areas: Optimal (CBA 2);	High	Biodiversity offsets are likely to be required, unless there are compelling reasons why a biodiversity offset should not be required.

• Endangered ecosystems outside of CBAs; • Natural forests; • Strategic Water Source Areas; • buffer zones around protected areas and protected area expansion zones identified in protected area management plans; • the Coastal Protection Zone; • areas seawards of development setback lines, and where development setback lines have been determined, within 1 km of the High Water Mark; or • areas within 100 meters of a watercourse; or • irreversible loss or deterioration of valued ecosystem services at provincial level.		
Threshold of potential concern: Residual impacts in this category could lead to – • irreversible loss of vulnerable biodiversity, such as - • Ecological Support Areas; • Strategic Water Source Areas; • Ecological infrastructure that provides highly significant ecosystem services, which is not within a SWSA and is not identified as an ESA; • conservation areas; • Vulnerable ecosystems or species; or • areas that have two or more of the following characteristics: Threatened Ecosystem, confirmed habitat for Threatened Species; or important ecological process area or corridor; or • irreversible loss or deterioration of valued ecosystem services at local level.	Medium	Biodiversity offsets are likely to be required, unless there are reasons why a biodiversity offset should not be required.
Threshold of Low concern: Residual impacts in this category include – • Other Natural Areas; or • impacts on Not Threatened or Least Concerned ecosystems or species, where those species or ecosystems do not – • support Protected or Threatened ecosystems or species; • constitute important ecological process areas or corridors; or • provide important ecosystem services.	Low	Biodiversity offsets are unlikely to be required, unless there are reasons why a biodiversity offset should be required.
Threshold of negligible concern: Impacts in this category are on highly modified areas.	Very Low	Biodiversity offsets will not be required.

The different thresholds mentioned above have different implications for impact significance:

- If an exclusionary threshold is breached, impact significance is Very High and the proposed project is therefore fatally flawed and should not be approved. Biodiversity offsetting would not be feasible when there is loss of irreplaceable biodiversity, although ecological compensation would be required when such loss is considered justifiable under exceptional circumstances, unless there are reasons, based on the factors in the paragraph below, that ecological compensation should not be required.
- If a threshold of major concern is breached, impact significance is High and a biodiversity offset would be required unless there are compelling reasons based on the factors in the paragraph below that a biodiversity offset should not be required.
- If a threshold of potential concern is breached, impact significance is Medium and a biodiversity offset would be required, unless the factors in the paragraph below suggest that no biodiversity offset should be required under the circumstances.
- If a threshold of low concern is breached, impact significance is Low and a biodiversity offset would not be required, unless other factors suggest that a biodiversity offset should be required.
- If a threshold of negligible concern is breached, impact significance is Very Low and no biodiversity offset would be required.

4. LOXTON WIND ENERGY FACILTIES BASELINE ANALYSIS

In this section, the main biodiversity features of the site are highlighted and discussed with reference to the development and the likely impacts thereof. Although it is the Loxton Wind Energy Facility 3 that provided the initial trigger for the offset needs analysis, the baseline description covers all three project areas in order to provide the wider context for the development, the potential for cumulative impacts as well as better illustrate the avoidance that has been implemented to date.

4.1 BROAD-SCALE VEGETATION PATTERNS

The national vegetation map (Mucina & Rutherford 2006 & SANBI 2018 update) for the study area is depicted below in Figure 2. The majority of the site is classified as falling within the Eastern Upper Karoo vegetation type with some Upper Karoo Hardeveld and Bushmanland Vloere also present in the east of the site. This is clearly an oversimplification of the vegetation of the site and there are extensive tracts of Upper Karoo Hardeveld at the site, as well as fairly extensive areas of riparian vegetation which would currently fall into the Bushmanland Vloere vegetation type but are more-closely allied to the Southern Karoo

Riviere vegetation type. These three vegetation types are described and illustrated briefly below.

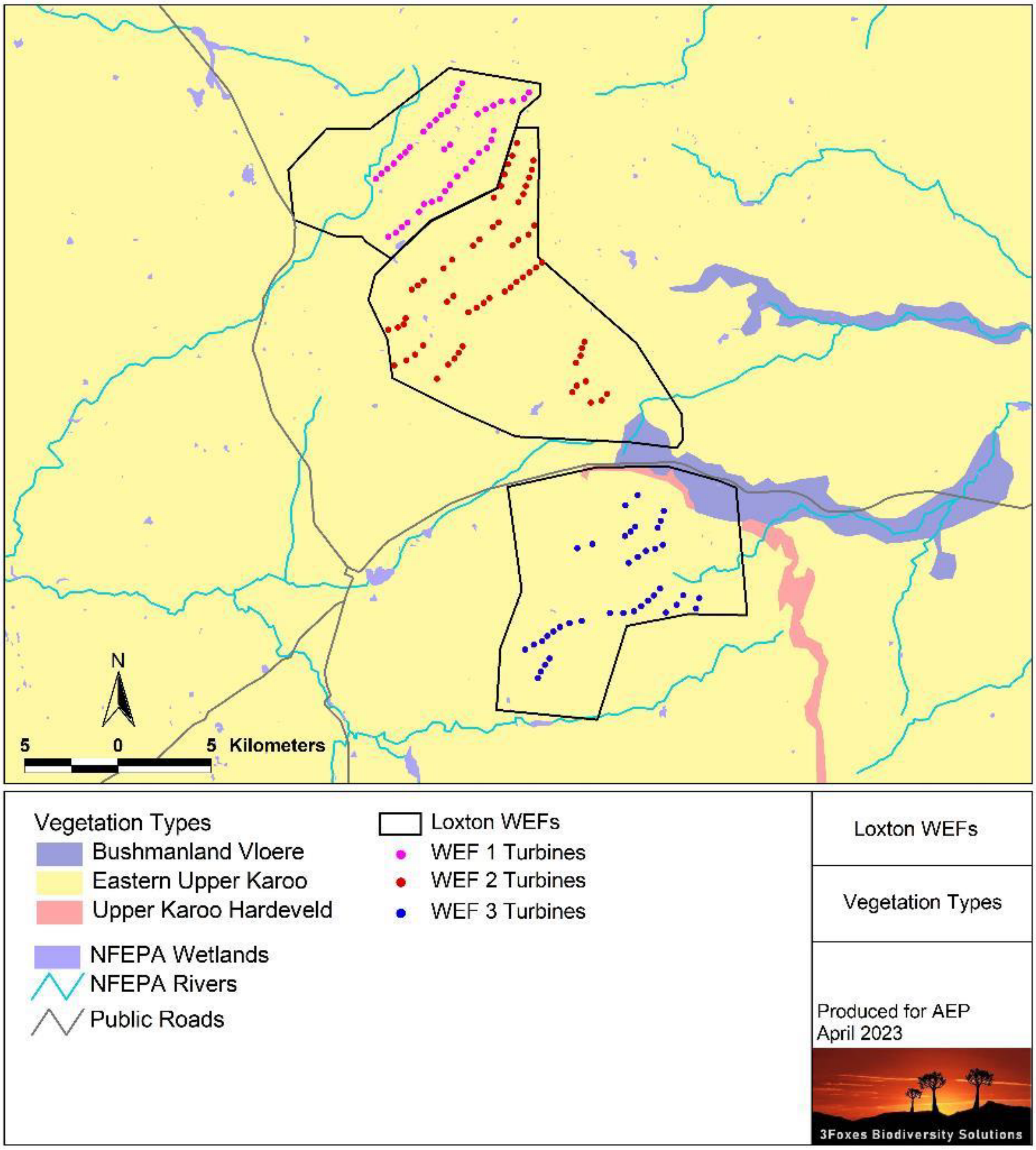

Figure 2. The national vegetation map (SANBI 2018 Update) for the Loxton WEFs and surrounding area.

Eastern Upper Karoo

The whole of the Loxton Wind Energy Facility 3 is mapped under the Vegmap as falling within the Eastern Upper Karoo vegetation type. Eastern Upper Karoo has an extent of 49 821 km^2 and is the most extensive vegetation type in South Africa and forms a large proportion of the central and eastern Nama Karoo Biome. This vegetation type is classified as Least Threatened, and about 2% of the original extent has been transformed largely for intensive agriculture. Eastern Upper Karoo is however poorly protected and less than 1% of the 21% target has been formally conserved. Mucina & Rutherford (2006) list eight endemic species for this vegetation type, which considering that it is the most extensive unit in the country, is not very high. As a result, this is not considered to represent a sensitive vegetation type.

Within the study area, this is dominant vegetation type and forms the matrix in which the other vegetation units are embedded. There is however a fairly large degree of variation in the structure and composition of Eastern Upper Karoo within the site, driven largely by the substrate conditions, with the main differences being associated with dolerite-derived soils vs. shale and mudstone- derived soils. Overall, these tend to be represented by large tracts of fairly homogenous landscapes of low plant diversity.

Figure 3. Typical open plains present in the study area, corresponding with the Eastern Upper Karoo vegetation type. The typical plains of the study area are considered low sensitivity and considered suitable for wind farm development. Example taken from the within the Loxton WEF 3 site.

Upper Karoo Hardeveld

The extent of Upper Karoo Hardeveld within the site as mapped by the VegMap significantly under-represents this vegetation type within the site, across all three project areas. The majority of dolerite outcrops and hills within the site can be considered to represent this vegetation type. The Upper Karoo Hardeveld vegetation type is associated with 11 734 km^2 of the steep slopes of koppies, buttes mesas and parts of the Great Escarpment covered with large boulders and stones. The vegetation type occurs as discrete areas associated with slopes and ridges from Middelpos in the west and Strydenburg, Richmond and Nieu-Bethesda in the east, as well as most south-facing slopes and crests of the Great Escarpment between

Teekloofpas and eastwards to Graaff-Reinet. Altitude varies from 1000-1900m. Mucina & Rutherford (2006) list 17 species known to be endemic to the vegetation type. This is a high number given the wide distribution of most karoo species and illustrates the relative sensitivity of this vegetation type compared to the surrounding Eastern Upper Karoo.

The Upper Karoo Hardeveld vegetation type usually consists of very rocky ground and is often associated with steep slopes, with the result that it is considered vulnerable to disturbance but is also an important habitat for fauna. It also contains a higher abundance of protected plant species than the adjacent areas of Eastern Upper Karoo. In addition, these areas are considered to represent suitable habitat for the Karoo Dwarf Tortoise (VU). Consequently, it is generally considered higher ecological sensitivity than the surrounding areas. This habitat creates a wide variety of microhabitats for fauna and flora and the areas with large amounts of exposed rock have therefore been mapped as high sensitivity within the ecological studies associated with the three project EIA applications.

Figure 4. Typical dolerite outcrop within the Loxton Wind Energy Facility 3 site, with the Upper Karoo Hardeveld vegetation type. These areas are considered more sensitive than the surrounding plains as they create a wide variety of habitats for both fauna and flora.

Southern Karoo Riviere

Although not all areas associated with this vegetation type have been mapped in the VegMap, the vegetation along the major rivers within the site corresponds with the Southern Karoo Riviere vegetation type. The Southern Karoo Riviere vegetation type is associated with the rivers of the central karoo such as the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega and Sundays Rivers. About 12% has been transformed as a result of intensive agriculture and the construction of dams. Although it is classified as Least Threatened, it is associated with rivers and drainage lines and as such represents areas that are considered ecologically significant.

Although there are some larger drainage systems within the original Loxton WEF study area, these areas have been excluded from the more recent layouts that have been included into the EIA phase. This includes areas with confirmed Riverine Rabbit sightings and under the final project areas included in this study, no Riverine Rabbits were confirmed present within the active project areas. The most sensitive area in this regard is the area bounded by Loxton in the west and the R63 in the north. In general, the drainage features within the site are poorly developed without extensive areas of riparian vegetation (Figure 6).

Figure 5. Riparian vegetation from the northern margin of the site, with dense shrubland considered potentially suitable habitat for the Riverine Rabbit.

Figure 6. The majority of drainage features within the Loxton WEF 3 are minor features without well-developed riparian vegetation.

All of the affected vegetation types within the Loxton WEF site have experienced relatively little transformation to date. Of the three vegetation types present, Eastern Upper Karoo is considered least sensitive and is an extensive and homogenous vegetation type with very few species of concern present. The riparian ecosystems, regardless of their classification as either Bushmanland Vloere or more correctly, Southern Karoo Riviere, are considered sensitive and important habitats for fauna and for the maintenance of ecosystem services such as water provision. The larger riparian systems of the site are home to the Riverine Rabbit, which is a species of high potential concern and highlights the importance of this habitat. The Upper Karoo Hardeveld, which is under-mapped within the study area but also across the karoo in general, is considered more sensitive than the surrounding plains as the dolerite outcrops associated with this vegetation type have a significantly higher botanical and faunal diversity than the surrounding areas. The rocky hills are also home to the only red-listed reptile of the area, the Karoo Dwarf Tortoise, which has not been confirmed from the site to date, but as this species is difficult to detect, a conservative, risk-avoidant approach suggests that it should be assumed to be present within these areas. In terms of the sensitivity mapping and avoidance implemented as part of the EIA, all the larger riparian areas and associated flood-plains have been mapped as no-go areas and as such would be avoided. Buffers of 500m have also been included around all floodplain habitat areas considered suitable for Riverine Rabbits regardless of whether they were detected in that patch or not. The rocky hills have been differentiated into high sensitivity areas where some limited local impact is considered acceptable and into very high sensitivity areas considered to represent no-go areas. No rare or unique vegetation features were observed within the site. The development would not alter the threat status of any of the affected vegetation types and they are all extensive in comparison with the footprint of the development.

4.2 AQUATIC ECOSYSTEMS

The study area was assessed by EnviroSci (Pty) Ltd from an aquatic perspective for close on two years, for this project, or adjacent sites associated with the SKA (associated support infrastructure) roads and telecoms upgrades or other Renewable Energy projects. The findings of site-specific surveys, indicated that the study area is dominated by three major types of natural aquatic features and a small number of artificial barriers associated with catchments and rivers, characterised as follows:

- Ephemeral watercourses - alluvial systems with or without riparian vegetation. These range from narrow channels to broad flood plain areas;
- Depressions
- Valley bottom wetlands (channelled)
- Minor watercourses; and
- Dams and weirs / berms with no wetland or aquatic features.

The site is mostly located within the D55D (Soutpoort River), with small portions in the D5G (Gansvlei River) and the D61J (Groen River) Quinary Catchments of the Nama Karoo Ecoregion in the Orange River Water Management Area (Kimberley Regional Office). The DFFE Screening Tool identified the aquatic environment for the study area as having a Very High Sensitivity, but this was based on the only the presence of these rivers which are included as important rivers and also contain National Freshwater Priority Ecosystem Areas (NFEPAs). The presence of these Very High Sensitivity features was confirmed during the assessment and included in a Site Sensitivity Verification Report for the developer. Riverine features such as alluvial floodplains and riparian thickets dominated by *Vachellia karroo*, *Searsia lancea*, *Euclea undulata* and *Gymnosporia buxifolia* were observed and mapped on a fine-scale. The sensitive areas were considered by the proponent as No-Go areas and which were then avoided by the proposed layouts. Similarly, small wetlands and depressions were also mapped and are considered No-Go, i.e. Very High Sensitivity. The wetlands (seeps and valley bottom systems, are dominated by various *Juncus, Cyperus* and *Isolepis* sedge species.

The study area is not located within an International Bird Area (IBA) or a Strategic Water Resource Area and did not contain any Wetland Clusters or listed Threatened Ecosystems.

Aquatic Species of Conservation Concern

No listed or protected plant species associated with the aquatic environment were observed, and all species observed are ubiquitous to ephemeral riverine systems within the greater region (ca 22 000km^2). Similarly, no listed or protected aquatic animal species were observed within the dry riverine systems. Any large pools that could provide habitat for approximately 20 obligate species, namely Fish (3), Crustacea (2), Invertebrates (12) and Amphibians (3), are all considered Least Concern will be avoided, i.e. the proposed conditions of development is impact avoidance inclusive of avoiding intact or no -go aquatic areas. Crossings of any such systems, will be located within previously disturbed areas allowing for the upgrade of any existing crossings (improve hydrological conditions) and or allow in areas that have limited functionality such as dry sandy alluvial areas. These exceptions will be confirmed during the micro-siting process should the project proceed and post-authorisation.

Habitat Uniqueness and Critical Biodiversity Areas

EnviroSci has over a period of 10 years assessed various projects in the greater Karoo region, which spans approximately 22 000km^2, mentioned above. In other words, the riverine / wetland habitats observed within this study area are similar in function and composition to rivers and wetlands observed between Frasersburg and Williston in the, Carnarvon to the North, Victoria West to the East and the Nuweveld to the South above Beaufort West. Therefore, based on the scale of the three projects, compared to the remaining habitat, and through impact avoidance, no detrimental loss of aquatic habitat will occur, which is abundant in the greater region as stated above.

The CBA map (Figure 10), only highlights three CBA 1 areas that could be associated with riverine habitats, with little overlap with the fine scale mapping provided to the developer. The CBA mapping is therefore considered very coarse in its treatment of freshwater and wetland features. The current fine-scale mapping includes large areas of additional Very High Sensitivity habitat that have been delineated in excess of that shown in the CBA spatial data and provided as No-Go areas.

Residual and Cumulative impacts

During the EIA process, the project layout and design was assessed against the following potential impacts

- Impact 1: Loss of vegetation and in particular species / habitats that could contain species listed as Critically Endangered, Endangered, or Vulnerable
- Impact 2: Loss of habitat containing protected species or Species of Special Concern
- Impact 3: Loss of any critical corridors and connect habitats that are linked to any future conservation plans or protected areas expansion
- Impact 4: The potential spread of alien vegetation
- Impact 5: Loss of riparian habitat
- Impact 6: Changes to the hydrological regime and increased potential for erosion
- Impact 7: Changes to water quality

In summary, it was found that with overall impact avoidance and with mitigation, limited impact would occur within the aquatic environment and any residual impact would be limited to small changes to the hydrological environment, which could lead to sedimentation and erosion. This would also be the only impacts that could have a cumulative impact on the respective catchments if not monitored and provided with mitigation. However, with proposed engineering considerations, that would limit inundation and or diversion of flows, with proper stormwater management, both residual and cumulative impacts would be LOW.

4.3 FAUNAL COMMUNITIES

The faunal communities present within the larger Loxton WEF Cluster have been well-characterised through the various specialist studies that have been conducted as part of the EIA for the development. The faunal communities present within the site are described below, highlighting species of conservation concern and potential impacts on these species.

Terrestrial Mammals

Approximately 48 mammals can be considered likely to be present in the area and potentially impacted by the development. Species confirmed present through camera trapping or direct observation include African Wildcat, Steenbok, Cape Hare, Riverine Rabbit, Yellow Mongoose, Honey Badger, Cape Grey Mongoose, Springhare, Water Mongoose, Rock Hyrax, Cape Porcupine, Kudu, Caracal, Suricate, Aardvark, Cape Fox, Bat-eared Fox. This represents a typical faunal community for the area and is similar to the faunal communities observed on other wind farm projects in the wider Loxton area.

Red-listed species that potentially occur in the area include the Riverine Rabbit *Bunolagus monticularis* (CR), Black-footed Cat *Felis nigripes* (VU), Grey Rhebok *Pelea capreolus* (NT), Mountain Reedbuck *Redunca fulvorufula* (EN) and Brown Hyena *Hyaena brunnea* (NT). However, despite extensive camera trapping across the site, only the Riverine Rabbit can be confirmed present within the larger project area.

In terms of the sensitivity mapping relating to mammals, the larger riparian areas have been classified as Very High sensitivity based on their value as Riverine Rabbit habitat but also as a result of their general ecological significance. All areas deemed potentially suitable for the Riverine Rabbit have been buffered by 500m and mapped as no-go areas for turbines. The rocky hills and steep slopes have been classified as either High Sensitivity or Very High sensitivity on account of the value of these areas as habitat for mammals associated with rocky areas and the more general ecological value of these areas.

Given the avoidance of the riparian habitats and the primacy of the Riverine Rabbit as a species of concern at the site, the impact of the final layouts on the Riverine Rabbit and associated habitat would be negligible, while general faunal impacts are considered acceptable.

The Riverine Rabbit was confirmed present within the original Loxton Wind Energy Facility 3 project area, but this area was later excluded from the project as part of the risk-reduction and avoidance measures implemented during the project planning.

Residual Impacts on Terrestrial Mammals

Despite the avoidance of important mammalian habitats through the sensitivity mapping, there would be some residual impacts on mammals, through habitat loss, which is unavoidable as well as through noise and other types of disturbance during the operational phase. The operational phase impacts related to turbine noise in particular are not well understood and predicting which species would be impacted and the extent of this impact requires some speculation. However, given the avoidance of Riverine Rabbit habitat at the site and likely absence of other mammals of concern, the longer-term impacts of habitat loss and turbine noise are likely to be on common and widespread species of low conservation concern.

Potential for Cumulative Impacts on Mammals

Due to the presence of numerous wind energy development in the wider Loxton area, which includes the current suite of projects, there is some potential for cumulative impacts on mammals related largely to habitat loss, habitat degradation and direct impacts of mortality through vehicle collisions and other direct impacts. Although there are several species of concern present in the area, the Riverine Rabbit would be most vulnerable to cumulative impact given the limited distribution range and low population density. However, as with the current project, the wind farms in the area have all implemented significant avoidance of Riverine Rabbit habitat with the result that long-term impacts of habitat loss on this species would be low. There is some potential for noise from turbines during operation to have a negative impact on this species, but given the habitat buffering that has been implemented across projects, this would likely be of a low magnitude. Overall, based on the existing projects in the area, cumulative impacts on species of concern are likely to be low, while there may be some local cumulative impacts on the populations of more common species which experience wind farms as unfavourable.

Reptiles

Reptile diversity in the wider area is relatively high which can be ascribed to the diversity of habitats present, especially along the Nuweveld escarpment south of the site. Diversity within the Loxton WEF Cluster site itself is considered to be moderate. The only threatened (Red Listed) reptile species in this region is the Karoo Padloper (EN). This small tortoise is seldom observed, even when specifically targeted during herpetofaunal surveys as it is active for only very short parts of the day and may also aestivate for extended periods during unfavourable environmental conditions. They are associated with dolerite ridges and rocky outcrops of the southern Succulent and Nama Karoo biomes. Threats to this species include habitat degradation due to agricultural activities and overgrazing, and predation by Pied Crows which in recent decades have expanded in distribution range.

There are fairly extensive tracts of suitable habitat within the Loxton WEF 3 site for the Karoo Dwarf Tortoise and in terms of the precautionary principle, this species should be considered present. Fortunately, tortoises are one of the few groups of reptiles that have been specifically studied with regards to their responses to wind energy development and no significant negative impacts have been detected within population's resident on wind farms (Agha *et al*. 2015, Lovich *et al*. 2011). Consequently, habitat loss for this species is likely to be the major avenue of potential impact resulting from the wind farm development. Specific attention to potential habitat loss for this species was however paid during the sensitivity mapping and all areas which represent highly favourable habitat for this species have been mapped as no-go areas for turbines. There would however, still be some impact on the smaller ridges due to turbines and access roads and hence some potential habitat loss for this species as a result of the development. However, overall, given the avoidance that has been implemented and the existing research suggesting that wind energy development is largely compatible with the persistence of tortoises on wind farms, it is likely that the impact of the three Loxton WEFs on the Karoo Dwarf Tortoise would be relatively low after mitigation and no significant long-term negative impacts are anticipated.

Residual Impacts on Reptiles

The most important residual impacts of the current suite of developments on reptiles are likely to be some habitat loss and possibly increased levels of predation of reptiles when crossing the wind farm roads. The Karoo Dwarf Tortoise is however the only species of concern that is known from the area and as the areas of presumed optimal habitat for this species will be largely avoided, residual impacts on this species would be relatively low.

Potential for Cumulative Impacts on Reptiles

The current suite of projects would contribute towards cumulative impacts of renewable energy development on reptiles in the wider Loxton area. These impacts would result from habitat loss and degradation as well as potentially increased levels of predation of reptiles by crows along the power lines associated with these facilities. This would operate across the wider Loxton area, but as these are no unique or endemic species to this area, a wider species-level impact on any particular species is considered highly unlikely.

Amphibians

The diversity of amphibians in the study area is relatively low with only 11 species having being recorded in the area. Species observed at the vicinity of the site include the Karoo Toad, Clawed Toad and Poynton's River Frog. There are no listed amphibian species known from the area. Within the sites, the major drainage lines present have permanent or long-lived pools that can be used by toads and frogs for seasonal breeding purposes. But given that these areas are considered important for Riverine Rabbits and other ecological considerations, areas important for amphibians are captured through other sensitivities and there are no areas that would need to be avoided on specific account of amphibians. Given the localised nature of important amphibian habitats at the site as well as the generally arid nature of the site and the low overall abundance of amphibians, a significant long-term impact on amphibians is unlikely.

Residual Impacts on Amphibians

The most important residual impacts of the current suite of developments on amphibians is likely to be some habitat loss and degradation within the affected wind farm development areas. As the more important amphibian habitats within the wind farms such as riparian and wetland habitats are well-avoided by wind-farm developments, residual impacts on amphibians are likely to low.

Potential for Cumulative Impacts on Amphibians

The current suite of projects would contribute some degree towards cumulative impacts of renewable energy development on amphibians in the wider Loxton area. These impacts would result from habitat loss and degradation of freshwater ecosystems as a result of erosion and pollution. These impacts would operate across the wider Loxton area, but as these are no unique or endemic species to this area, a wider species-level impact on any particular species is considered highly unlikely. As such, cumulative impacts on amphibians within the current project areas as well as across the wider Loxton area are considered to be low.

Terrestrial Faunal Sensitivity Analysis

The constraints/sensitivity map for the Loxton Wind Farm cluster area for terrestrial fauna is depicted below in Figure 7. There are a variety of constraints operating across the site, associated largely with Riverine Rabbit habitat and their associated drainage features and also the steep slopes and dolerite outcrops of the site which are associated with the Karoo Dwarf Tortoise as well as fauna more generally. There are no turbines located in Very High or High sensitivity areas within any of the three wind farms, including the Loxton WEF 3. Based on the avoidance that has been implemented for the very high and high sensitivity features present within the wind farm, the development footprint would be restricted largely to the medium and low sensitivity areas, where impacts on biodiversity are likely to be lower. As such, based on the fine-scale feature mapping and the draft layouts of the three wind farms, the overall impacts of the development on terrestrial biodiversity is likely to be low and would be considered acceptable without the need or consideration of an offset, when considered solely with regards to faunal impacts.

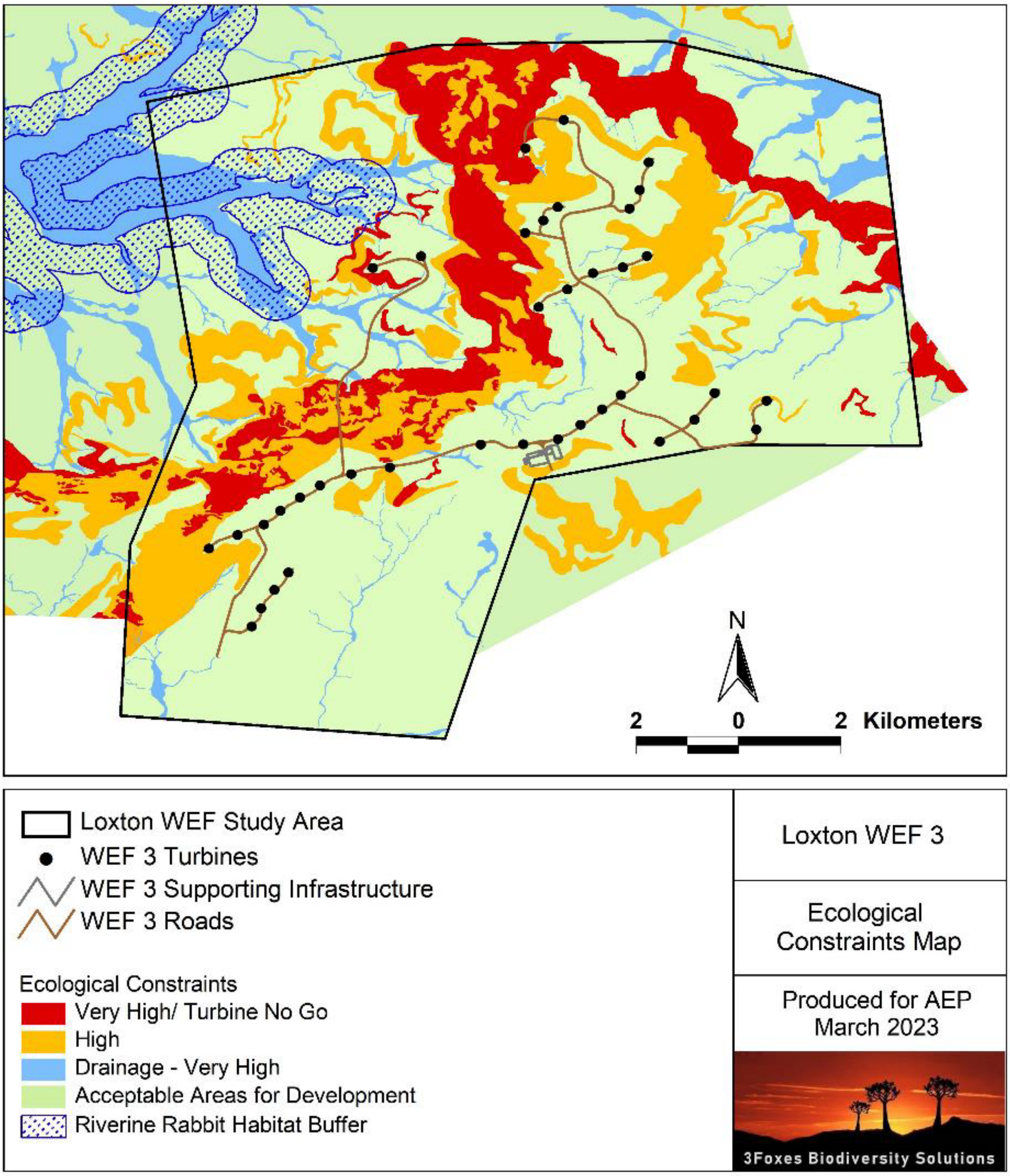

Figure 7. Terrestrial ecological sensitivity map for the proposed Loxton WEF study area.

Bats

Based on current taxonomic information and bat occurrence data, 10 bat species from seven families could occur within the PAOI (Table 2). The Project Area of Influence (PAOI) is defined as the AoI of each Loxton WEF plus a 10 km buffer given that bats are volant mammals (Scottish Natural Heritage 2019) (Figure 8). The presence of five bat species was confirmed for the PAOI through acoustic monitoring over a 12-month period from November 2021 to November 2022 (Table 2).

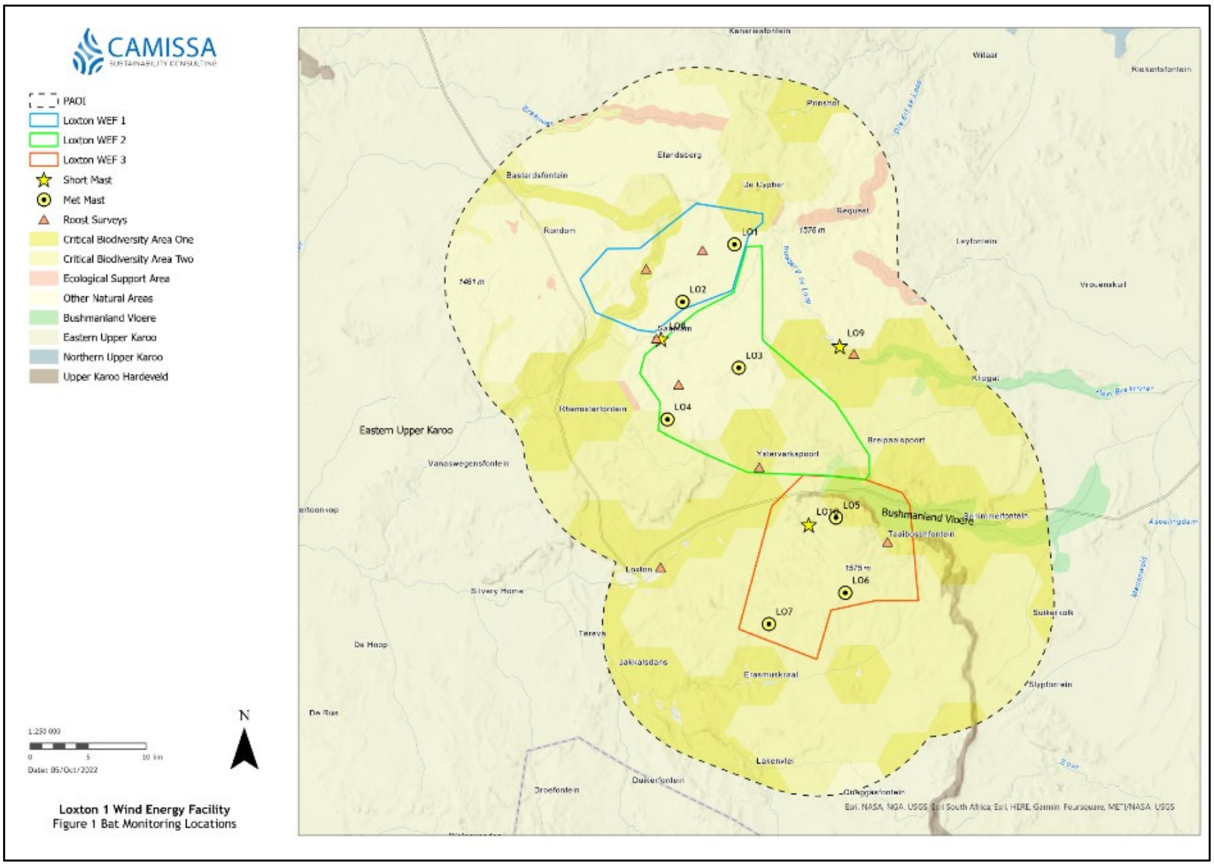

Figure 8. Map of the Loxton study area, illustrating the three phases of the Loxton project and the PAOI as assessed for bats.

Table 2*:* List of Bat Species within the Loxton Project PAOI.

Common Name ***Species Name***	**Family**	**Key Habitat Requirements***	**Prob. of Occurrence**	**Conservation Status**		**WEF Risk**
				IUCN	**RSA**	
Natal long-fingered bat *Miniopterus natalensis*	Miniopteridae	Temperate or subtropical species. Primarily in savannas and grasslands. Roosts in caves, mines, and road culverts. Clutter-edge forager.	**Confirmed**	LC	LC	High
Cape serotine *Neoromicia capensis*	Vespertilionidae	Arid semi-desert, montane grassland, forests, savanna and shrubland. Roosts in vegetation and human-made structures. Clutter-edge forager.	**Confirmed**	LC	LC	High
Egyptian free-tailed bat	Molossidae	Desert, semi-arid scrub, savanna, grassland, and agricultural land. Roosts in	**Confirmed**	LC	LC	High

Common Name *Species Name*	Family	Key Habitat Requirements*	Prob. of Occurrence	Conservation Status		WEF Risk
				IUCN	RSA	
Tadarida aegyptiaca		rocky crevices, caves, vegetation, and human-made structures. Open-air forager.				
Roberts's flat-headed bat *Sauromys petrophilus*	Molossidae	Wet and dry woodlands, shrublands and Acacia-wooded grasslands always in areas with rocky outcrops and hills. Roosts in narrow rock crevices and fissures. Open-air forager.	**Confirmed**	LC	LC	High
African Straw-coloured fruit bat *Eidolon helvum*	Pteropodidae	Non-breeding migrant in the PAOI.	Low	NT	LC	High
Long-tailed serotine *Eptesicus hottentotus*	Vespertilionidae	Montane grasslands, marshland and well-wooded riverbanks, mountainous terrain near water. Roosts in caves, mines, and rocky crevices. Clutter-edge forager.	**Confirmed**	LC	LC	Medium
Lesueur's wing-gland bat *Cistugo lesueuri*	Cistugidae	Roosts in rock crevices, usually near water, associated with broken terrain (koppies and cliffs) in high-altitude montane vegetation. Clutter-edge forager.	Moderate	LC	LC	Medium
Egyptian slit-faced bat *Nycteris thebaica*	Nycteridae	Savannah, desert, arid rocky areas, and riparian strips. Gregarious and roosts in caves but also in mine adits, Aardvark holes, rock crevices, road culverts, roofs, and hollow trees. Clutter forager.	Moderate	LC	LC	Low
Geoffroy's horseshoe bat *Rhinolophus clivosus*	Rhinolophidae	Savannah woodland, shrubland, dry, riparian forest, open grasslands, and semi-desert. Roosts in caves, rock crevices, disused mines,	Moderate	LC	LC	Low

Common Name *Species Name*	Family	Key Habitat Requirements*	Prob. of Occurrence	Conservation Status		WEF Risk
				IUCN	RSA	
		hollow baobabs, and buildings. Clutter forager.				
Damara Horseshoe bat *Rhinolophus damarensis*	Rhinolophidae	Arid savannah and shrubland in the Nama-Karoo biome. Roosts in natural caves but will use mines.	Low	LC	LC	Low

*Child et al. (2016), *Monadjem et al. (2020); †IUCN (2021); δ MacEwan et al. (2020)

Bat species diversity and species richness in the PAOI are typical of the Nama Karoo biome in South Africa (Cooper-Bohannon et al. 2016, Monadjem et al. 2018). There are no bat species of conservation concern present in the PAOI, with all bats species currently classified as Least Concern (LC) nationally (Table 1). However, the impact of wind energy on bats is a relatively new phenomenon and evidence from North America has shown that Least Concern bats may be experiencing impacts due to wind energy development that could result in changes to their conservation status (Frick et al. 2017, Rodhouse et al. 2019, Davy et al. 2020). Apart from conservation status, an additional indicator of the degree a species may be of concern to wind energy impacts is collision risk, since collisions with wind turbine blades is the primary impact to bats.

Wind energy collision risk for bats is determined based on bat ecology and life history characteristics. Bats that move and feed in airspaces which overlap with wind turbine blades are most vulnerable to collisions. Aerial-hawking bats that fly in open areas and at high altitudes are most at risk and at most concern (Aronson 2022). Globally, migratory bats are also at elevated risk from wind energy (Arnett et al. 2016). Based on this, a species of concern in the PAOI that may be negatively influenced by the project is Egyptian free-tailed bat. This is the most impacted bat species across currently operating wind farms in South Africa (Aronson 2022).

With respect to unique features, for bats these would primarily include major roosting sites. Bat roosting sites in the PAOI are relatively limited and unlikely to support large congregations of bats. The closest known major bat roost is approximately 55 km north of the study area. Rocky outcrops are present throughout the PAOI and these geological features may provide roosting spaces for species such as Roberts's flat-headed bat, Egyptian free-tailed bat, Lesueur's wing-gland bat, and Long-tailed serotine that roost in rocky crevices (Monadjem et al. 2018). The Long-tailed serotine roosts in small groups of a few individuals while Roberts's Flat-headed bat tends to roost communally in small groups of tens of individuals (Jacobs and Fenton 2002). Egyptian free-tailed bats can roost in groups of tens to a few hundred individuals (Herselman and Norton 1985). Bats are also likely to roost in buildings associated with farmsteads within and bordering the project especially Cape serotine and Egyptian Free-tailed Bat (Monadjem et al. 2018). Trees growing at these farmsteads, and in limited places elsewhere in the PAOI usually at livestock water points, could also provide roosting spaces for bats although the extent of this is limited since these trees are typically not large and day-time temperatures may be too hot to use them as roosts (Monadjem et al. 2018). Inspections of buildings in the PAOI did not reveal any roosting bats although bats do typically use these structures for roosts and visible signs of bat presence (brown, stained exit/entry points) was found at some buildings. Based on the acoustic monitoring data, it is likely that bats are roosting in buildings at farmsteads. Generally, the site does not contain specific, notable or unique habitat features, but does nonetheless contain typical habitat features which bats will make use of.

Sensitive features in the PAOI at which bat activity may be concentrated include farmsteads, wetlands, farm dams, irrigated cultivated areas, the livestock water points, rocky outcrops, and along drainage networks/riparian areas. The presence of water, vegetation and lighting at these features could promote insect activity and hence attract foraging bats. For example, Long-tailed serotine have been captured foraging for flies at a livestock kraal (Shortridge 1942). Activity could also be concentrated along the non-perennial rivers and smaller streams. These features have been buffered into No-Go areas for development (Figure 9) to spatially limit the potential for bats to interact with project infrastructure, and to avoid impacting key bat habitat.

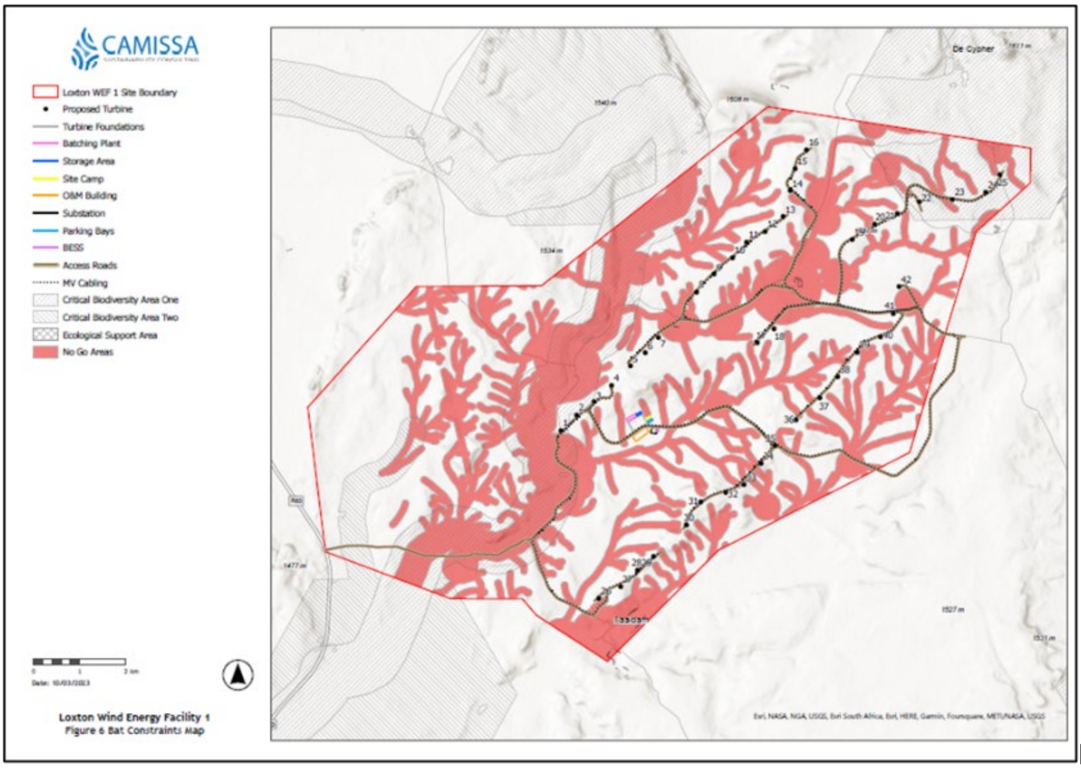

Figure 9. Map of bat turbine no-go areas within the Loxton WEF 3 study area.

The Loxton WEF cluster site is not of a particular regional or national significance for bats for the following reasons:

1) The availability of sufficient roosting spaces is a limiting factor for bats. Bat roosting sites in the PAOI are relatively limited and unlikely to support large congregations of bats with the closest known major bat roost approximately 55 km north of the PAOI.

2) The site is not within a known migratory pathway for bats in South Africa, although bat migration is understudied in South Africa. In addition, only one known migratory bat was confirmed present on site during the pre-construction bat monitoring, Natal long-fingered bat. Based on the magnitude of bat activity for this species, it is classified as low-risk from the project. The acoustic data collected also do not suggest migratory behaviour through the PAOI of this species.

3) Habitat in the PAOI is representative of habitats elsewhere in the Nama Karoo biome.

4) The primary species of concern is Egyptian free-tailed bat, which is a widely distributed species in South Africa (Monadjem et al. 2020).

The impacts of the development on bats can be broadly classified into a) indirect impacts on bat habitats, and b) direct impacts to bat individuals through collision with wind turbine blades resulting in mortality. Habitat-based impacts from either WEF, including WEF 3, are **unlikely** to be significant post-mitigation, where mitigation includes the buffering of key bat habitats (Figure 9). Collision impacts are predicted to significantly negatively impact Egyptian free-tailed bats. This is based on the magnitude of bat activity recorded at 10 m, 50 m and 100 m from static bat acoustic monitoring devices recorded over 12 months from the PAOI (Table 2).

Habitat in the PAOI is representative of habitats elsewhere in the Nama Karoo biome. There is limited structural habitat heterogeneity, a lack of roosting sites that would support large congregations of bats, and limited presence of migratory bats. Hence, the PAOI has low irreplaceability and it not especially unique in term of habitats. However, the proximate impact to bats as a result of the development is not habitat loss, but rather loss of individual bats and the concomitant, potential, decline in local bat populations.

There is broad overlap between areas designated as CBA and areas that would support bats. For example, the CBA reasons GIS layer identifies areas designated to protect wetlands and rivers. These features support bat activity (Sirami et al. 2013) and have similarly been buffered to protect bats. However, the bat sensitivity map identifies additional areas and habitat features important to bats for which the CBA has not been designated, for example bat roosts in buildings and rocky crevices/outcrops resulting in some degree of non-overlap. The areas of non-overlap are largely due to the courser spatial resolution used to map the CBA's compared to the bat constraints map, which maps specific features of importance, compared to the CBA mapping which classifies areas using the attributes of the underlying hexagonal planning units.

Residual Impacts on Bats

The major residual impacts on bats is collision with wind turbine blades, assessed as having a moderate significance with mitigation. This residual impact will be monitored during the operational phase of each project through (at least) two years of bat fatality monitoring. The fatality monitoring will provide data on which species are colliding with wind turbine blades, and enable an estimation of the fatality rate for bat species. These fatality rates will be compared to fatality thresholds for South African bats (MacEwan et al. 2018) and if exceeded, mitigation such as turbine curtailment or the use of acoustic bat deterrent devices will be used to reduce the estimated fatality rates to below threshold levels.

Potential for Cumulative Impacts on Bats

With reference to the National Renewable Energy Application database (Q2, 2022), currently one approved wind energy project is located within the Ecologically Appropriate Area of Analysis (EAAA), defined as a 35 km radius around the PAOI (Figure 3). However, two additional approved facilities are just beyond the EAAA. Also considered is the fact that the Loxton WEFs are being developed as part of a cluster; three projects will be developed, which will increase cumulative impact effects.

Given that the EAAA includes a Renewable Energy Development Zone (Beaufort West), it is reasonable to expect further development over a 25-year period (the typical operational lifespan of a wind farm). As such, at least a moderate level of wind energy development can be expected over the following 25 years in the EAAA. With respect to the nature of cumulative impacts, there are no documented major past threats to bat species in the EAAA or current threats to them other than wind energy (Child et al. 2016). Therefore, wind energy is the primary impact to bats in the EAAA with the potential to have population-level effects for some species (Frick et al. 2017). Cumulative impacts may have high significance before, and moderate significance after mitigation.

Avifauna

Throughout the year of avifaunal monitoring to date, observers have identified 165 bird species on-site across all methodologies, and incidentally. The South African Bird Atlas Project 2 (SABAP 2) has a relatively low reporting rate across the 16 pentads that span the site boundary. The SABAP 2 assemblage of 164 reported species is essentially very similar to what the current bird monitors have reported for the site. Eleven species observed to occur on the site are Red-Listed: Martial Eagle (*Polemaetus bellicosus*), Ludwig's Bustard (*Neotis ludwigii*) and Black Harrier (*Circus maurus*) are Endangered; Verreaux's Eagle (*Aquila verreauxii*), Lanner Falcon (*Falco biarmicus*), Secretarybird (*Sagittarius serpentarius*) and Black Stork (*Ciconia nigra*) are Vulnerable, and Blue Crane (*Grus paradisea*), Karoo Korhaan (*Eupodotis vigorsii*), Sclater's Lark (*Spizocorys sclateri*) and African Rock Pipit (*Anthus crenatus*) are Near-Threatened. Twenty-four of the recorded species are either endemic or near-endemic to South Africa, or endemic to South Africa, Lesotho and Eswatini.

The avifaunal community is typical of the broader area. The areas of particular importance for avifauna are: eagle nests; dams/wetlands/arable lands; Ludwig's Bustard leks. These have been excluded from the development footprint. Since much of the same habitat exists elsewhere in the Karoo, the site cannot be considered to be of particularly high significance regionally or nationally for the species present. The development of the wind farms, and particularly Loxton 3 could impact significantly on the avifauna present, and this necessitates a thorough and proactive mitigation programme.

There are no avifaunal features on site which would be irreversibly removed by the project or which are not available in the broader Karoo. The loss of the affected area or the direct fatality impact on the bird species present will however place more pressure on the remaining un-impacted populations elsewhere. In general terms, the south of the proposed site – i.e. the Loxton 3 project area, is amongst the more sensitive areas of the overall project area. The identified CBA areas correspond with steeper topography and high-use areas for raptors, which are susceptible to turbine collision and as such, the CBA do reflect avifaunal sensitivity to some degree.

Residual Impacts on Avifauna

The most important residual impact is that of collision of birds with wind turbines. A comprehensive programme of proactive mitigation has been recommended to address this risk. However, since these mitigation measures have not yet been fully proven in SA, we take a cautious approach and judge the significance to remain at Moderate post mitigation.

Potential for Cumulative Impacts on Avifauna

The potential cumulative impact of renewable energy, in particular wind, and associated overhead power lines on birds in this area is significant. There are multiple wind farms proposed adjacent to the Loxton project, and these each face similar challenges in terms of mitigation and residual risk. The Loxton (x3) projects probably represent 20/25% of all the active projects in the wider area and so contribute proportionally to the cumulative impact on birds.

4.4 SYNTHESIS – IMPACTS OF WIND ENERGY DEVELOPMENT ON FAUNA

It is difficult to characterise the long-term impacts of wind energy development on biodiversity patterns and processes as these have not been well-studied anywhere to date. A review of the literature finds a wide variety of impacts on fauna and flora, from positive to negative depending on the situation and species being studied. For flora, impacts are largely restricted to direct habitat loss within the development footprint. While for fauna these tend to be a lot more idiosyncratic and dependent on the sensitivity of fauna present to human activity. A review of the current state of knowledge is provided below. This is skewed towards terrestrial fauna as birds and bats are firstly better studied and secondly, there is already long-term monitoring of fatalities required for these groups on wind farms, with the result that knowledge on the impacts on birds and bats is increasing significantly as time goes on, in contrast to the situation with terrestrial fauna.

There have been numerous studies that have examined activity or landscape spatial use patterns of large mammals in and around wind farms. Klich et al. (2020) examined stress levels of Roe Deer in Eastern Poland in and around wind farms and found that the roe deer exhibited an elevated stress level in the vicinity of larger farms, but not in proximity to smaller wind farms. Both the area of the farm and the number of turbines was able to explain the increased stress in the roe deer and the authors estimated that 824 ha or 18 turbines was a threshold level of the impact of wind farms on the cortisol concentration (stress level) in the roe deer. Since all of the wind farms in the Loxton area have in excess of 30 turbines, it is likely that similar species such as Mountain Reedbuck and Grey Rhebok may find the interior of wind farms unfavourable. However, this would need to be demonstrated and in addition, these species appear to be relatively uncommon in the area and have only been picked up sporadically through camera trapping.

Lopucki et al. (2017) examined the utilization of functioning wind farm areas by four terrestrial animals common to agricultural landscapes: European roe deer, European hare, red fox, and the common pheasant. The authors found that wind farm operations may affect terrestrial animals both in wind farm interiors and in a 700-m buffer zone around the edge of turbines. The reactions of animals were species-specific, with Roe Deer and European hare avoiding the wind farm interiors and proximity to turbines; while common pheasant showed a positive reaction to wind turbine proximity. The red fox had the most neutral response to wind turbines and while this species visited wind farm interiors less often than the control area, there was no relation between fox track density and turbine proximity. Skarin et al. (2018) used GPS tracking data to examine habitat use of reindeer around wind farms in Sweden, before, during and after construction. They found that the distance between reindeer calving sites and WEFs increased during the operation phase, compared to before construction. There was also a significant decrease in habitat selection of areas in proximity to the WEFs, as well as a shift in home range selection away from habitats where wind turbines became visible toward habitats where the wind turbines were obscured by topography. In one of the few studies from other parts of the world, Kumara et al. (2022) found that Blackbuck, Chinkara (an antelope), Golden Jackal, and Jungle Cat were less likely to occupy sites with a high number of wind turbines in their study site in India. Inferring from these studies, it can be presumed that certain species, especially shy species and those that rely heavily on hearing for prey detection or avoidance are likely to find the increased noise levels within wind farms undesirable and may avoid these areas. Species potentially susceptible this impact would include Bat-eared Fox, Riverine Rabbit, Cape Fox and Caracal. Although antelope such as Kudu, Grey Rhebok and Mountain Reedbuck are susceptible to disturbance levels, these species can also become habituated to human activity and it is likely that they would also become habituated to wind turbines if these are not associated with other types of persecution or disturbance.

Apart from the general studies on large mammalian fauna, numerous studies have specifically examined the impact of wind farms on predators firstly because these are key species in ecosystems and secondly because these types of species are frequently sensitive to disturbance and hence would be predicted to be particularly vulnerable to wind farm construction and operation. Ferrão da Costa et al. (2018) monitored several wolf populations in proximity to wind farms in northern Portugal and show that wind farms induce a variety of effects on wolves, such as: (i) changes in spatial use by avoidance during the construction and early operation phase; (ii) decreases in reproductive rates;

and (iii) changes in the selection and fidelity of breeding sites used during the birth and pup-rearing period. There was however also evidence that newly-formed packs, recently recolonising areas with already built wind farms, show a relative tolerance to this infrastructure, selecting breeding sites less than 3 km from wind turbines. Smith et al. (2017) investigated spatial variation in predation risk of Prairie Chickens by sampling occupancy of mammalian and avian predators within 10 km of a wind energy facility in Nebraska, USA. Mammalian predators were documented at all sample locations, but the capture index for all mammals was lower at sample sites near the wind turbines. Occupancy of coyotes (*Canis latrans*), the likely main mammalian predator of adult prairie-chickens in the area, did not vary significantly throughout the study site (within 0.5 km of wind energy facility, although trends were in the direction expected if coyotes were avoiding the wind energy facility). The potential for predators to avoid wind energy facilities, and thus affect predation risk, underscores the complexity of planning to address potential impacts of wind energy as variation in predation risk may have consequences for the population viability of a wide range of species at risk from wind energy development. In the current context, jackal and caracal are the most common predators present in the study area, but are generally quite heavily persecuted by farms with the result that they have a relatively low density in the study area. However, these are opportunistic species and may also be able to take advantage of wind farms and changes to the ecosystem associated with these developments.

Apart from larger mammals, there have also been a handful of papers examining the impacts of wind farms on Desert Tortoises in southwestern USA. Lovich et al. (2011) and Agha et al. (2015) studied a Desert Tortoise population at a wind farm in southern California and compared growth and demographic parameters to populations living in less disturbed areas. No negative effects of the wind energy facility on Desert Tortoise survival were detected. Similarly, Keehn and Feldman (2018) found that Side-Blotched Lizards (*Uta stansburiana*) have responded to changes in predator community composition and abundance at disturbed wind farms in southern California by becoming less wary. At the same site, Alaasam et al. (2021) found that contrary to their expectations, individuals of Side-Blotched Lizards at wind farm sites had significantly fewer external parasites than at undeveloped sites. It seems therefore that reptiles are relatively resilient when it comes to wind farms, but this would also need to be verified under Karoo conditions.

The impacts on wind energy development on avifauna are better documented than for terrestrial fauna. However, since wind energy development in South Africa is relatively recent, the impacts on local avifauna is still being investigated. The results of these studies indicate that displacement effects are relatively minor or undetectable and that the major impacts result from collisions of birds with turbine blades (Ralston et al. 2017). Based on monitoring from existing wind energy facilities, diurnal raptors accounted for most fatalities (36%), followed by songbirds (26%). Threatened species affected by collisions with wind turbines included Blue Crane, Verreaux's Eagle, Martial Eagle and Black Harrier (Ralston et al. 2017). Based on a mean mortality rate of 4.1 birds per turbine per year, should all proposed facilities be built, this would result in approximately 1400 bird mortalities for the greater Loxton area per year. Depending on the identity of these mortalities, this would have significant implications for certain species.

As with birds, bats are susceptible to long-term collision impacts rather than habitat loss from wind energy development. Aronson (2022) provides a review of bat mortalities in South Africa as a result of wind energy development and finds that bat fatalities occurred at all operating wind energy facilities in South Africa. Egyptian free-tailed bats accounted for the majority of carcasses, followed by Cape serotine and Natal long-fingered bat. All three of these species are confirmed present at the current Loxton site. In addition, the numbers of bat fatalities differed between wind energy facilities but these differences could not be easily explained by broad scale vegetation patterns. Total estimated bat fatality between 2011 and 2020 was 12,601 bats, while mean fatality/MW/year was estimated at 2.8 bats/MW/yr. Extrapolating these fatality rates to the Loxton area is likely to provide erroneous results given the variability in observed impact as well as the low bat density in this area, but as a worst-case estimate, should all proposed developments be built, it would result in up to 6000-7000 bat mortalities a year for the area. Without a reliable estimate of current population size and the actual mortality rates likely to result from wind farms in the area, it is difficult to draw reasonable conclusions as to the long-term impacts on bats based on these generalised findings. However, what is more apparent and relevant is that all three of the species found to be most-affected in terms of number of fatalities are also present in the current study area and are likely to be significantly affected in the area should numerous wind energy facilities be built.

4.5 Critical Biodiversity Areas & NPAES Focus Areas

In this section, the relevant conservation planning tools for the broad area are illustrated and discussed. The most important of these are the Northern Cape Conservation Plan (2016) and the National Protected Area Expansion Strategy (2018). The CBA maps indicate biodiversity priority areas required to maintain species richness and ecological processes, while the NPAES highlights areas that have been identified as potential areas for the future expansion of formal conservation. The above plans are not entirely independent of one another as all areas demarcated as Conservation Expansion Focus Areas, are classified as Tier 1 or Tier 2 CBAs and some of the CBAs are demarcated with the specific purpose in mind of maintaining development-free corridors between existing conservation areas to facilitate future expansion of conservation areas into these corridors.

In terms of the three projects associated with the Loxton WEF Cluster, the Loxton WEF 1 has a CBA 1 as a buffer protecting the Gansvlei River, as well as an isolated CBA 1 in the northeast corner of the site, all of which have also been mapped as a NPAES Focus Area. Under the layout assessed, there are 5 turbines in the CBA 1 and NPAES Focus Area. As the total footprint of these turbines and associated infrastructure would be less than 5 ha and would avoid the important biodiversity features of the area, the impact on the CBAs and NPAES is considered to be low. Therefore, in terms of the Loxton WEF 1, the overall impact of the development on CBAs and NAPES Focus Areas is considered to be acceptable.

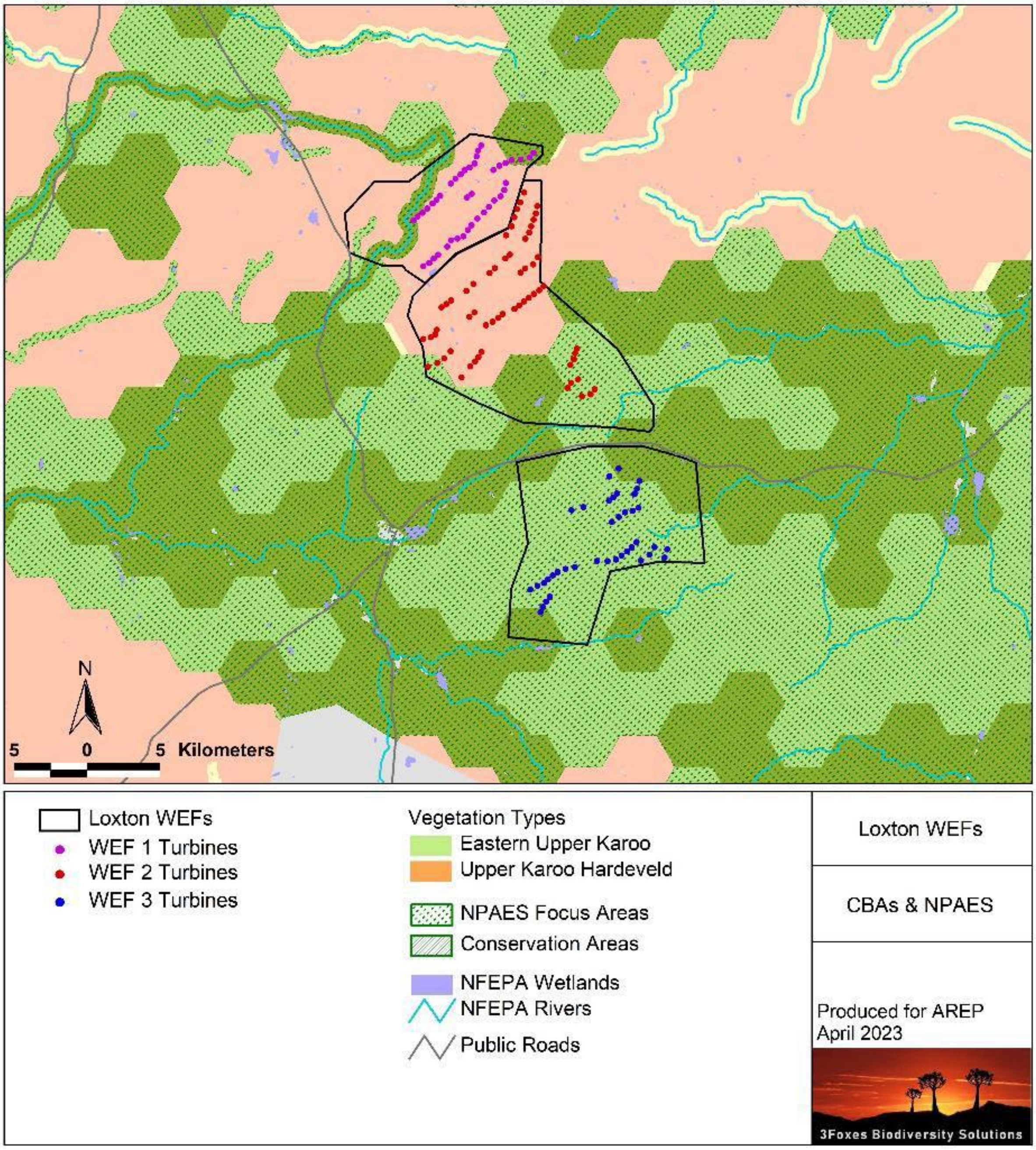

Figure 10. Critical Biodiversity Areas map for the study area, showing that the Loxton WEF is located across a boundary from other natural areas into a Tier 1 and 2 CBA.

In terms of the WEF 2, there are 12 turbines located within the CBA 2 that occupies the south of the site. Although there are some areas of CBA 1 within the project area these have been avoided and there are no turbines in areas of CBA 1. The same 12 turbines are within a NPAES Focus Areas that includes all of the areas of CBA 1 and CBA 2 within the site. While the impact on the CBA 2 as a result of the 12 turbines present in this area is considered undesirable, the areas of CBA 2 are considered to have low irreplaceability, with the result that the affected area is, in principle at least, not of exceptional importance with regards to biodiversity maintenance in the area (this is supported by the current sensitivity mapping). As a result, there would be some residual impact on the affected CBA 2 as a result of the development, but this is considered acceptable given the actual avoidance of the important biodiversity features of the site and the avoidance of the areas of CBA 1 within the site. There would however be some direct loss of habitat estimated at less than 10 ha within the NPAES FA.

In terms of the Loxton WEF 3, this has the greatest potential impact on CBAs of the three projects, given that the entire project area falls within CBAs. Under the layout provided for the current assessment, there are three turbines located marginally within CBA 1s and the remaining 38 turbines are located within the CBA 2. Since the layout takes account of the fine-scale mapping of biodiversity features, the impact of the Loxton WEF 3 on biodiversity features would be relatively low and while there would be some residual impact on the affected CBAs, it is unlikely that the development would compromise the overall ecological functioning of the area and the affected CBAs.

The whole of the Loxton WEF 3 site falls within a NPAES Focus Area. While the loss of 65 ha of habitat within the NPAES FA is not considered to represent a highly significant impact in its own right, the presence of wind turbines within the NPAES FA should be interpreted more broadly. These areas should not be considered to represent precise targets for conservation expansion, but rather as indicating that there is a need to consider protected area expansion in context of the broader landscape and connectivity between existing protected areas or to cater for large scale ecological processes. When seen as such, the development could be interpreted as representing an obstacle to linking the NPAES Focus Areas to the east and to the west of the site, should a protected area ever be developed in the area. At the scale of the affected vegetation types (Figure 11), similar habitats extend from Carnarvon in the northwest down to the Karoo National Park at Beaufort West in the southwest and extending eastwards to the Camdeboo National Park at Graaff Reinet and the Mountain Zebra National Park and from there northwards via Richmond all the way to De Aar.

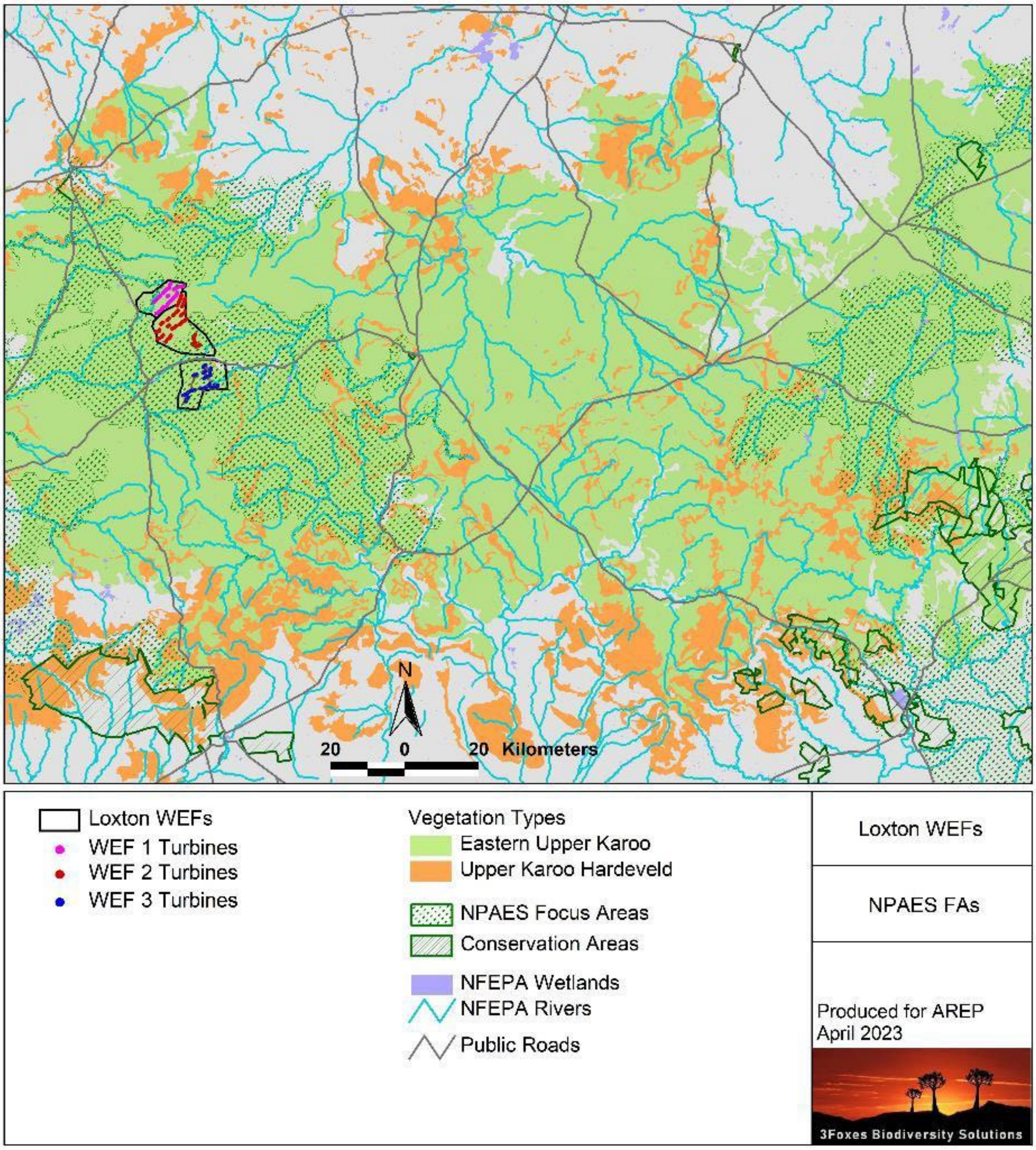

Figure 11. The common extent of Upper Karoo Hardeveld and Eastern Upper Karoo, showing the NPAES Focus Areas within these vegetation types.

5. EVALUATION OF CUMULATIVE & RESIDUAL IMPACTS

In terms of cumulative impacts in and around the Loxton Suite site, there are no existing wind farms in the area. Adjacent to the site are the planned WKN Windcurrent Taaibos South and Taaibos North Projects that are immediately east of the project area and would impact the same environment as the current project. Under the layouts currently available for public comment, there are numerous turbines located within CBAs, especially within the Taaibos North WEF, the majority of which falls within CBAs. According to the DSR, an offset may be required for the Taaibos North WEF, given the development impact on CBAs. There are also several other wind farm developments that have either been approved (Nuweveld – 3 WEFs) or are currently in-process (Hoogland – 4 WEFs) that are all located further south of the current site. In addition, there are also the Mura series of PV projects that are planned for south of the site, adjacent to the Nuweveld series of wind farms. Altogether, the overall footprint of the planned and approved projects would be approximately 2000ha. The three Loxton WEFs would add an additional 360ha of development to this total. While it is clear that there is a node of renewable energy development starting to develop around Loxton, there are no facilities built to date and the current level of transformation in the area remains low.

As there are numerous planned and authorised developments in the Loxton area as detailed above, the potential for cumulative and residual impacts should be considered as this is an important aspect with regards to the potential need for an offset especially with regards to the functioning of the broader landscape and the possible consequences of this in terms of the future potential to develop and expand formal conservation into the affected areas.

In terms of the requirements for an offset study, it is required to evaluate the adequacy of measures considered and adopted to avoid, minimize and rehabilitate potentially significant negative impacts on biodiversity. Any development must ensure that there are no residual impacts of very high significance that could lead to irreplaceable loss of biodiversity and/ or priority ecosystem services. In other words, an offset does not negate the need to reduce on-site impacts to an acceptable level. Table 3 below, provides an analysis of residual and cumulative impacts related to the current Loxton suite of projects and the associated uncertainties with the assessment and the resultant potential consequence for biodiversity. The analysis reveals which components of biodiversity are likely to be most at risk as a result of development in the Loxton area and provides an assessment of the likely consequence of development on these different components of biodiversity. The likely consequences of development on vegetation and plant species, aquatic ecosystems, terrestrial fauna, bats and CBAs have all been assessed as low. This can be ascribed largely to the fine-scale feature mapping that has been done in service of the current project and the resultant avoidance of important biodiversity features that has been implemented by the developer in response.

The low assessed consequence of development on CBAs warrants some explanation given the relatively high footprint in these areas. The Northern Cape CBA map has been produced at a broad scale and for many areas, there is very little fine-scale biodiversity information available that can be used to inform the CBA mapping. As a result, the CBA map relies extensively on biodiversity surrogates and the maintenance of broad-scale process features. As such, the CBA map for the study area is not well under-pinned by biodiversity pattern features and is largely driven by broad-scale vegetation and landscape features with low irreplaceability value. The same underlying features have been mapped at a fine-scale and detailed in the various specialist studies conducted for the current development. As these features have been classified as no-go areas, the overall impact of the development on biodiversity pattern features within the study area would be low and since these are the features the CBA mapping is aimed at protecting, the development would be unlikely to compromise the overall ecological functioning of the affected CBAs.

The long-term consequence of the development on avifauna is considered moderate. This is a potential concern for the current development as well as all other projects currently under way in the area. It is as a result of this potential impact that stringent mitigation and avoidance measures including long-term monitoring and possible curtailment have been recommended in the avifaunal specialist study for the three Loxton WEFs. Based on the results of the avifaunal specialist study, these three projects are considered acceptable contingent on the application of the recommended mitigation and avoidance measures.

Finally, in terms of the impacts on NPAES Focus Areas, these are considered to be low when considered simply in terms of the extent of habitat loss and the direct impact on the affected NPAES Focus Areas. However, when the development is considered in broader terms of landscape functionality and the potential impediment that renewable energy development would have on protected area expansion potential in the area, then this impact should be considered to be moderate after mitigation. The Loxton WEF 3 project in particular is located within a broadly sensitive area and while the development footprint would largely avoid the sensitive features of the site, it lies within a broader context with several notable biodiversity features present, as discussed further below.

Based on the current analysis of impacts associated with the Loxton 3 WEF, cumulative impacts and the broader landscape and conservation planning context, it is clear the primary concern regarding the development would be its' potential impact on broad-scale biodiversity processes. The extent to which this can be mitigated is therefore considered a key aspect regarding whether an offset should be considered an appropriate recommendation for the Loxton WEF 3 project. The major ecological corridors and process features as observed by the consultant who has worked extensively in the area for over 20 years, is illustrated below in **Figure 12**. The most important process features can be split between terrestrial features and those associated with drainage features/riparian ecosystems. In terms of the riparian features of the area, the Sak River and Krom River systems are both important in terms of Riverine Rabbits as well as general ecological corridors. For the same reasons, the Brak-Ongers system east of the site is also considered similarly significant. In terms of terrestrial features, there is a linkage between the high-lying ground within the Karoo National Park and the mountainous terrain northeast of the Park. These areas share several species of concern such as Braak's Pygmy Gecko and several butterfly species restricted to the higher elevation mountains of the Nuweveld. This area also forms part of the Great Escarpment which runs all the way from the Tanqua Karoo in the west all the way through to the Camdeboo and Mountain Zebra National Parks in the east. There are no major broad-scale features within the site, although the Loxton WEF 3 site lies at the watershed between the Klein Brak system which drains eastwards and the Brak system which drains westwards and may be important as a area where fauna move between these two systems.

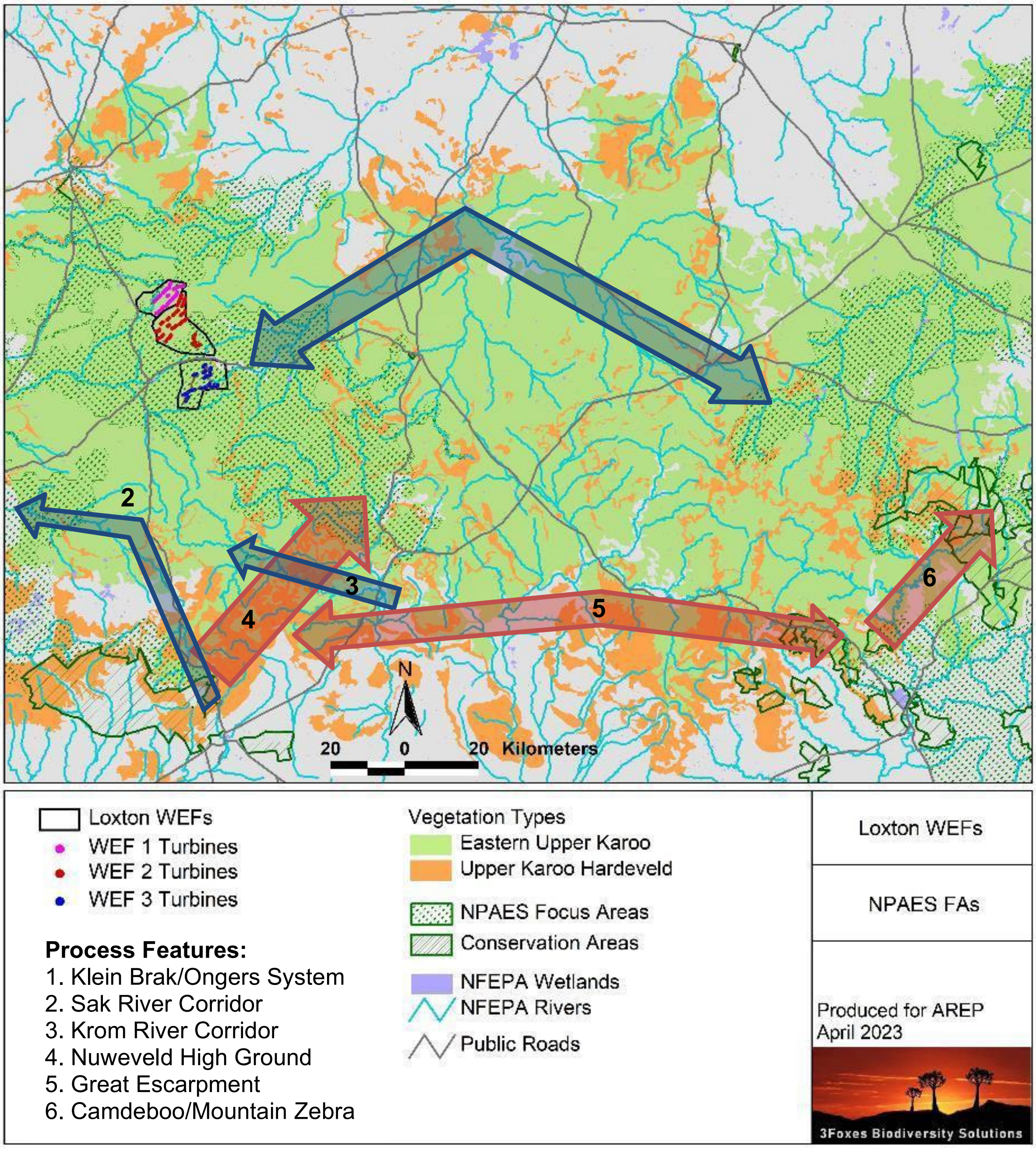

Figure 12. The same figure as Figure 11, but showing the major terrestrial (red) and aquatic/riparian (blue) corridors and process features within the wider area.

Table 3. Consideration of residual and cumulative impacts related to the current Loxton suite of projects and the concomitant risks due to uncertainty associated with the assessment and the resultant potential consequence for biodiversity.

Biodiversity Component	**Residual Impacts**	**Cumulative Impact**	**Risks**	**Consequence**
Vegetation & Plant Species	Low	Low	Low	Low
	There are no threatened ecosystems at the site and very few listed species that would be impacted by WEF development.	The affected vegetation types are widespread and even at a cumulative level, the overall footprint would not be considered significant in relation to the national extent of these vegetation types	Direct impacts of WEF development on vegetation can be accurately quantified with the result that there is very low risk and uncertainty associated with the assessment.	There are no significant residual or cumulative impacts likely to be associated with the development of the three Loxton wind farms.
Aquatic Ecosystems	Low	Low	Low	Low
	Aquatic environments would be avoided as much as possible with the result that disturbance would be low and long-term residual impact are considered to be low.	As the impact on aquatic environments would be low and with the implementation of the suggested mitigation, there would be low potential for cumulative impacts.	Due to the avoidance of sensitive aquatic features and the generally low potential impact of the development on aquatic systems, the risks associated with wind energy development in the area is low.	No major long-term impacts on the aquatic systems of the area are anticipated.

Terrestrial Fauna	Medium	Medium	Medium	Low
	There would be some residual habitat loss and long-term disturbance associated with the development that cannot be well mitigated.	It is likely that the cumulative development of wind farms in the Loxton are will have a significant cumulative impact on some species.	While the long-term impacts of wind energy development on South African fauna is not well known, the sensitive species of the area such as the Riverine Rabbit have been well-avoided, with the result that there are few significant long-term risks and uncertainties on fauna SCC. However, there remains some general uncertainty as to impacts on faunal community structure and this uncertainty could be addressed through the current project.	While there is likely to be some long-term impact on fauna from wind energy development in the area, the overall risk is assessed as being low as this is unlikely to significantly impact any terrestrial fauna of concern.
Avifauna	Medium	Medium	Medium	Medium
	There is likely to be a long-term residual impact of the development on avifauna as a result of collisions with turbine	The potential for cumulative impacts is considered moderate given the relatively large number of potential developments in the area as well as the high	As it is still uncertain as to which species would be most-affected by wind energy development in the area, there is some risk that certain species may be	As a result of the long-term cumulative impacts on susceptible avifauna, there is potential that wind energy development will have a locally significant

	blades as well as mortality associated with power lies.	number of listed species present in the area.	significantly impacted beyond the current predictions.	impact on certain species considered to be of moderate consequence.
Bats	Medium	Medium	Low	Low
	There is likely to be a long-term residual impact of the development on susceptible bats as a result of barotrauma and collisions with turbine blades.	The potential for cumulative impacts is considered moderate given the relatively large number of potential developments in the area.	Although there is some risk that certain species may be significantly impacted by wind energy development, the bat density in the area is low and the species most likely to be affected are widespread species.	Despite the potential for wind energy development to have a locally significant impact on certain bat species susceptible to wind turbine impact, this would be on widespread species with the result that the overall consequence of such impact would be considered low.
Critical Biodiversity Areas	Medium	Medium	Low	Low
	Development within CBAs would result in long-term habitat loss within CBAs that cannot be avoided or well mitigated.	As there are numerous proposed developments with infrastructure located within CBAs, there is a moderate potential for cumulative impact on CBAs.	Given the fine-scale feature mapping that has been conducted as part of the various specialist studies for the current as well as other development applications in the area, there is a relatively low risk of significant	Although there would be some negative impact on the CBAs of the area, when considered at a broader scale, there are no specific features of concern or with demonstrated biodiversity features of high value that

			unpredicted impacts on biodiversity.	would be impacted by the development. As such, the overall consequence of development within the affected CBAs is considered to be low.
NPAES Focus Areas	Medium	Medium	Low	Medium
	This impact is considered moderate after mitigation as it is clear that the development is located within a broadly sensitive area and while the development footprint would largely avoid the sensitive features of the site, it lies within an area with several notable biodiversity features present.	The overall footprint within NPAES Focus Areas from the current as well as other developments is low.	As the ecosystems of the area are not unique and have relatively low irreplaceability, there are few risks and uncertainties regarding potential impacts on NPAES Focus Areas.	The presence of the development would pose some limitations on the location and configuration of any conservation areas that may be developed in the area in the future.

6. CONCLUSIONS AND RECOMMENDATIONS

This offset needs analysis provides a synthesis of the potential biodiversity impacts associated with the Loxton Wind Energy Facilities and in particular the Loxton Wind Energy Facility 3. This includes cumulative impacts from the current suite of projects as well as other approved and planned projects in the area. The analysis finds that the consequence of residual and cumulative impacts associated with the current suite of projects are likely to be low for vegetation and plant species, aquatic ecosystems, terrestrial fauna, bats and CBAs. This can be ascribed largely to the fine-scale feature mapping that has been done in service of the current project and the resultant stringent avoidance of important biodiversity features that has been implemented by the developer in response. The long-term consequence of the development on NPAES Focus Areas is considered moderate. This is a potential concern for the current development as well as all other projects currently under way in the area.

Despite the relatively high footprint of the Loxton Wind Energy Facility 3 within CBAs, the current study finds that that overall consequence of development within the CBAs of the site can be assessed as low due to the extensive avoidance that has been implemented. The Northern Cape CBA map relies extensively on biodiversity surrogates and the maintenance of broad-scale process features. As such, the CBA map for the study area is not well under-pinned by biodiversity pattern features and is largely driven by broad-scale vegetation and landscape features, with only moderate alignment between the results of the CBA mapping the specialist findings for the current study. The fine-scale feature mapping that has been conducted and which informs the layout of the three Loxton Wind Energy Facilities classifies all important biodiversity features as no-go areas, with the result that the overall impact of the development on biodiversity pattern features within the study area would be low. Since these are the features the CBA mapping is aimed at protecting, the development would be unlikely to compromise the overall ecological functioning of the affected CBAs.

In terms of the implementation of the mitigation hierarchy, the project has focussed very strongly on the avoidance of sensitive biodiversity features. This has been instrumental in reducing potential impacts on biodiversity to acceptable levels. While a number of mitigation actions have been suggested in the various specialist studies for the development, there are additional monitoring and mitigation measures that can be implemented on the project site that can aid in reducing residual and cumulative impacts on biodiversity within the site and more generally. Since the impacts of wind energy development on terrestrial fauna are not well known, this represents an obstacle to identifying effective mitigation options and also limits confidence in assessing and predicting the impacts of wind energy development on fauna, it would be valuable to implement monitoring at the site to address this knowledge gap as part of the suggested mitigation actions associated with the Loxton Wind Energy Facility 3 development.

In terms of the impacts of the Loxton 3 WEF on NPAES Focus Areas, these can be considered to be low when considered simply in terms of the extent of habitat loss and the direct impact on the affected NPAES Focus Areas. However, when the development is more appropriately considered in broader terms of landscape functionality and the potential impediment that renewable energy development would have on protected area expansion in the area, then this impact should be considered to be moderate after mitigation as it is clear that the development is located within an area with some important biodiversity features present. The primary concern regarding the development would be its' potential impact on broad-scale biodiversity processes. The question is thus raised as to whether there are any additional mitigation measures that can be implemented which would reduce this impact to an acceptable level or whether an offset would be the most appropriate measure to deal with the residual impacts on biodiversity? The defining feature for an offset is the "**loss of vulnerable or potentially irreplaceable biodiversity in areas of recognised biodiversity importance**". In the current case, it seems highly unlikely that the development would lead to a "loss of irreplaceable biodiversity" given the extensive avoidance that has been implemented. However, in terms of process features, it is recommended that a development-free corridor be established and maintained through the project site which would encourage and facilitate the linkage between the Klein Brak and Brak River systems. The area where this should be established is illustrated below in Figure 13.

The following conclusions and recommendations are made with regards to the Loxton Wind Energy Facilities and the possible need for an offset:

- The study finds that there are insufficient grounds to warrant an offset for the development of the Loxton Wind Energy Facility 1 and Wind Energy Facility 2, either singly or in combination. This can be ascribed to the low footprint within CBAs and the avoidance of important biodiversity features within the sites. No additional mitigation or avoidance measures are deemed necessary.

- In terms of the Loxton Wind Energy Facility 3, impacts on NPAES Focus Areas have been assessed as being medium after mitigation. This suggests that some kind of non-standard mitigation to reduce this impact is required. As mentioned above, a primary concern regarding the development would be its' impact on broad-scale connectivity and landscape functionality. In order to address this impact, the following mitigation is recommended:

  - The major drainage feature on the farm Biesjespoort 140 which includes part of the site and runs adjacent to the R63, represents a significant feature of the area and has an uncharacteristically large floodplain area which has confirmed Riverine Rabbit sightings from the current project as well as older records from EWT. This is considered to represent an important area for Riverine Rabbits and also represents the likely best connection between the Brak-Sak River system west of the site and the Klein Brak/Ongers River system east of the site. This area is likely to represent an important faunal movement corridor for most larger fauna present in the area as well as the Riverine Rabbit. It is therefore concluded that the protection and management of this feature for biodiversity purposes would represent the most favourable outcome for the current development in terms of mitigating potential impacts on broad-scale ecological processes. The identified area is illustrated below in Figure 13.

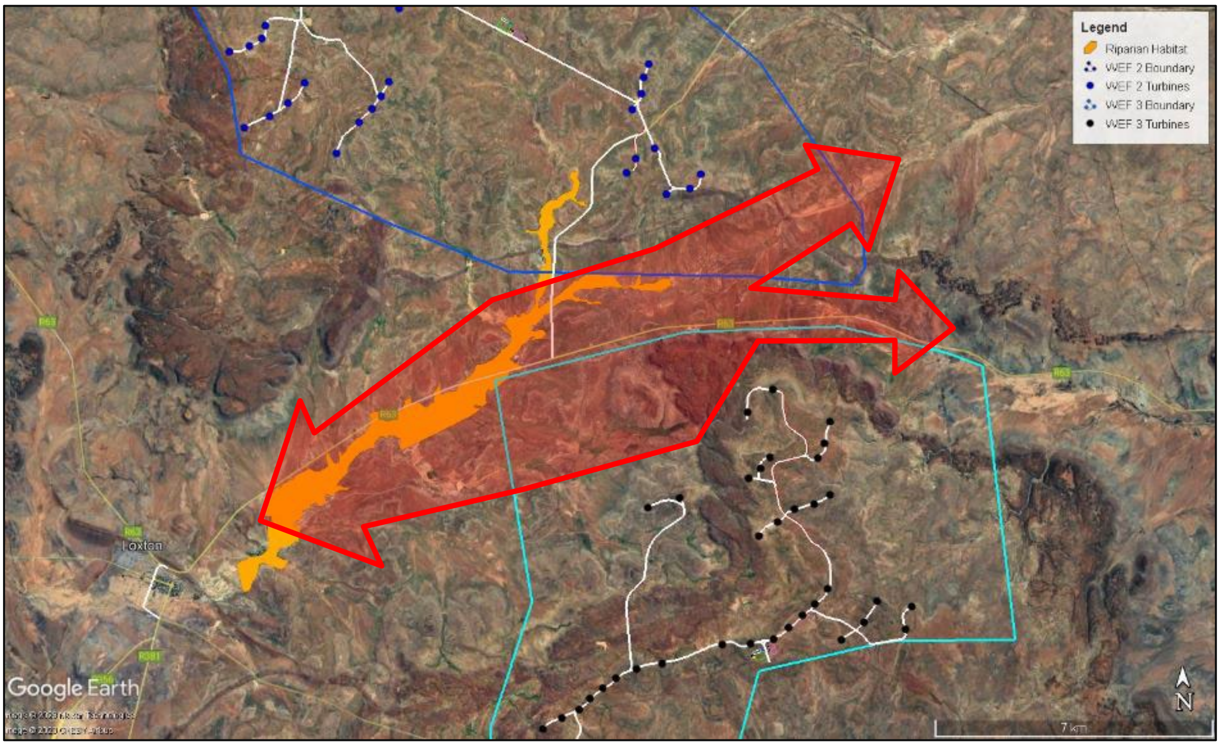

Figure 13. Recommended general area within which a development-free zone should be established, showing the primary drainage feature in orange that should form the core feature of the set-aside development-free zone.

The proposed development-free zone should be established within the above demarcated area as illustrated above in Figure 13. In terms of promoting the functionality of the corridor, the following recommendations are made:

- The corridor should at most points be at least 1km wide and should not be less than 300m wide at any point. The exact configuration should be delimited in consultation with the relevant landowners and should take existing livestock camps and fencing into account. New fencing can be added if required in order to accommodate practical and operational issues such as existing roads, existing irrigated fields etc., but should not be of the jackal-proof type, made of mesh.
- Grazing within the corridor should be reduced to a maximum of 50% of the Department of Agriculture recommendation for the area when calculated on an annual basis. Livestock grazing represents a major impact on biodiversity and has ecosystem-wide impacts. As such, the reduction in grazing pressure within the corridor would improve the habitat condition within the corridor for a wide range of fauna. In addition, it would have positive impacts on flora and vegetation cover. This would significantly increase the use of the corridor by fauna and would improve the ability of fauna to move through the area.

- The corridor should be kept clear of any additional development for the lifetime of the wind energy facility. Existing areas of intensive agriculture i.e cultivated crop fields should be allowed to remain within the corridor but should not be expanded.
- The overall extent of the development free corridor should not be less than 2000 ha, which is approximately 30 times larger than the development footprint of 65 ha.
- An agreement in-principle with the landowner/s should be obtained and included in the final EIA demonstrating the practicability of the corridor in terms of landowner buy-in and willingness.
- The corridor would only come into effect should the Loxton WEF 3 become a preferred bidder under the REIPPP or another power-supply arrangement.
- The final development free corridor should be defined and binding contracts signed with all relevant landowners before construction commences. The contracts should be valid for the lifetime of the facility.

In addition to the establishment of the above corridor an associated Fauna Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on fauna including the Riverine Rabbit as well as other key species at the site. Such monitoring has also been recommended for the Nuweveld and Hoogland suite of projects and the current development should align with those projects in order to create a broader initiative examining the impacts of the wind energy development on key biodiversity features of the area. It is important to note that such monitoring is not simply for its' own sake, but is also important to demonstrate the effectiveness of the implemented conservation set-aside and the on-site mitigation and avoidance measures. In addition, it can also be used to ensure compliance with some of the recommended measures in terms of livestock numbers and grazing duration. At a minimum, the monitoring should align with the existing recommended wind farm monitoring protocols for the area and should take the following basic form in order to ensure credibility and scientific rigour:

- The monitoring should adhere to a BACI (before-after-control-impact) approach with regards to examining the impacts of the wind farm on terrestrial fauna. As such, this would necessitate preconstruction monitoring to establish a reliable baseline of faunal activity, abundance and distribution at the site as well as the use of a matched control site. In terms of practicality and repeatability, it is recommended that camera trap-monitoring is used as this is the norm for such studies.
- The preconstruction monitoring would be followed up by matched post-construction monitoring to evaluate the potential negative impacts of the development on community structure, activity and distribution in relation to wind turbine density and proximity.
- It is estimated this would require up to 1 year for preconstruction monitoring and then 3-to 5 years post construction monitoring to evaluate long-term impacts on fauna, which may take several years to become apparent. The monitoring must be conducted in a manner which allows for reliable effect sizes and statistically-backed inferences to be made.

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- A detailed methodology would need to be developed prior to construction, which should include an outline of the experimental layout with regards to the camera trapping sampling approach with details on the number, frequency and distribution of camera traps in relation of the wind turbines and features of the site, such that the above criteria with regards to the statistical reliability of the results can be met.
- The results of the monitoring should be written up in a formal publication and made available to public.

This needs analysis has been undertaken to assess the need and desirability of applying an offset to the Loxton 3 WEF in order to account for residual impacts of the development, especially those related to impacts on CBAs and NPAES Focus Areas. The finding of the needs analysis is that no high or moderate residual impacts on irreplaceable biodiversity features have been identified, and thus, an offset is not required. The project does however occur in a NPAES focus area, and the developer is cognisant of the need to maintain ecological processses within and across the site. As a mitigation measure to promote the maintenance of connectivity through the affected area into the long term, the developer has commited to the implementation of a development-free corridor that would facilitate and enhance landscape connectivity. This study has identified the most suitable area within the site where such a corridor would have maximal effect and which should form the basis for the conservation set-aside to be implemented before construction commences on the site.

The Applicant should appoint an ecologist with experience in conservation planning to prepare an open space management plan to outline the monitoring, measurement and management processes associated with the conservation set-aside. The open-space management plan would need to be developed prior to the commencement of construction of the Loxton WEF 3. It is therefore recommended that it be included as a condition to the Environmental Authorisation.

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