succulent shrubland with *Ruschia, Drosanthemum, Aridaria, Augea, Zygophyllum*), in extreme precipitation-poor years appearing barren, while the slopes of the koppies and adjacent mountain piedmonts support well-developed medium-tall succulent *Euphorbia hamata–Pteronia incana* shrubland (Rubin 1998). Small quartz patches occur in the southern Tanqua Basin. Annual flora (*Gazania lichtensteinii, Euryops annuus, Ursinia nana*) becomes conspicuous with sufficient precipitation, while geophytes and grasses play a subordinate role. *Stipagrostis ciliata* and *S. obtusa* can become locally dominant in places. The unit occurs on Mudrocks, Dwyka Group diamictites and sandstones (Bokkeveld Group) and soils are sandy-loamy of various depths. Quartz patches are a rare phenomenon concentrated in the southern portions of the Tanqua Basin. Fc is the dominant land type, with Ag land type playing subordinate role. Climatically the unit falls within a winter-rainfall regime with most of the precipitation between May and August, while December and January are virtually precipitation-free. The region has high spatial variability of precipitation, with some rain shadows experiencing as little as 40 mm of rainfall per year (in extremely dry years). MAP varies from a low of 72 mm in the central part of the unit to 112 mm in the north of the unit and to 111 mm in the south of the unit. MAT is slightly above 17 °C, but in winter the temperature can often fall below the frost mark (15 days in a year). Mean maximum and minimum monthly temperatures of 35.9 °C and 5.64 °C occur in January and July, respectively.

A general list of species that are represented in the vegetation type and conservation status characteristics is provided in Table 3.

Table 3: Tanqua Karoo ([W]Western distribution limit)

Growth Form	Description/Species
Geophytic herbs	*Drimia intricata*, *Lachenalia ameliae*, *Moraea pallida*, *M. speciosa*, *Ornithogalum xanthochlorum*, *Ornithoglossum viride*, *Oxalis pes-caprae*, *Strumaria unguiculata*, *Tritonia florentiae*
Grasses	*Stipagrostis ciliata* (d), *S. obtusa* (d), *Aristida adscensionis*, *Cladoraphis spinosa*, *Ehrharta calycina*, *Enneapogon desvauxii*, *E. scaber*, *Fingerhuthia africana*.
Herbs	*Gazania lichtensteinii* (d), *Amellus microglossus*, *A. strigosus* subsp. *pseudoscabridus*, *Dicoma capensis*, *Emex australis*, *Euryops annuus*, *Hebenstretia parviflora*, *Helichrysum herniarioides*, *Lepidium africanum*, *L. desertorum*, *Lessertia pauciflora*, *Leysera tenella*, *Lotononis parviflora*, *Lyperia tristis*, *Oncosiphon grandiflorum*, *Osteospermum pinnatum*, *Pelargonium minimum*, *Plantago cafra*, *Radyera urens*, *Ursinia nana*.
Semiparasitic shrub	*Thesium lineatum*
Succulent Shrubs	*Antimima hantamensis* (d), *Augea capensis* (d), *Gibbaeum gibbosum* (d), *Ruschia spinosa* (d), *Antimima wittebergensis*, *Aridaria noctiflora* subsp. *noctiflora*, *A. noctiflora* subsp. *straminea*, *Braunsia apiculata*, *Cephalophyllum curtophyllum*, *C. framesii*, *Crassula subaphylla*, *C. tetragona* subsp. *connivens*, *Drosanthemum delicatulum*, *D. framesii*, *D. lique*, *Euphorbia decussata*, *E.*

Growth Form	Description/Species
	mauritanica, *E. multiceps*, *E. rectirama*, *Hoodia gordonii*, *Leipoldtia schultzei*, *Lycium cinereum*, *Othonna pteronioides*, *Peersia macradenia*, *Pelargonium crithmifolium*, *Phyllobolus grossus*, *P. splendens*, *Ruschia intricata*, *Salsola aphylla*, *S. namibica*, *Sarcocaulon crassicaule*, *Scopelogena bruynsii*, *Tetragonia fruticosa*, *T. robusta* var. *psiloptera*, *Tylecodon reticulatus*, *T. wallichii* subsp. *wallichii*, *Zygophyllum flexuosum*, *Z. microcarpum*
Low Shrubs	*Tripteris sinuata* (d), *Aptosimum indivisum*, *Asparagus capensis* var. *capensis*, *Berkheya spinosa*, *Chrysocoma ciliata*, *Eriocephalus africanus*, *E. ericoides*, *E. pauperrimus*, *E. spinescens*, *Euryops cuneatus*, *Galenia africana*, *G. fruticosa*, *Hermannia multiflora*, *Lessertia fruticosa*, *Limeum aethiopicum*, *Monechma spartioides*, *Pelargonium grandicalcaratum*, *Pteronia aspalatha*, *P. ciliata*, *P. erythrochaeta*, *P. glauca*, *P. intermedia*, *P. oblanceolata*, *P. pallens*, *P. scariosa*, *P. sordida*, *Rhynchosia bullata*, *Stachys cuneata*[W], *Zygophyllum microphyllum*
Herbaceous climber	*Cyphia comptonii*
Succulent herbs	*Brownanthus vaginatus*, *Crassula muscosa*, *Duvalia caespitosa* subsp. *caespitosa*, *Mesembryanthemum excavatum*, *M. guerichianum*, *M. stenandrum*, *Psilocaulon articulatum*, *P. junceum*, *Tetragonia microptera*.
Woody climber	*Asparagus fasciculatus*, *Microloma sagittatum*
Biogeographically Important Taxa	([RH]Roggeveld-Hantam endemic, [S]Southern distribution limit) Low Shrubs: *Nenax cinerea*[RH], *Stachys aurea*[RH]. Herbs: *Alatoseta tenuis*[RH], *Dimorphotheca polyptera*[S], *Nemesia karroensis*[RH]. Geophytic Herbs: *Haemanthus barkerae*[RH], *Lapeirousia violacea*[RH]. Succulent Herbs: *Stapelia surrecta*[RH], *Tridentea parvipuncta subsp. truncata*[RH],*Tromotriche thudichumii*[RH]
Endemic Taxa	Succulent Shrubs: *Braunsia stayneri*, *Cephalophyllum corniculatum*, *Didymaotus lapidiformis*, *Drosanthemum bellum*, *D. lignosum*, *Euphorbia gentilis* subsp. *tanquana*, *Hammeria meleagris*, *Hereroa nelii*, *H. teretifolia*, *Malephora crassa*, *Ruschia tardissima*, *Tanquana prismatica*. Geophytic Herbs: *Haemanthus tristis*, *Strumaria karoopoortensis*.
Conservation Status	Least Concern
Conservation Target	*19 %*
Conserved in	About 10% statutorily conserved in the Tankwa Karoo National Park and a further 4% in private reserves, including Inverdoorn, Zwartbosch, Jakkalsfontein, Basjanskloof, Groote Kapelsfontein, Uintjieskraal and Vaalkloof.
Threat activities	Only a small portion of this area of low agricultural production has been transformed but due to overgrazing in some places, aliens such as *Atriplex lindleyi* subsp. *inflata* have invaded. Erosion is moderate (47%), high (36%) as well as very low (14%).
Protection Level	*Moderately Protected*
Remarks	Tanqua (Tankwa) Karoo is one of the driest forms of the Succulent Karoo Biome, and the whole appearance of the landscape resembles desert rather than semidesert during most of the year (in extremely precipitation-poor years in particular). The eastern edge (the foot of the Roggeveld Escarpment) and southern parts of the Tanqua Karoo, are wetter and consequently more densely vegetated. The classification status of the driest parts of the Tanqua Karoo as rain-shadow desert rather than semidesert (Succulent Karoo) remains open for the time being. The mapped unit nevertheless lies within the same range of MAP corresponding to some of the Succulent Karoo mapped elsewhere within the winter-rainfall region (Port Nolloth southwards to Wallekraal) but lacks the coastal fog of the latter area. The role of heavy grazing pressure in the 19th and early 20th centuries in the Tanqua Karoo needs to be evaluated in places where it is 'terribly tramped out' according to Acocks (1953). Tanqua Karoo (including the extensive sheet-wash plains) is an important local centre of endemism housing two endemic genera (*Didymaotus* and

Growth Form	Description/Species
	Eurystigma) and three near-endemic genera (*Braunsia, Hammeria* and *Tanquana*)—all of the family Aizoaceae.
References	Lane (1977), Jürgens (1986), Acocks (1988), Mackay (1994), Mackay & Zietsman (1996), Milton et al. (1997), Rubin (1998), Schmiedel & Mucina (2006).

Although not directly associated with the project footprint, influences from Tanqua Escarpment Shrubland elements are prevalent along the northern and western sides of the greater project area. The unit is present in the Northern Cape province along a narrow belt on northwest-facing slopes of the Klein-Roggeveldberge and on southwest-facing and west-facing slopes of the Roggeveld Escarpment as far north as Bloukrans Pass, south of Calvinia. Generally found at altitudes between 620–1 600 m. The vegetation is found on steep flanks below an escarpment overlooking a basin, generally facing southwest supporting succulent shrubland of medium height with *Tylecodon* (botterboom) and *Euphorbia mauritanica* (melkboom) prominent and with undergrowth of both succulent (*Aridaria, Crassula*) and non-succulent (*Asparagus, Pteronia*) shrubs. Soils are derived from mudrocks as well as brown to grey shales, siltstones and sandstones, broken by network of intrusive Jurassic Karoo dolerites. The shallow soils form the basis for the classification of most of the area into Ib land type (with Dc land type being of lesser importance). The area has a less pronounced winter-rainfall regime with most of the rainfall is spread between March and August (peaking from June to August). MAT is almost 16°C and the incidence of frost is relatively high (30 days).

A general list of species that are represented in the vegetation type and conservation status characteristics is provided in Table 4.

Table 4: Tanqua Escarpment Shrubland

Growth Form	Description/Species
Geophytic herbs	*Androcymbium volutare, Asplenium cordatum, Boophone disticha, Cyanella hyacinthoides, Empodium plicatum, Oxalis obtusa*
Grasses	*Ehrharta calycina, Fingerhuthia africana, Merxmuellera dura*
Herbs	*Galium capense subsp. garipense, Lasiospermum brachyglossum, Leysera tenella, Pelargonium moniliforme, Tripteris microcarpa.*
Low shrubs	*Pteronia incana (d), Asparagus capensis var. capensis, A. striatus, Berkheya cardopatifolia, Chrysocoma ciliata, Eriocephalus africanus, E. ericoides, E. spinescens, Felicia filifolia, F. macrorrhiza, F. scabrida, Galenia africana, G. fruticosa, Heliophila cornuta var. squamata, Hermannia multiflora, Lessertia fruticosa, Limeum aethiopicum, Pelargonium grandicalcaratum, Pteronia oblanceolata, P. sordida, Salvia disermas, Selago albida, S. polycephala, Tripteris sinuata, Ursinia pilifera,*
Semiparasitic shrub	*Thesium lineatum*
Succulent Shrubs	*Tylecodon paniculatus (d), T. wallichii subsp. wallichii (d), Aridaria noctiflora subsp. straminea, Crassula tetragona subsp. connivens,*

Growth Form	Description/Species
	Drosanthemum lique, Euphorbia caterviflora, E. mauritanica, Lycium cinereum, Manochlamys albicans, Tetragonia robusta var. psiloptera, Tylecodon ventricosus.
Herbaceous climber	*Fockea sinuata*
Succulent herbs	*Crassula tomentosa, C. umbella, Tetragonia microptera*
Tall shrubs	*Diospyros austro-africana, Gomphocarpus fruticosus, Montinia caryophyllacea, Rhus burchellii, R. undulata*
Woody climber	*Asparagus fasciculatus, A. multituberosus, Microloma sagittatum*
Biogeographically Important Taxa	([RH]Roggeveld-Hantam endemic, [S]Southern distribution limit, [W]Western distribution limit) ▪ Low Shrubs: *Felicia burkei*[S], *Nenax cinerea*[RH], *Pelargonium magenteum*[RH], *Pteronia aspalatha*[RH], *Selago polygala*[RH], *Stachys aurea*[RH]. ▪ Herbs: *Cromidon hamulosum*[RH], *Diascia macrophylla*[RH], *Jamesbrittenia thunbergii*[RH], *Lotononis maximiliani*[RH], *Nemesia anisocarpa*[S], *Polycarena aurea*[RH], *Trigonocapnos lichtensteinii*[RH]. ▪ Succulent Herb: *Crassula dodii*[RH]. ▪ Graminoids: *Ehrharta melicoides*[W], *Secale strictum* subsp. *africanum*[RH].
Endemic Taxa	▪ Low Shrub: *Indigofera hantamensis*.
Conservation Status	Least Concern
Conservation Target	Target 19 % (National Biodiversity Assessment, 2018)
Conserved in	Only a very small portion statutorily conserved in Tankwa Karoo National Park.
Threat activities	No visible signs of transformation or invasion of alien plants. Erosion is moderate (59%) and low (41%).
Protection Level	*Moderately Protected*
Remark	Tanqua Escarpment Shrubland is part of the Hantam-Roggeveld Centre of Endemism (Van Wyk & Smith 2001) and remains one of the least studied vegetation types of the country.
Reference	Van Wyk & Smith (2001).

Also not directly associated with the project footprint, being found in the lower lying alluvial valleys to the west of the project area, Tanqua Wash Riviere elements are represented along watercourses in the valleys that drain towards the north, west and south of the project area.

The unit is found within the Western Cape and Northern Cape Provinces along alluvia of the Tankwa and Doring Rivers and sheet-wash plains of their less important tributaries embedded within SKv 5 Tanqua Karoo. It is found at altitude ranging from 300–1 000 m within deeply incised valleys of intermittent rivers supporting a mosaic of succulent shrublands with *Salsola* and *Lycium* alternating with *Acacia karroo* gallery thickets. The broad sheet-wash plains support sparse vegetation of various *Salsola* species, often building phytogenic hillocks interrupting the monotonous barren face of a sheet wash. Occasional rainfalls in early winter result in localised displays of annuals and early flowering geophytes along washes. Found within broad Quaternary alluvial floors and drainage lines filled with recent sediments mostly from eroded Karoo Supergroup sediments and having sodic loamy to sandy soils (Ia land type). The run-off

in these habitats is very low and spread over large areas. Climatically, the region is characterised by arid to hyper-arid climate, with MAP ranging between 100 mm and 170 mm and overall MAP 162 mm, mainly falling in autumn and winter. Mean daily maximum and minimum temperatures are 32.5 °C and 3.0 °C for January and July, respectively while overall MAT is slightly higher than 17 °C. Due to basin macro-topography the occurrence of frost is fairly frequent.

A general list of species that are represented in the vegetation type and conservation status characteristics is provided in Table 5.

Table 5: Tanqua Wash Riviere

Growth Form	Description/Species*
Important Taxa	Riparian thickets: Small Tree: *Acacia karroo* (d). Alluvial shrublands & herblands: Low Shrub: *Galenia africana*. Succulent Shrubs: *Lycium cinereum* (d), *Malephora luteola*, *Salsola arborea*, *Sarcocornia mossiana* agg. Geophytic Herbs: *Moraea speciosa*, *Tritonia florentiae*. Graminoids: *Cladoraphis spinosa*, *Stipagrostis obtusa*. Sheet washes: Succulent Shrubs: *Augea capensis*, *Salsola aphylla*. Herbs: *Euryops annuus*, *Gazania lichtensteinii*, *Osteospermum pinnatum*, *Ursinia nana*.
Endemic Taxa	Alluvial shrublands & herblands: Herbs: *Limonium* sp. nov. (*Mucina 310104/1* STEU). Sheet washes: Succulent Shrub: *Salsola ceresica* (d).
Conservation Status	Least Concern
Conservation Target	Target 19 % (National Biodiversity Assessment, 2018)
Conserved in	About 13% statutorily conserved in the Tankwa National Park and in some private reserves (Inverdoorn, Jakkalsfontein, Uintjieskraal, Groote Kapelsfontein, Vaalkloof).
Threat activities	About 3% already transformed for cultivation or dam building (Oudebaaskraal Dam and Swartkop se Dam). Alien *Atriplex lindleyi* subsp. *inflata* and *Prosopis* species can become frequent in places.
Protection Level	*Moderately Protected*
Remark	This unit is of heterogeneous character at present and the ecological and floristic relationship between the *Acacia karroo*-dominated riparian vegetation on the one hand and the *Salsola*-dominated sheet-wash vegetation on the other, deserves re-evaluation in the light of new data still to be collected.
Reference	Rubin (1998).

It is notable across the vegetation types that a suite of species tends to be represented across most of the area, but dominant species vary depending on climatic factors which are influenced by aspect and altitude. Slight variations in community structure, composition and dominant species are also noted within the vegetation units represented on site.

Within the Mountainous area, more specifically the Renosterveld, there is a distinct and visible difference between north and south facing slopes, with north-facing slopes being drier and having a strong succulent shrub composition. Wetter south-facing slopes have a notable lower succulent shrub composition, with herbaceous shrubs dominating. This difference is less noticeable in lower lying areas, within the Moordenaars Karoo, where north and south facing slopes tend to both have more prominent succulent shrub and herb component.

Within lower lying areas, dominant species include shrubs such as *Ruschia intricata, Eriocephalus microphyllus* var. *microphyllus*, *Chrysocoma ciliata, Hirpicium alienatum, Asparagus capensis, Amphiglossa tomentosa, Pteronia ciliata, Pteronia sordida, Pentzia incana, Tripteris sinuata* and *Oedera genistifolia*, grasses including *Ehrharta calycina* and *Merxmuellera stricta* and succulents such as *Tylecodon wallichii* and *Crassula tetragona* subsp. *connivens*.

There is a clear change in the vegetation discernible above 1 350 m, where the cooler and wetter conditions result in a change in composition compared to the lower elevation areas. Although the vegetation is broadly similar in terms of the dominant species as listed above, species which characterise these areas which are not present or uncommon at lower elevations include *Rosenia spinescens*, *Eriocephalus grandiflorus* (Rare), *Ehrharta eburnea* (NT) and *Tribolium purpureum, Pelargonium griseum, Zygophyllum spinosum, Berkheya heterophylla* var. *heterophylla* and *Ruschia lineolata*. The abundance of geophytes and other species of potential concern are significantly higher within the slopes and higher lying areas, compared to the lower lying plains and river valleys.

Observations made during the walkdown supplemented by previous ecological and biodiversity assessments undertaken on several adjacent G7 WEF projects by Todd (2011, 2014, 2016, 2019) identify the following vegetation and flora characteristics:

1) Most of the central uplands of the project area are classified as Central Mountain Shale Renosterveld, transitioning to Koedoesberge-Moordenaars Karoo on the south and east sides. Although the vegetation on the west side is designated as Koedoesberge-Moordenaars Karoo, the composition is clearly different to the same unit on the east side where the vegetation appears to transition towards Tanqua Karoo rather than Koedoesberge-Moordenaars Karoo. Furthermore, there is a transition towards Tanqua Escarpment Shrubland towards the north and Tanqua Karoo to the west, with elements of both these units being represented within the peripheral boundaries of the project area,

even though they do not overlap with the mapped vegetation as per the National Vegetation Map (2018).

2) In the field the vegetation unit distinction is not always obvious and there is a large overlap in the species composition of the units with a distinct transitional aspect. At a local level, altitude, aspect and soil depth are the dominant drivers of vegetation composition. High-lying areas are dominated by typical Renosterveld species while the proportion of succulents and karroid species increased with decreasing altitude or on drier aspects, thus transitioning into the surrounding low-lying drier Karroid vegetation. Higher altitude south-facing slopes are also distinctly less arid compared to north-facing slopes.
3) High-lying areas and cooler southern aspects are typically dominated largely by woody shrubs such as *Elytropappus rhinocerotis, Euryops lateriflorus, Eriocephalus africanus and Eriocephalus grandiflorus, Pteronia ambrariifolia, Pteronia glomerata, Pteronia glauca, Rosenia glandulosa* and *Asparagus capensis;* succulents such as *Ruschia cradockensis, Leipoldtia schultzei, Crassula deltoidea, Crassula tetragona*. Grasses tend to be scarce but become more common in patches where there is some soil present. Common grasses tend to be restricted to the tufted species including *Tenaxia (Merxmuellera) stricta*, *Ehrharta calycina* and *Karroochloa purpurea*. Grasses tend to be scarce in the rocky outcrops, stone benches and rocky pavements. It has also been postulated that south-facing slopes are likely to represent an important climate change refugia for biodiversity, and these areas have been designated as such in the Namakwa Biodiversity Sector Plan (2008).
4) The drier, sunny aspects and lower lying areas contain a larger proportion of succulent species and are dominated by succulents such as *Ruschia cradockensis*, *Crassula rupestris*, *Crassula deltoidea*, *Crassula nudicaulis*, *Tylecodon reticulatus*, *Sarcocaulon patersonii*, common woody or herbaceous shrubs include *Pteronia glomerata*, *Pteronia sordida*, *Eriocephalus ericoides*, *Pelargonium magenteum* and *Pelargonium abrotanifolium*.
5) Although Renosterveld is usually a fire-prone ecosystem, there is little evidence of regular fires at the site. Discussions with the local farmers also confirmed that although fires do occasionally occur, they are not a regular feature and are not used by farmers as a veld management tool. Within arid Renosterveld types, the significance of fire is reduced, and it does not appear that fire is an important ecosystem driver that may be disrupted by the development. Fire scars in the broader area indicate that occasional fires may be caused by lightning ground-strikes, but their subsequent spread appears to be limited to high-lying areas of dense vegetation along south-facing slopes.
6) In terms of unique and sensitive habitats at the site, a few different potentially sensitive environments are identified.

a) In general, the slopes are more speciose and contained a greater variety of habitat types than the lower lying valleys and mountain ridges and crests, which tend to be more broadly homogenous. The varied aspects as well as microhabitats created by rocky outcrops on the slopes, is likely to be a contributing factor to the higher diversity.

b) There are several wetlands and rivers within the study area which should be avoided by the development as these are important habitats for plants as well as fauna and are especially sensitive to disturbance. Several specific sites have been identified that are at risk from the current layout plan.

c) *Brunsvigia josephinae* which is listed as Vulnerable, is widespread across the project area, from lower lying areas to mid-slope and occasionally on lower mountain tops. It is also found sporadically along riverbanks of watercourses with one notable sub-population found on an upper order tributary of the Groot River. Several small to large sized population of a few hectares was noted to be present in the broader area within or near project component footprints. This species will require relocation where affected by project components, but due to the extensive coverage in the wider project area, it is not anticipated that the project specific impact will be significant to the species as a whole.

d) Several other species of conservation concern were found to be present, as small scattered and localised populations or very few individuals to single individual occasionally noted within the areas surveyed. These include *Indigofera hantamensis, Antimima androsacea, Euryops sulcatus, Antimima loganii, Geissorhiza karooica, Lotononis venosa, Romulea eburnea, Romulea hallii, Romulea syringodeoflora* and *Romulea tortuosa*.

e) Although no quartz patches were observed at the site, several gravel patches and rock pavements are present, particularly along ridges. Although these often look biologically depauperate due to their low plant cover, they frequently contain rare or endemic geophytes and dwarf succulent species and should also not be disturbed. They are also likely to a somewhat unique landscape feature for specific faunal species, including reptiles.

11.2 Faunal Habitat and Communities

Observations made during the walkdown supplemented by previous ecological and biodiversity assessments undertaken on several adjacent G7 WEF projects by Todd (2011, 2014, 2016, 2019) identify the following faunal attributes:

11.2.1 Mammals

At least 50 mammal species potentially occur at the site (Appendix 2). Due to the diversity of habitats available, which includes rocky uplands, densely vegetated kloofs and riparian areas, as well as open plains and low shrublands, the majority of species with a distribution that includes the site are likely to be present in at least part of the site. The mammalian community is therefore relatively rich and due to the remote and inaccessible nature of the area probably has not been highly impacted by human activities. Larger carnivores such as jackal and caracal are persecuted by the local farmers to reduce livestock losses. Nevertheless, discussions with the local farmers indicate that these species appear to remain relatively common in the area. There is likely to be quite a large differentiation in community composition between the lowlands and the uplands of the site. The uplands provide suitable habitat for species which require or prefer rock cover such as Cape Rock Elephant Shrew, *Elephantulus edwardii*, Smith's Red Rock Rabbit, *Pronolagus rupestris*, Namaqua Rock Mouse *Micaelamys namaquensis* and Rock Hyrax, *Procavia capensis*. The lowlands are likely to contain an abundance of species associated with lowland habitats such as deeper soils and floodplain habitats, which includes Brants's Whistling Rat *Parotomys brantsii*, the Bush Vlei Rat *Otomys unisulcatus*, Hairy- footed Gerbil *Gerbillurus paeba* and Common Duiker *Sylvicapra grimmia*. In general, the ungulates present at the site are likely to be fairly widespread. Springbuck are confined by fences and occur only where farmers have introduced them or allowed them to persist and should be considered as part of the farming system rather than as wildlife per se. Both Duiker and Steenbok *Raphicerus campestris,* are adaptable species that can tolerate high levels of human activity and are not likely to be highly sensitive to the disturbance associated with the development. Klipspringer *Oreotragus oreotragus* and Grey Rhebok *Pelea capreolus* are somewhat more specialized in their habitat requirements and make use of the upper slopes of the site. Klipspringer are associated with steep slopes, cliffs and rocky outcrops and may be more vulnerable to impact from the development due to greater overlap between their habitat and the distribution of the wind turbines.

The Riverine Rabbit which is listed as Critically Endangered (IUCN 2010) and is regarded as the most threatened mammal in South Africa is known to occur within the broad area. Populations

of this species occur between Sutherland and Fraserburg to the northeast as well as around Touwsriver to the southwest. Based on the available information, the habitat at the site does not appear to be suitable for this species and there are no known records from the area, indicating that it is highly unlikely that it occurs at the site. Should it occur at the site it would most likely be associated with the alluvial soils and riparian fringe along the major drainage lines that occur in the lowlands of the site which would not be directly impacted by the development which is restricted to the uplands. It is further established that the site is outside of the typical Riverine Rabbit distribution range.

11.2.2 Reptiles

There is a wide range or environments present for reptiles at the site, including rocky uplands and cliffs, open lowlands and densely vegetated riparian areas. As a result, the site has a rich reptile fauna which is potentially composed of 7 tortoise species, 20 snakes, 17 lizards and skinks, two chameleons and 10 geckos. The site falls within the range of the little-known Fisk's House Snake *Lamprophis fiskii* which is listed as Vulnerable and has usually been recorded in karroid sandy areas. This species may therefore occur within the lowlands of the site and as such would probably not be significantly impacted by the development especially given its nocturnal, largely subterranean and secretive nature. Several protected and listed lizard species are likely to occur at the site including the Namaqua Plated Lizard *Gerrhosaurus typicus* (Near Threatened), the Karoo Girdled Lizard *Cordylus polyzonus* (protected) and the Cape Crag Lizard *Pseudocordylus microlepidotus*. Since the Karoo Girdled Lizard and Cape Crag Lizard are associated with rocky outcrops, it is not likely that these species will be directly affected by the development if the turbines are not positioned in areas with steep slopes where such outcrops are likely to be located. The Namaqua Plated Lizard may be more common than believed (Alexander & Marais 2007) and occurs in karroid succulent veld where it digs burrows at the base of shrubs. This species is therefore likely to be restricted to the lowlands of the site which will be little impacted by the development.

Tortoises were relatively abundant at the site and many Angulate Tortoises, *Chersina angulata* were observed as were several Karoo Tent Tortoises, *Psammobates tentorius tentorius*. Tortoises may be negatively impacted by the development as they are vulnerable to collisions with motor vehicles and predation by avian predators while traversing open areas. Attractive species such as tent tortoises are also vulnerable to collection for use as pets or trade, and the increased accessibility resulting from the new roads that will be constructed as part of the development would raise the risk for these species.

Several outcrops will be marginally affected by the turbine layout and construction. Rehabilitation measures should be implemented to reduce the overall effects.

11.2.3 Amphibians

Although there are no perennial rivers at the site, several of the larger drainage lines in the area were observed to contain rocky, sheltered pools that are likely to contain water on a permanent basis. Several wetlands with dense stands of sedges were also observed at the site and are likely to represent important amphibian habitats. Consequently, amphibians which require near-permanent water as well as those adapted to more arid conditions are likely to occur at the site. Nevertheless, only eight frog and toad species are likely to occur at the site, all of which are quite widespread species of low conservation concern. The Karoo Dainty Frog, *Cacosternum karooicum* is listed as Data Deficient reflecting the little-known distribution and ecology of this species. To date, the Karoo Dainty Frog has been recorded from a few scattered locations across the Karoo in the Western and Northern Cape, but it is likely that it occurs more widely across the karoo in general. The site also falls within the distribution of two other regional endemic species, the Cape Sand Frog, *Tomopterna delalandii* and the Raucous Toad, *Amietophrynus rangeri*. The Cape Sand Frog occurs in lowlands and valleys in fynbos and succulent karoo throughout most of the Western Cape and into Namaqualand. The Raucous Toad is more widely distributed and occurs throughout much of South Africa inland and along the east coast into Gauteng and Mpumalanga. There do not therefore appear to be any range-restricted species which occur at the site which would be vulnerable to population-level impacts. In general, the most important areas for amphibians at the site are the riparian areas, seeps and wetlands and the man-made earth dams which occur in the area. As these are widely recognized as sensitive habitats, the development is likely to avoid these areas as far as possible and the potential conflict between amphibians and the development is likely to be low. Amphibians are however extremely sensitive to pollutants and the large amount of construction machinery and materials present at the site during the construction phase would pose a risk to amphibians should any spills occur.

11.2.4 Invertebrates

An aggregating, ground-nesting bee (Hymenoptera) was observed at several places generally associated with lower-lying alluvial deposits. While it is not possible to accurately identify without collected specimens, it has been determined that it possibly within one of six bee families/subfamilies, based on the fact that they were ground-nesting on flat, non-friable soil

with no turrets marking each nest; aggregating in a large population; and some photographed specimens appeared to have pollen on their bodies. These families/subfamilies are Melittidae, Andrenidae, Colletidae, Halictidae, Megachilidae (subfamily Fideliinae) and Apinae (Tribe Anthophorini). Based on the robustness of the bodies, it is more likely that they are Andrenids, Megachilids or in the Apinae, as the other groups mentioned above tend to have slimmer body designs (Owen, 2021). All of these groups are largely data-deficient, and it is thus difficult to find information on population sizes, ranges and conservation statuses. None the less, based on available literature sources, ground-nesting bees are vulnerable to any activities that will till the soil, such as agriculture or construction, or loss of their host plants from which they collect pollen or leaf material for nest provisioning (Owen, 2021). All of these groups are important pollinators, although undervalued because of the general focus on the African Honey Bee as a pollinator. Since the bees are found in populations that are not confined to a single burrow, but occupy numerous burrows in a wider area, making relocation not feasible, together with their important ecological role as pollinators, these populations should be retained where identified, as they were found to be uncommon across the broader project area of influence.

11.3 Bioregional Planning

Since the component projects and area of influence overlaps the Western Cape and Northern Cape boundary, these two regional plans (Western Cape Biodiversity Spatial Plan and Northern Cape Critical Biodiversity Areas) will be briefly considered for contextual purposes. Additional Plans that overlap with the project area include the Namakwa Bioregional Plan and the Succulent Karroo Ecosystem Planning (SKEP) project, which will be briefly incorporated where relevant aspects are identified that are relevant. These regional plans are not specifically relevant to the walkdown and were considered as part of the original ecological assessments undertaken for the project. They are however important to consider in terms of regional planning processes.

With reference to Figure 3, the project area overlaps with Critical Biodiversity Areas (CBA) 1 & 2 and Ecological Support Areas (ESA) designated as per the Western Cape Biodiversity Spatial Plan and Northern Cape Critical Biodiversity Areas. In general terms the CBA 1 area runs from the south-west (connecting with the Tanque Wash Riviere) of the project area through the south-western side towards the east and north, with CBA 2 in the north-east and ESA 1 corresponding with the Tanqua Wash Riviere draining to the north-west of the project area.

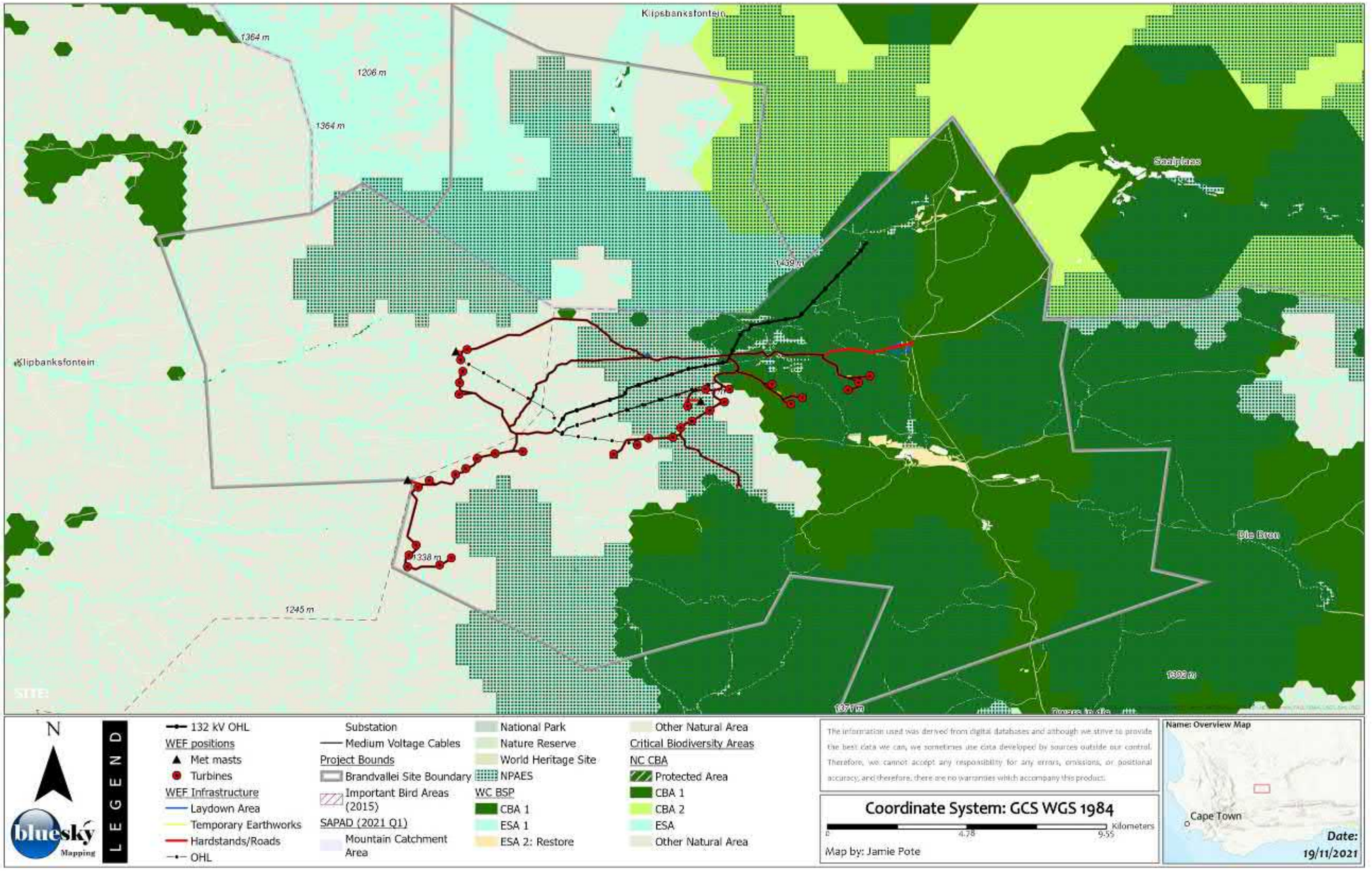


Figure 3: Bioregional Planning (Critical Biodiversity Areas)

12 Walkdown Findings

12.1 Vegetation

Since the original ecological assessments were undertaken for each of the separate wind energy facility projects, this walkdown has been undertaken for the wider project area and thus it has been possible to refine and better understand the vegetation composition and local distribution of flagged species of conservation concern within the greater area of influence. Figure 4 below provides a refinement of the national vegetation map, based on broad level observations during the walkdown.

12.2 Flora

Flora species typical of the vegetation include…

Several Species of Conservation Concern were identified during the initial ecological assessments. In addition, with the inclusion of additional available information and surveying, additional species have been identified. Where these species have been identified as occurring, measures have been taken to try and better understand the species, the broader distribution of the species and local populations within the project site and broader area of influence. A list of flora species of conservation concern that have been identified or recorded or during the walkdown is provided in Table 6 below, with photos and additional information relating to the species and populations from respective databases and walkdown observations is provided in Table 7.

A list of species that are confirmed to be present for which permits will be required in terms of the Western Cape Nature Conservation Laws Amendment Act (Act No 3 of 2000) and the Northern Cape Naure Conservation Act (Act No 9 of 2009) are provided in Appendix 2.

Project : Euronotus

Layout - Sensitivity Overview

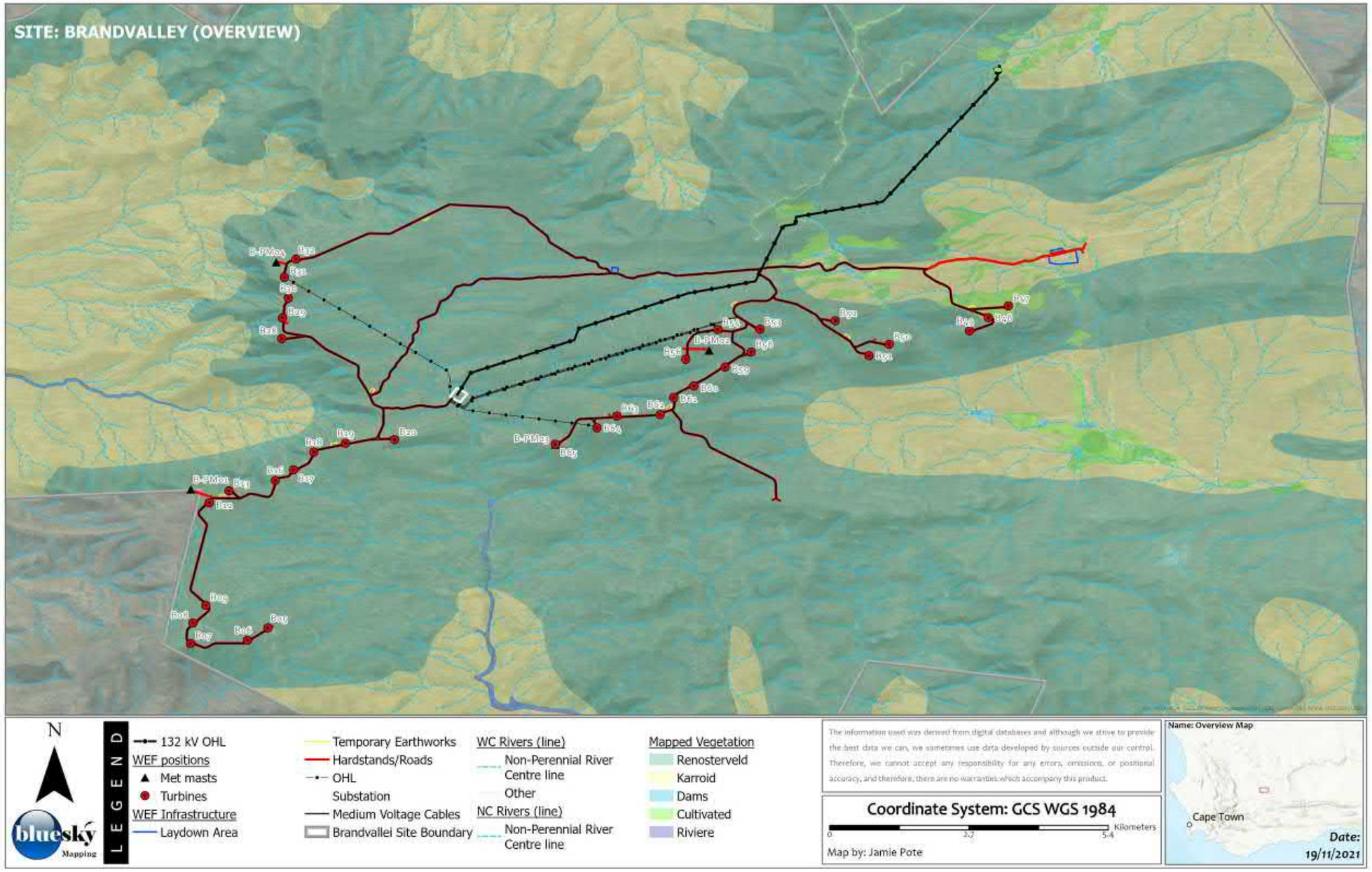


Figure 4: Refined vegetation mapping.

Table 6: Flora species of Conservation Concern confirmed to be present

Scientific Name	Family	IUCN Status*	Description and Distribution
Antimima androsacea	Aizoaceae	Critically Rare	A range-restricted species (EOO 10km²), known from one site where it is not threatened. Sutherland, Roggeveld Escarpment.
Antimima loganii	Aizoaceae	Vulnerable	Poorly known and apparently rare species. Its distribution range is not well known, but occurrence records suggest that it is very small. There is currently one known location, but it is likely an underestimate, as it may be overlooked due to taxonomic uncertainty. It is potentially threatened by overgrazing. Endemic to Roggeveld Escarpment near Sutherland in the Northern Cape.
Brunsvigia josephinae	Amaryllidaceae	Vulnerable	Long-lived bulb occurs as widely scattered subpopulations in lowland areas that are subject to continued habitat loss to. Herbarium specimens record about 18 subpopulations, and an estimated further 70 unrecorded subpopulations may exist. All subpopulations consist of fewer than 50 adult plants and are declining due to collection on an ongoing basis for medicinal purposes. Nieuwoudtville to Baviaanskloof.
Euryops sulcatus	Asteraceae	Vulnerable	Has a restricted range, with an extent of occurrence (EOO) of 1083 km². It has been recorded from five locations, but likely to occur at a few more within unexplored suitable habitat within its range. It continues to decline due to ongoing habitat degradation as a result of drought and overgrazing. Endemic to the Roggeveld and Nuweveld escarpments on the border between the Western and Northern Cape
Geissorhiza karooica	Iridaceae	Near Threatened	A range restricted species, EOO 497 km², known from six locations where it is potentially threatened by habitat loss and degradation as a result of overgrazing and erosion. Known from Roggeveld Mountains to Matjiesfontein.
Indigofera hantamensis	Fabaceae	Rare	A rare species, known from only three subpopulations scattered over a large area. Not threatened. Roggeveld to Calvinia.
Lotononis venosa	Fabaceae	Endangered	An endemic species to the Klein Roggeveld escarpment (extent of occurrence 84km², and area of occupancy 16km²). It is known from four locations. Some of the habitat has been transformed for crop cultivation in the past. Overgrazing by livestock and more frequent and persistent droughts are causing ongoing habitat degradation. Klein Roggeveld Mountains.
Romulea eburnea	Iridaceae	Vulnerable	A rare, localized endemic to the Roggeveld Escarpment, where it is known from two locations and potentially threatened by habitat degradation due to overgrazing. Klein Roggeveld.
Romulea hallii	Iridaceae	Vulnerable	A Roggeveld endemic known from two locations, (EOO 39km²). It is potentially threatened by road maintenance and expansion and livestock overgrazing. Roggeveld Plateau southwest of Sutherland.
Romulea	Iridaceae	Near	A range restricted Roggeveld endemic (EOO

Scientific Name	Family	IUCN Status*	Description and Distribution
syringodeoflora		Threatened	474km²), known from nine location and possibly occurring at a few more in unsurveyed parts of its range. Experiencing ongoing decline of habitat to crop cultivation as well as habitat degradation as a result of livestock overgrazing. Stony shale flats and slopes, Roggeveld Plateau.

* IUCN/SANBI Status

Antimima androsacea

Indigofera hantamensis

Antimima loganii

Lotononis venosa

Geissorhiza karooica

Romulea syringodeoflora

Brunsvigia josephinae

Romulea eburnea

Euryops sulcatus

Romulea hallii

Table 7: Flora species descriptions

Scientific Name	Occurrence within Area of Influence
Antimima androsacea	Large sub-population on north-facing slope as indicated on north side of Brandvalley WEF. Found to be common within the broader area. Population is unlikely to be at risk from irreversible loss on condition relocation is undertaken before commencement, where affected. Unlikely to be significantly affected.
Antimima loganii	Widespread within broader project area, on slopes and ridges, mostly to the west, south-west and north-west. Unlikely to be significantly affected.
Brunsvigia josephinae	Occurs throughout are, several large sub-populations outside of project footprint. Several sub-populations across the broader areas are far larger than the '*fewer than 50 adult plants*' as described in the conservation assessment for the species. Population is unlikely to be at risk from irreversible loss on condition that all affected adults and juveniles are relocated before commencement.
Euryops sulcatus	Scattered, sporadic clumps on slopes and valleys. Appears to be more common in valleys to the west of the Brandvalley but extends eastward onto slopes and hilltops on the north side of the Brandvalley WEF extending through the south-western side of the Rietkloof WEF. Unlikely to be significantly affected.
Geissorhiza karooica	Present, scattered throughout the site in low-lying areas. Unlikely to be significantly affected.
Indigofera hantamensis	Few scattered individuals recorded near Karreebosch powerline. Unlikely to be

Scientific Name	Occurrence within Area of Influence
	significantly affected as on west-facing slopes outside of project footprints.
Lotononis venosa	Possibly recorded on site in original assessment by Todd. Not recorded during walkdown. Unlikely to be significantly affected.
Romulea eburnea	Recorded and common in seep areas and on south-facing slopes. Unlikely to be significantly affected.
Romulea hallii	Scattered on south-facing slopes and peaks. Unlikely to be significantly affected.
Romulea syringodeoflora	Scattered widespread clumps. Unlikely to be significantly affected.

12.3 Fauna

Fauna species of Conservation Concern typical of the vegetation and site include species listed in Table 8.

Table 8: Fauna species

Scientific Name	Family	IUCN Status	Occurrence/Comment
MAMMALS			
Bunolagus monticularis (Riverine Rabbit)	Lagomorpha	CR	**Not Present.** Confined to riparian bush on the narrow alluvial fringe of seasonally dry watercourses in the Central Karoo. Presence highly unlikely. Site is outside of known distribution range.
Felis nigripes (Black-footed cat)	Carnivora	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub. May a be transient species.
REPTILES			
Psammobates tentorius tentorius (Karoo Tent Tortoise)	Testudinidae	NT	Tortoises are highly susceptible to collisions with motor vehicles and trucks on new roads. Found throughout the project area but observed to be more common in lowland areas.
Psammobates tentorius veroxii (Bushmanland Tent Tortoise)	Testudinidae	NT	Tortoises are highly susceptible to collisions with motor vehicles and trucks on new roads. Found throughout the project area but observed to be more common in lowland areas.
AMPHIBIANS			
None of Concern			
INVERTEBRATES			
Aloeides thyra orientis (Red copper)	Lycaenidae	LC	In vicinity of known distribution range of related subspecies (Brenton Blue). No Lycaenidae species observed during walkdown.

12.4 Sensitive Areas and species populations

Sensitive areas are identified either in the original biodiversity assessment and/or observed during the walkdown include the following:

- Rocky Outcrops and Ridges on slopes and mountain peaks;
- Rivers, seeps, wetlands and pans; and
- Sub-populations of flagged species of conservation concern.

A summary of the Sensitive Areas is provided in Table 9 and shown in Figure 5.

Table 9: Sensitive Areas identified in proximity to project infrastructure

Label	Sensitivity	Vegetation	Comment
1	*Indigofera hantamensis*	Karroid	Few individuals of *Indigofera hantamensis* sp. To be avoided.
2	*Brunsvigia josephinae*	Karroid/ Renosterveld	Extensive population of scattered *Brunsvigia josephinae*. Due diligence during any activities.
3	*Brunsvigia josephinae*	Renosterveld	Sub population of dense *Brunsvigia josephinae*. No further loss without relocation.
4	*Brunsvigia josephinae*	Renosterveld	Sub population of dense *Brunsvigia josephinae*. No further loss without relocation.
5	Rocky Garden	Renosterveld	Sensitive rocky habitat. No infrastructure to be placed in vicinity. To be demarcated and signposted as no-go area.
6	*Brunsvigia josephinae*	Renosterveld	Extensive population of scattered *Brunsvigia josephinae*. Due diligence during any activities.
7	Pan (No-Go)	Karroid	No-Go ephemeral pan adjacent to site camp and road at risk from vehicles as a turning point. To be demarcated with fence and signage.
8	Seep (No-Go)	Renosterveld	Intact seep area. No-Go area. Not suitable for pylon placement.
9	Canal (No-Go)	Karroid	Canal traversing proposed site. At risk from flooding during rainfall. Not suitable for Site Camp.
10	*Brunsvigia josephinae*	Renosterveld	Extensive population of scattered *Brunsvigia josephinae*. Due diligence during any activities.
11	*Antimima androsacea* (dense)	Renosterveld	Dense population of Critically Rare species. Due diligence ot be applied working in this area and infrastructure to be kept to minimum. Relocation required where necessary.
12	Seep/Watercourse (No-Go)	Renosterveld	Seep/canal area. At risk from flooding during rainfall. Not suitable for Site Camp.
13	*Brunsvigia josephinae*	Karroid	Moderate density *Brunsvigia josephinae* population. Not suited for proposed Karreebosch powerline.
14	High Biodiversity slope	Karroid	Elevated and rich biodiversity along southernmost slopes. Loss to be kept to minimum.
15	High Biodiversity slope	Karroid	Elevated and rich biodiversity along southernmost slopes. Loss or impacts to be kept to minimum.
16	Aggregating, ground-nesting Bee species	Karroid	Population of unknown aggregating, ground-nesting Bee species. To be avoided, as sensitive to disturbance and bees are critical ecologically as pollinators.
17	Aggregating, ground-nesting Bee species	Karroid	Population of unknown aggregating, ground-nesting Bee species. To be avoided, as sensitive to disturbance and bees are critical ecologically as

Label	Sensitivity	Vegetation	Comment
			pollinators.
18	Watercourse/Seep (No-Go)	Renosterveld	Extensive seep and watercourse area at risk from multiple road crossings. Road to be adjusted to reduce impact.
19	*Brunsvigia josephinae*	Renosterveld/ Karroid	Extensive population of large *Brunsvigia josephinae* associated with watercourse and riparian vegetation. Edge of new road to not extend closer to river than existing access track edge.
20	Watercourse (No-Go)	Karroid	Watercourse next to access track. To be avoided and not used for project access.
21	*Antimima androsacea (*sparse*)*	Renosterveld/ Karroid	Critically Rare species present sporadically. Not specifically at risk from project as generally more common on south facing slopes but small clumps also on summits. Due diligence to be implemented with pre-construction screening and relocation before commencement on footprint within this area.

Project : Euronotus

Layout - Sensitivity Overview

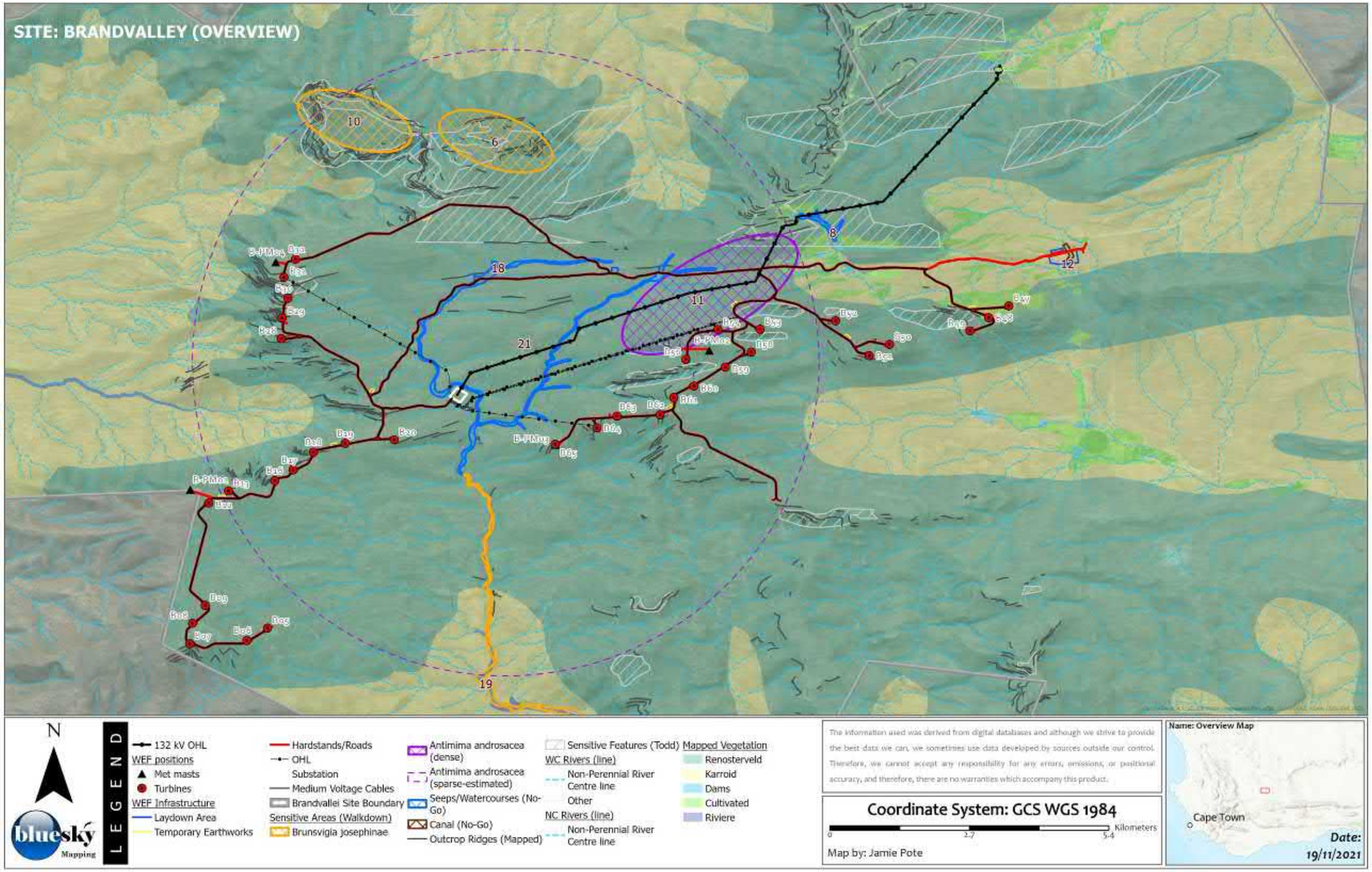


Figure 5: Sensitive and Critical Habitat features identified during walkdown (Overview).

12.4.1 Turbines, Roads and other Infrastructure

A summary analysis of specific infrastructure risks is provided in Table 10 and indicated in Figure 6.

Table 10: Summary of WEF and infrastructure vegetation and sensitivities.

Postiion/ Segmenrt	Vegetation	Species	Comment
1	Renosterveld		
2	Renosterveld		
3	Renosterveld		
4	Renosterveld		
5	Renosterveld		
6	Renosterveld		
7	Renosterveld		
8	Renosterveld		
9	Renosterveld		
12	Renosterveld		
13	Renosterveld		Rocky Outcrop
14	Renosterveld		Rocky Outcrop
15	Renosterveld		
16	Renosterveld		
17	Renosterveld		
18	Renosterveld		
19	Renosterveld		
20	Renosterveld		
24	Renosterveld		Rocky Outcrop
25	Renosterveld		
26	Renosterveld		Rocky Outcrop
28	Renosterveld		Rocky Outcrop
29	Renosterveld		Rocky Outcrop
30	Renosterveld		
31	Renosterveld		
32	Renosterveld		
34	Renosterveld		
35	Renosterveld		
37	Renosterveld	*Brunsvigia josephinae*	
40	Renosterveld	*Brunsvigia josephinae*	
41	Renosterveld	*Brunsvigia josephinae*	
44	Renosterveld	*Brunsvigia josephinae*	
45	Renosterveld	*Brunsvigia josephinae*	
46	Renosterveld	*Brunsvigia josephinae*	
47	Renosterveld		
48	Renosterveld		
49	Renosterveld		Rocky Outcrop
50	Renosterveld		
51	Renosterveld		
52	Renosterveld		
53	Renosterveld		
54	Renosterveld		
55	Renosterveld	*Antimima androsacea*	Site over cell phone mast
56	Renosterveld		
57	Renosterveld		

Postiion/ Segmenrt	Vegetation	Species	Comment
58	Renosterveld		
59	Renosterveld		
60	Renosterveld		
61	Renosterveld		
62	Renosterveld		
63	Renosterveld		
64	Renosterveld		
65	Renosterveld		Rocky Outcrop
66	Renosterveld		
67	Renosterveld		
68	Renosterveld		
69	Renosterveld		
70	Renosterveld		
Site Camp	Renosterveld		Canal traverses proposed site camp (12). Not suitable as it may be prone to seasonal flooding.
Substation	Renosterveld		
Powerline			Central (east-west) portion traverses seep area (8), with pylons in seep. Should be realigned. Passes through species area (11), due care to be taken during construction within minimal pylons.
Northern Access Road	Renosterveld		Access road passes through and along seep area (18) multiple times. Access road should be realigned.
Southern Access Road	Karroid/ Renosterveld		
Central North-South Access Road	Renosterveld		Access road passes through and along seep area (18) multiple times and along watercourse with large *Brunsvigia josephinae* population (19). Access road should be aligned as far from watercourse as possible and should not extend closer to watercourse than inner side of existing access track.
WTG 1-9	Renosterveld		
WTG 12-20	Renosterveld		
WTG 24-32	Renosterveld		
WTG 34-46	Renosterveld		Scattered *Brunsvigia josephinae* sub-population (6, 10), will require search and rescue.
WTG 47-49	Renosterveld		
WTG 50-52	Renosterveld		
WTG 53-57	Renosterveld		
WTG 58-65	Renosterveld		
WTG 66-70	Renosterveld		

Project : Euronotus

Layout - Sensitivity Overview

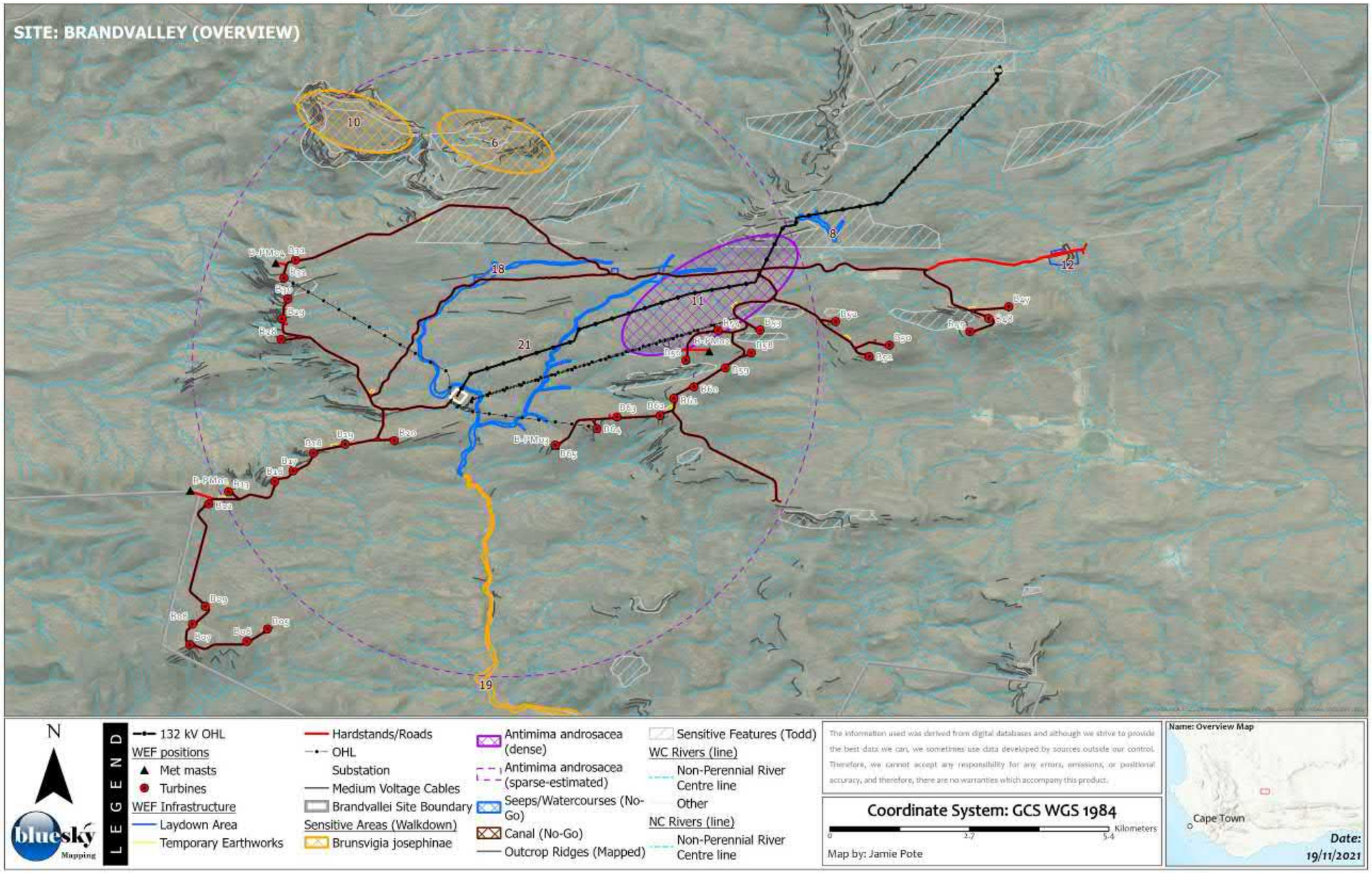


Figure 6: Sensitive Areas identified and WEF infrastructure.

13 Walkdown Conclusions and Recommendations

The following general recommendations are made based on the findings of the walkdown, with reference to Table 10 and Figure 6:

- Turbines 13, 28, 29, 49 & 65 are located adjacent to outcrops. The outcrops should be avoided as far as possibly during final surveying and pegging out.
- Central (east-west) portion of the overhead powerline traverses a seep area (8), where pylons would be required in the seep. This section must be realigned to avoid intrusion into or near the seep (remain 50 away from the seep).
- The overhead powerline also passes through an area having a high density of *Antimima androsacea* (11), due care to be taken during construction to avoid impact to this species.
- A water transfer canal traverses proposed site camp (12) and as such the site camp may be prone to seasonal flooding.
- The north-western access road passes multiple times through and directly adjacent to an extensive and well-defined watercourse with seep areas (18). The access road should be realigned to minimise impact to watercourse and in shall not traverse seep areas.
- The western access road passes through and along a well-defined watercourse with large *Brunsvigia josephinae* population (19) present within the riparian vegetation and directly adjacent to the watercourse. The access road should be aligned as far from watercourse as possible and should not extend closer to watercourse than inner side of the existing access track.
- *The species Antimima androsacea* was found to occur at low densities throughout a broader area as indicated (21)

The following specific recommendations should be included in any updated EMPr for the project.

- A flora and fauna search and rescue (relocation) must be undertaken before commencement of vegetation clearing and should preferable be undertaken in the Spring season. A comprehensive list of species for which permits will be required, is provided in Appendix 1: Plant Species of Conservation Concern (Red listed) and Appendix 2: Flora Protected in Terms of Provincial Acts and Ordinance(s).

- Several turbine footprints are identified that overlap slightly with outcrops. Where possible, minor layout adjustments should be implemented during final surveying and pegging out to avoid such areas as far as possible.
- Where there are further changes/updates to the vertical and horizontal alignments of the road network and site laydown area, such sections/areas must be reassessed in order to determine any further risks and impacts to the ecology and/or species.

14 References

General Reference Sources

- Acocks, J. P. H. 1988. *Veld Types of South Africa*. Memoirs of the Botanical Survey of South Africa, No 57. Botanical Research Institute, Department of Agriculture and Water Supply, South Africa.
- Atlas and Red List of the Reptiles of South Africa, Lesotho, and Swaziland. 2014. Edited by Michael F. Bates, William R. Branch, Aaron M. Bauer, Marius Burger, Johan Marais, Graham J. Alexander & Marienne S. de Villiers. SANBI, Pretoria.
- Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & Marienne S. de Villiers. (Eds). 2014. *Atlas and Red List of the Reptiles of South Africa, Lesotho, and Swaziland.* SANBI, Pretoria.
- Brauneder KM, Montes C, Blyth S, Bennun L, Butchart SH, Hoffmann M, Burgess ND, Cuttelod A, Jones MI, Kapos V, Pilgrim J, Tolley MJ, Underwood EC, Weatherdon LV, Brooks SE, 2018. *Global screening for Critical Habitat in the terrestrial realm*. PloS one, 13(3), p.e0193102. doi:10.1371/journal.pone.0193102
- Bromilow, C. 2001. *Problem Plants of South Africa*. A Guide to the Identification and Control of More than 300 Invasive Plants and Other Weeds. Briza Publications. Pp 258
- Child M.F., Roxburgh L., Do Linh San E., Raimondo D., Davies-Mostert H.T. 2016. *The Red List of Mammals of South Africa, Swaziland, and Lesotho.* South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
- Council for Scientific and Industrial Research. NFEPA river FEPAs 2011 [vector geospatial dataset] 2011. Available from the Biodiversity GIS website, downloaded on 20 July 2020.
- Council for Scientific and Industrial Research. NFEPA rivers 2011 [vector geospatial dataset] 2011. Available from the Biodiversity GIS website, downloaded on 20 July 2020.
- Council for Scientific and Industrial Research. NFEPA wetland clusters 2011 [vector geospatial dataset] 2011. Available from the Biodiversity GIS website, downloaded on 20 July 2020.
- Council for Scientific and Industrial Research. NFEPA wetlands vegetation 2011 [vector geospatial dataset] 2011. Available from the Biodiversity GIS website, downloaded on 20 July 2020.
- Cowling, R.M., Richardson, D.M. & Pierce, S.M. 1997. Vegetation of Southern Africa. Cambridge University Press.
- Driver, A., Sink, K.J., Nel, J.L., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. *National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis report*. South Africa National Biodiversity Institute and Department of Environmental Affairs, Pretoria.
- Esler, K.J., Milton, S.J. & Dean, W.R.J. 2006. Karroo Veld: Ecology and Management. Briza Publications.
- Fuggle, R. F. & Rabie, M. A. 2003. *Environmental Management in South Africa*. Juta & Co, Johannesburg.
- Germishuizen, G. & Meyer, N.L. (eds). 2003. *Plants of southern Africa: An annotated checklist*. Strelitzia, 14. Pretoria: National Botanical Institute.
- Golding, J. (Ed.) 2002. *Southern African Plant Red Data Lists*. Southern African Botanical Diversity Network Report No 14.
- Henderson, L. 2001. *Alien Weeds and Invasive Plants*. Plant Protection Research Institute Handbook No 12. Agricultural Research Council. Pp 300.
- Hilton-Taylor, C. 1996. *Red Data List of Southern African Plants*. National Botanical Institute.
- Hockey PAR, Dean WRJ and Ryan PG 2005. Roberts - Birds of southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.
- International Finance Corporation. 2012. Performance Standards on Environmental and Social Sustainability.
- International Finance Corporation. 2012. Performance Standards on Environmental and Social Sustainability.
- Low, A.B. & Rebelo, A.G. 1998. *Vegetation of South Africa, Lesotho, and Swaziland*. Pretoria: Department of Environmental Affairs and Tourism.
- M.F. Bate, W.R. Branch, A.M. Bauer, M. Burger, J. Marias, G.J. Alexander and M.S. de Villiers (eds), *Atlas and Red List of Reptiles of South Africa, Lesothos and Swaziland*. Suricata 1. South African National Biodiversity Institute, Pretoria.
- Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. *Important Bird and Biodiversity Areas of South Africa*. Johannesburg: BirdLife South Africa.
- Martin CS, Tolley MJ, Farmer E, Mcowen CJ, Geffert JL, Scharlemann JPW, Thomas H, van Bochove JH, Stanwell-Smith D, Hutton JM, Lascelles B, Pilgrim JD, Ekstrom JMM, Tittensor DP, 2015. *A global map to aid the identification and screening of Critical Habitat for marine industries*. Marine Policy 53: 45-53. doi:10.1016/j.marpol.2014.11.007 .
- Mecenero, S., Ball, J.B., Edge, D.A., Hamer, M.L., Hening, G.A., Krüger, M., Pringle, R.L., Terblanche, R.F. & Williams, M.C. (Eds). 2013. *Conservation assessment of butterflies of South Africa, Lesotho, and Swaziland:* Red List and atlas. Saftronics (Pty) Ltd., Johannesburg and Animal Demography Unit, Cape Town.

- Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (Eds). 2004. *Atlas and Red Data book of the frogs of South Africa, Lesotho, and Swaziland.* SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.
- Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho, and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.
- Mucina, L. & Rutherford, M.C. (Eds). 2006. *The vegetation of South Africa, Lesotho, and Swaziland*, in Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- Myers, N., Mittermeir, R.A., Mittermeir, C.G., De Fonseca, G.A.B. & Kent, J. 2000. *Biodiversity hotspots for conservation priorities*. Nature, 403: 853–858.
- Nel, J., Colvin, C., Le Maitre, D., Smith, J., Haines, I. 2013. Defining South Africa's Water Source Areas. WWF South Africa & Council for Scientific & Industrial Research (CSIR).
- Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., van Deventer, H., Funke, N., Swart, E.R., Smith-Ado, L.B., Mbona, N., Downsborough, L. & Nienaber, S. 2011. *Technical Report for the National Freshwater Ecosystem Priority Areas project.* Report to the Water Research Commission, WRC Report No. 1801/2/11. ISBN 978-1-4312-0149-5.
- Pienaar, K. 2000. *The South African What Flower is That*? Struik Publishers (Pty) Ltd. Cape Town.
- Powrie, L.W. 2013. A database of biodiversity taxon names in South Africa for copy-and-paste into reports or documents. South African National Biodiversity Institute, Cape Town. Obtained from SANBI on 20 July 2020.
- Powrie, L.W. 2013. A list of South African biodiversity terms and common names for spell checking. South African National Biodiversity Institute, Cape Town. Downloaded from www.sanbi.org on 20 July 2020.
- Powrie, L.W. 2013. A list of South African botanical names for spell checking. South African National Biodiversity Institute, Cape Town. Downloaded from www.sanbi.org on 18 July 2020.
- Powrie, L.W. 2013. A list of South African physical feature names for spell checking. South African National Biodiversity Institute, Cape Town. Downloaded from www.sanbi.org on 20 July 2020.
- Powrie, L.W. 2013. A list of South African zoological and other (including fungi and lichen) names for spell checking. South African National Biodiversity Institute, Cape Town. Downloaded from www.sanbi.org on 20 July 2020.
- Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004. *South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component.* Pretoria: South African National Biodiversity Institute.
- Samways, M.J. & Simaika, J.P. 2016. *Manual of Freshwater Assessment for South Africa: Dragonfly Biotic Index.* Suricata 2. South African National Biodiversity Institute, Pretoria.
- Samways, M.J. & Simaika, J.P. 2016. Manual of Freshwater Assessment for South Africa: Dragonfly Biotic Index. Suricata 2. South African National Biodiversity Institute, Pretoria.
- Skowno, A.L., Raimondo, D.C., Poole, C.J., Fizzotti, B. & Slingsby, J.A. (Eds.). 2019. *South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm*. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.
- Snyman-Van der Walt, L. 2019. Strategic Environmental Assessment for the Expansion of Electricity Grid Infrastructure in South Africa: Nama Karoo, Succulent Karoo and Desert Biomes. Council for Scientific and Industrial Research (CSIR).
- South African National Biodiversity Institute (SANBI). 2019. *National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report.* South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria. pp. 1–214.
- Stirton, C. H. 1987. *Plant Invaders: Beautiful, but Dangerous*. The Department of Nature and Environmental Conservation of the Cape Province Administration. Galvin and Sales, Cape Town.
- Taylor, M.R., Peacock, F., and Wanless, R.M. 2015. Eskom Red Data Book of Birds of South Africa, Lesotho, and Swaziland.
- Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L. 1999. *Coordinated waterbird Counts in South Africa, 1992-1997.* Avian Demography Unit, Cape Town.
- The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.
- Turpie, J.K., Wilson, G. & Van Niekerk, L. 2012. *National Biodiversity Assessment 2011: National Estuary Biodiversity Plan for South Africa*. Anchor Environmental Consulting, Cape Town. Report produced for the Council for Scientific and Industrial Research and the South African National Biodiversity Institute.
- UN Natural Value Initiative. 2009. *The Ecosystem Services Benchmark,* 2009.
- Van Wyk, A.E. & Smith, G.F. 2001. *Regions of Floristic Endemism*: A Review with Emphasis on Succulents, Umdaus Press.

- Vromans, D.C., Maree, K.S., Holness, S.D. and Skowno, A.L. 2012. The Biodiversity Sector Plan for the Blue Crane Route Municipality. Supporting land-use planning and decision-making in Critical Biodiversity Areas and Ecological Support Areas for sustainable development. Addo Elephant National Park Mainstreaming Biodiversity Project. South African National Parks. Port Elizabeth. South Africa.
- Water Research Commission. *2017 Surface and Groundwater SWSA* [Vector] 2017. Available from the Biodiversity GIS website, downloaded on 25 January 2021.
- Water Research Commission. *2017 SWSA Surface water* [Vector] 2017. Available from the Biodiversity GIS website, downloaded on 25 January 2021.
- Weather Bureau. 1988. Climate of South Africa – Climate statistics up to 1984 (WB40). Government Printer, Pretoria.
- Weather Bureau. 1988. Climate of South Africa – Climate statistics up to 1984 (WB40). Government Printer, Pretoria.
- Young, D.J., Harrison, J.A, Navarro, R.A., Anderson, M.A., & Colahan, B.D. (Eds). 2003. *Big birds on farms: Mazda CAR Report 1993-2001.* Avian Demography Unit: Cape Town.

Western and Northern Cape

- Desmet, P. & Marsh A. 2008. *Namakwa District Biodiversity Sector Plan*. Available from BGIS at http://bgis.sanbi.org/namakwa/project.asp.
- Driver, A., Desmet, P. G., Rouget, M., Cowling, R. M., & Maze, K. 2003. *Succulent Karoo Ecosystem Plan: biodiversity component technical report*. Cape Conservation Unit Report No. CCU, 1(03).
- Driver, A., Sink, K.J., Nel, J.L., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. *National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis report*. South Africa National Biodiversity Institute and Department of Environmental Affairs, Pretoria.
- Esler, K.J., Milton, S.J. & Dean, W.R.J. 2006. Karroo Veld: Ecology and Management. Briza Publications.
- Fynbos Forum, 2016. Ecosystem Guidelines for Environmental Assessment in the Western Cape, Edition 2.
- Grobler, A., Vlok, J., Cowling, R, van der Merwe, S., Skowno, A.L., Dayaram, A. 2018. Technical Report: Integration of the Subtropical Thicket Ecosystem Project (STEP) vegetation types into the VEGMAP national vegetation map 2018.
- Hilton-Taylor, C. 1994. *Western Cape Domain (Succulent Karoo)*. In Davis, S.D., Heywood, V.H. & Hamilton, A.C. (eds), Centres of plant diversity: A guide and strategy for their conservation, 1. Cambridge: IUCN Publications Unit. pp. 201–203.
- Holness, S. & Oosthuisen, E. 2019. *Critical Biodiversity Areas of the Northern Cape: Technical Report.* Department Environment & Nature Conservation., Northern Cape Province.
- Northern Cape Department of Environment and Nature Conservation. Archived Namakwa District Terrestrial CBAs 2008.
- Pool-Stanvliet, R., Duffell-Canham, A., Pence, G. & Smart, R. 2017. *The Western Cape Biodiversity Spatial Plan Handbook.* Stellenbosch: CapeNature.
- Van Der Merwe, H. 2009. Patterns of plant diversity in the Hantam-Tanqua-Roggeveld Subregion of the Succulent Karoo, South Africa. Department of Plant Science, University of Pretoria.
- Van der Merwe, H., Van Rooyen, M.W. & Van Rooyen, N. 2008. *Vegetation of the Hantam-Tanqua-Roggeveld subregion, South Africa. Part 2. Succulent Karoo Biome* related vegetation. Koedoe 50 (1), 160-183.
- Van der Merwe, H., Van Rooyen, M.W. & Van Rooyen, N. 2008. Vegetation of the Hantam-Tanqua-Roggeveld subregion, South Africa. Part 1. Fynbos Biome related vegetation. Koedoe 50 (1), 61-71.
- Van Der Merwe, H., Van Rooyen, M.W. 2011. Vegetation trends following fire in the Roggeveld, Mountain Renosterveld, South Africa. South African Journal of Botany 77 (2011) 127–136.
- Vlok, J.H.J. and Euston-Brown, D.I.W. 2002. The patterns within, and the ecological processes that sustain, the Subtropical Thicket vegetation in the planning domain for the Subtropical Thicket Ecosystem Planning (STEP) Project. Terrestrial Ecology Research Unit. Report 40. University of Port Elizabeth, Port Elizabeth.
- Vlok, J.H.J., Euston-Brown, D.I.W., Cowling, R.M., 2003. Acocks' Valley Bushveld 50 years on: New perspectives on the delimitation, characterisation and origin of subtropical thicket vegetation. South African J. Bot. 69, 27–51.

Web Databases and Sources

- Animal Demographic Unit: http://vmus.adu.org.za
- Conservation International: http://www.biodiversityhotspots.org

- Fitzpatrick Institute of African Ornithology (2020). MammalMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=MammalMAP on 2020-12-12.
- Fitzpatrick Institute of African Ornithology (2020). OrchidMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=OrchidMAP on 2020-12-12.
- Fitzpatrick Institute of African Ornithology (2020). PHOWN Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=PHOWN on 2020-12-12.
- FitzPatrick Institute of African Ornithology (2020). ScorpionMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=ScorpionMAP on 2020-12-12.
- Fitzpatrick Institute of African Ornithology (2020). SpiderMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=SpiderMAP on 2020-12-12.
- Global Biodiversity Information Facility (GBIF): http://gbif.org
- International Union for Conservation of Nature (IUCN) Redlist: http://iucnredlist.org
- IPIECA, https://www.ipieca.org/
- Millennium Ecosystem Assessment (MEA). 2005: https://www.millenniumassessment.org
- National Sustainable Development Strategies (NSDS): https://sdgs.un.org/topics/national-sustainable-development-strategies
- Plants of Southern Africa: http://newposa.sanbi.org
- South African National Biodiversity Institute (SANBI) Redlist: http://redlist.sanbi.org
- South African Bird Atlas Project: http://sabap2.birdmap.africa
- The South African Bat Assessment Association (SABAA): http://www.sabaa.org.za/
- United Nations Environment Programme (UNEP), *A to Z Areas of Biodiversity Importance:* http://www.biodiversitya-z.org
- d Nations Environment Programme (UNEP)-WCMC (2017) *Global Critical Habitat screening layer (Version 1.0)*. Cambridge (UK): UN Environment World Conservation Monitoring Centre. http://data.unep-wcmc.org/datasets/44.
- United Nations Environment Programme (UNEP), *World Database on Protected Areas*, Protected Planet: http://www.protectedplanet.net
- World Resources Institute (WRI): https://www.wri.org

Previous Project Reports

- Owen, C. 2021. *An aggregating, ground nesting Roggeveld bee (Hymenoptera)*. A short report compiled for Trusted Partners. 29 September 2021.
- Todd, S. 2011. *Terrestrial Vertebrate Fauna & Botanical Specialist Study: EIA for the proposed Roggeveld Wind Farm*. Report compiled for Environmental Resource Management Southern Africa (Pty) Ltd.
- Todd, S. 2014. *Fauna & Flora Specialist Report for EIA: EIA for the proposed Karreebosch WEF and associated grid connection infrastructure*. Report compiled for Savannah Environmental (Pty) Ltd.
- Todd, S. 2016. *Fauna & Flora Specialist Report for EIA: EIA for the proposed Brandvallei 132 kV OHL and substation*. Report compiled for Savannah Environmental (Pty) Ltd.
- Todd, S. 2016. *Fauna & Flora Specialist Report for EIA: EIA for the proposed Brandvallei WEF*. Report compiled for Savannah Environmental (Pty) Ltd.
- Todd, S. 2016. *Fauna & Flora Specialist Report: EIA for the proposed Rietkloof 132 kV OHL and substation*. Report compiled for Savannah Environmental (Pty) Ltd.
- Todd, S. 2016. *Fauna & Flora Specialist Report: EIA for the proposed Rietkloof WEF*. Report compiled for Savannah Environmental (Pty) Ltd.
- Todd, S. 2019. *Fauna & Flora Specialist Report and Conservation Management Plan:* EIA for the proposed Rietkloof WEF. Report compiled for Savannah Environmental (Pty) Ltd.
- Trusted Partners. 2020. *IFC Performance standard 6: Critical Habitat & Biodiversity Assessment for the Roggeveld Wind Energy Project*. Report compiled for Roggeveld Wind Power (RF) (Pty) Ltd.

15 Appendix 1: Plant Species of Conservation Concern (Red listed)

Species include those having elevated conservation status or identified as being having a distribution range overlapping or in proximity to the site. The list includes species from various online database sources that were also screened for possible occurrence, as well as data from original ecological assessments (Todd, 2011, 2014, 2016, 2019) have been included and verified for any recent name and status changes. Species that were previously noted, but now confirmed to either not having overlapping distribution ranges (due to improved databases and distribution records), or have not been recorded, are included for clarification.

The IUCN Red List Categories define the extinction risk of species assessed. Nine categories extend from NE (Not Evaluated) to EX (Extinct). Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) species are considered to be threatened with extinction. Additional non-IUCN status categories include Rare and Critically Rare, as determined by SANBI as possibly under threat, but not yet evaluated in terms of the IUCN criteria and categories.

Permits for the identified species would be required either in terms of the respective Provincial legislation and/or under the NEMBA Threatened of Protected Species (ToPS).

Highlighted species confirmed to be present.

Scientific Name	Family	Status*	Comment
Plants			
Acmadenia argillophila	Rutaceae	NT	Not recorded, found to the south in the Swartberg.
Adromischus mammillaris	Crassulaceae	EN, NC	Not recorded, known locations in Calitzdorp area
Adromischus phillipsiae	Crassulaceae	Rare, NC	Not recorded. NEST projected. Roggeveld Mountains to Kamiesberg. Sheltered rock crevices in loam soil.
Agathosma acocksii	Rutaceae	VU, NC	Not recorded. NEST projected. Witberg to the south, outside of project area in Fynbos.
Aloidendron dichotomum	Asphodelaceae	VU, WC, NC	Not recorded
Aloinopsis loganii	Aizoaceae	VU, WC, NC	Not recorded
Amphithalea spinosa	Fabaceae	VU	Not recorded. NEST projected, known locations to the south in the Hex River Valley/ Witteberg area

Scientific Name	Family	Status*	Comment
Amphithalea villosa	Fabaceae	NT	Not recorded
Anisodontea procumbens	Malvaceae	Rare	Not recorded. NEST projected
Antimima androsacea	Aizoaceae	CR Rare, WC, NC	A range-restricted species (EOO 10km²), known from one site where it is not threatened. Sutherland, Roggeveld Escarpment.
Antimima emarcescens	Aizoaceae	VU, WC, NC	Not recorded. NEST projected
Antimima hamatilis	Aizoaceae	VU, WC, NC	Not recorded, known locations to the south in the Robertson/Worcester area
Antimima loganii	Aizoaceae	VU, WC, NC	Poorly known and apparently rare species. Its distribution range is not well known, but occurrence records suggest that it is very small. There is currently one known location, but it is likely an underestimate, as it may be overlooked due to taxonomic uncertainty. It is potentially threatened by overgrazing. Endemic to Roggeveld Escarpment near Sutherland in the Northern Cape.
Antithrixia flavicoma	Asteraceae	VU	Not recorded. Outside of range (Namaqualand).
Aspalathus candicans	Fabaceae	EN	Not recorded, known locations in Worcester area to the south-west
Aspalathus intricata subsp. anthospermoides	Fabaceae	Rare, NC	Not recorded. NEST projected
Aspalathus intricata subsp. intricata	Fabaceae	Rare, NC	Not recorded. NEST projected
Aspalathus intricata subsp. oxyclada	Fabaceae	Rare, NC	Not recorded. NEST projected
Asparagus mollis	Asparagaceae	VU	Not recorded. NEST projected
Astroloba herrei	Asphodelaceae	VU, WC, NC	Not recorded. NEST projected, known locations to the south in the Swartberg mountains around Matjiesfontein & Prince Albert
Babiana sambucina	Iridaceae	EN, WC, NC	Not recorded.
Babiana cuneata	Iridaceae	*LC, WC, NC*	Present on site
Braunsia stayneri	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Brunsvigia josephinae	Amaryllidaceae	VU, WC, NC	Long-lived bulb occurs as widely scattered subpopulations in lowland areas that are subject to continued habitat loss to. Herbarium specimens record about 18 subpopulations, and an estimated further 70 unrecorded subpopulations may exist. All subpopulations consist of fewer than 50 adult plants and are declining due to collection on an ongoing basis for medicinal purposes. Nieuwoudtville to Baviaanskloof.
Bulbine torta	Asphodelaceae	Rare, WC, NC	Not recorded
Calamophyllum teretiusculum	Aizoaceae	DDT, WC, NC	Not recorded. Karoo Endemic, taxonomically problematic.
Calobota elongata	Fabaceae	VU	Not recorded
Cineraria lobata subsp. lasiocaulis	Asteraceae	Rare	Not recorded. NEST projected

Scientific Name	Family	Status*	Comment
Cleretum booysenii	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Cliffortia arborea	Rosaceae	VU	Not recorded. NEST projected
Crassula alpestris subsp. massonii	Crassulaceae	Rare, NC	Not recorded
Crassula brachystachya	Crassulaceae	Rare, NC	Not recorded
Crassula congesta subsp. laticephala	Crassulaceae	Rare, NC	Not recorded
Crassula dodii	Crassulaceae	DD, NC	Not recorded. Roggeveld-Hantam endemic, Known from general area. Widespread.
Crassula roggeveldii	Crassulaceae	Rare, NC	Not recorded
Crassula vestita	Crassulaceae	Rare, NC	Not recorded
Cromidon hamulosum	Scrophulariaceae	DD	Not recorded. Roggeveld-Hantam endemic, Known from general area. Widespread.
Delosperma sphalmanthoides	Aizoaceae	VU, WC, NC	Not recorded. NEST projected
Didymaotus lapidiformis	Aizoaceae	VU, WC, NC	Not recorded, known locations generally to the south-west in Tanqua karoo and Wash Riviere.
Drosanthemum comptonii	Aizoaceae	DDT, WC, NC	Not recorded. Karoo Endemic, taxonomically problematic.
Drosanthemum worcesterense	Aizoaceae	EN, WC, NC	Not recorded. NEST projected
Duvalia parviflora	Apocynaceae	VU, NC	Not recorded, known locations in the south around Ladismith & Oudshoorn
Erica glandulipila	Ericaceae	Rare, WC, NC	Not recorded. NEST projected
Eriocephalus grandiflorus	Asteraceae	Rare	Not recorded. Present in area
Eriocephalus microphyllus var. carnosus	Asteraceae	EN	Not recorded. NEST projected
Eriospermum exile	Ruscaceae	Rare	Not recorded
Euryops marlothii	Asteraceae	Rare	Not recorded
Euryops namaquensis	Asteraceae	VU	Not recorded. Outside of range (Namaqualand/ Knersvlakte) quarts patches.
Euryops sulcatus	Asteraceae	VU	Has a restricted range, with an extent of occurrence (EOO) of 1083 km². It has been recorded from five locations, but likely to occur at a few more within unexplored suitable habitat within its range. It continues to decline due to ongoing habitat degradation as a result of drought and overgrazing. Endemic to the Roggeveld and Nuweveld escarpments on the border between the Western and Northern Cape
Gasteria disticha	Asphodelaceae	CR, WC, NC	Not recorded, known locations in Worcester area to the south-west
Geissorhiza karooica	Iridaceae	NT, WC, NC	A range restricted species, EOO 497 km², known from six locations where it is potentially threatened by habitat loss and degradation as a result of overgrazing and erosion. Known from Roggeveld Mountains to Matjiesfontein.
Geissorhiza spiralis	Iridaceae	VU, WC, NC	Not recorded. NEST projected
Globulariopsis wittebergensis	Scrophulariaceae	Rare	Not recorded. NEST projected

Scientific Name	Family	Status*	Comment
Gnidia cyanea	Thymelaeaceae	Rare	Not recorded. NEST projected
Haemanthus tristis	Amaryllidaceae	VU, WC, NC	Not recorded
Haworthia lockwoodii	Asphodelaceae	VU, WC, NC	Not recorded
Haworthia mirabilis	Asphodelaceae	DDT, WC, NC	Not recorded, found to the west near Nieuwoudtville
Haworthia wittebergensis	Asphodelaceae	Rare, WC, NC	Not recorded. NEST projected
Helictotrichon barbatum	Poaceae	VU	Not recorded. NEST projected
Helictotrichon namaquense	Poaceae	VU	Not recorded. NEST projected
Helictotrichon roggeveldense	Poaceae	EN	Not recorded. NEST projected
Heliophila elata	Brassicaceae	VU	Not recorded
Hermannia pillansii	Malvaceae	CR Rare	Not recorded. NEST projected
Hesperantha flava	Iridaceae	Rare, WC, NC	Not recorded. Present in area
Hesperantha glabrescens	Iridaceae	Rare, WC, NC	Not recorded. NEST projected
Hoodia pilifera	Apocynaceae	NT, NC	Not recorded
Hypodiscus sulcatus	Restionaceae	VU, WC, NC	Not recorded, known locations in the south around Laingsburg/Touwsrivier (Matjiesfontein Shale Renosterveld)
Indigofera hantamensis	Fabaceae	Rare	A rare species, known from only three subpopulations scattered over a large area. Not threatened. Roggeveld to Calvinia.
Ixia mollis	Iridaceae	VU, WC, NC	Not recorded
Ixia oxalidiflora	Iridaceae	VU, WC, NC	Not recorded. Present in area
Ixia parva	Iridaceae	VU, WC, NC	Not recorded. NEST projected
Ixia rivulicola	Iridaceae	VU, WC, NC	Not recorded. NEST projected
Lachenalia congesta	Hyacinthaceae	VU, WC, NC	Not recorded
Lachenalia longituba	Hyacinthaceae	VU, WC, NC	Not recorded
Lachenalia martinae	Hyacinthaceae	VU, WC, NC	Not recorded
Lachenalia whitehillensis	Hyacinthaceae	NT, WC, NC	Not recorded
Lampranthus amoenus	Aizoaceae	EN, WC, NC	Not recorded, known locations in the Cape Flats to the south-west
Leobordea globulosa	Fabaceae	VU	Not recorded. NEST projected
Leucadendron cadens	Proteaceae	Rare, WC, NC	Not recorded
Leucadendron sp. nov. (Acocks 23716 NBG)	Proteaceae	CR EN, WC, NC	Not recorded. NEST projected
Lotononis comptonii	Fabaceae	EN	Not recorded, known locations to the south in the Swartberg
Lotononis densa subsp. congesta	Fabaceae	VU	Not recorded, known locations to the west (Piketberg)
Lotononis gracilifolia	Fabaceae	EN	Not recorded, known locations to the south in the Laingsburg/Worcester area
Lotononis venosa	Fabaceae	EN	An endemic species to the Klein Roggeveld escarpment (extent of occurrence 84km², and area of

Scientific Name	Family	Status*	Comment
			occupancy 16km²). It is known from four locations. Some of the habitat has been transformed for crop cultivation in the past. Overgrazing by livestock and more frequent and persistent droughts are causing ongoing habitat degradation. Klein Roggeveld Mountains.
Moraea aspera	Iridaceae	VU, WC, NC	Not recorded. Outside of range (Hantam).
Moraea contorta	Iridaceae	Rare, WC, NC	Not recorded
Moraea fenestrata	Iridaceae	NT, WC, NC	Not recorded
Moraea tanquana	Iridaceae	Rare, WC, NC	Not recorded
Moraea virgata subsp. karooica	Iridaceae	Rare, WC, NC	Not recorded
Muraltia karroica	Polygalaceae	VU	Not recorded, found to the south in the Swartberg.
Nenax velutina	Rubiaceae	Rare	Not recorded. NEST projected
Octopoma nanum	Aizoaceae	VU, WC, NC	Not recorded
Oftia glabra	Scrophulariaceae	Rare	Not recorded. NEST projected
Oxalis marlothii	Oxalidaceae	EN, NC	Not recorded. Present in area
Pauridia breviscapa	Hypoxidaceae	Rare, WC, NC	Not recorded. NEST projected
Peersia frithii	Aizoaceae	VU, WC, NC	Not recorded. Present in area
Pelargonium torulosum	Geraniaceae	Rare, NC	Not recorded
Phiambolia hallii	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Phylica comptonii	Rhamnaceae	Rare, NC	Not recorded. NEST projected
Phylica retorta	Rhamnaceae	Rare, NC	Not recorded. NEST projected
Phyllobolus amabilis	Aizoaceae	Rare, WC, NC	Not recorded
Polhillia involucrata	Fabaceae	EN, NC	Not recorded. NEST projected
Protea convexa	Proteaceae	CR EN, WC, NC	Not recorded. NEST projected, known locations in Northern Cederberg, Witteberg and Klein Swartberg mountains.
Protea lepidocarpodendron	Proteaceae	NT, WC, NC	Not recorded
Psoralea karooensis	Fabaceae	Rare	Not recorded. NEST projected
Pterygodium inversum	Orchidaceae	EN, WC, NC	Not recorded, found to the west in the Ceres/Malmesbury area
Restio aridus	Restionaceae	VU	Not recorded. NEST projected
Restio esterhuyseniae	Restionaceae	Rare, WC, NC	Not recorded. NEST projected
Rhodocoma vleibergensis	Restionaceae	Rare, WC, NC	Not recorded. NEST projected
Romulea eburnea	Iridaceae	VU, WC, NC	A rare, localized endemic to the Roggeveld Escarpment, where it is known from two locations and potentially threatened by habitat degradation due to overgrazing. Klein Roggeveld.
Romulea hallii	Iridaceae	VU [D2],	A Roggeveld endemic known from two

Scientific Name	Family	Status*	Comment
		WC, NC	locations, (EOO 39km²). It is potentially threatened by road maintenance and expansion and livestock overgrazing. Roggeveld Plateau southwest of Sutherland.
Romulea multifida	Iridaceae	VU, WC, NC	Not recorded. Present in area. South African endemic. Roggeveld Plateau. Roggeveld Shale Renosterveld.
Romulea syringodeoflora	Iridaceae	NT, WC, NC	A range restricted Roggeveld endemic (EOO 474km²), known from nine location and possibly occurring at a few more in unsurveyed parts of its range. Experiencing ongoing decline of habitat to crop cultivation as well as habitat degradation as a result of livestock overgrazing. Stony shale flats and slopes, Roggeveld Plateau.
Ruschia acocksii	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Ruschia altigena	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Secale strictum subsp. africanum	Poaceae	CR EN	Not recorded. NEST projected. Roggeveld-Hantam endemic, Found on riverbanks.
Selago albomontana	Scrophulariaceae	Rare	Not recorded. NEST projected
Strumaria karooica	Amaryllidaceae	Rare, WC, NC	Not recorded
Strumaria karoopoortensis	Amaryllidaceae	VU, WC, NC	Not recorded
Strumaria pubescens	Amaryllidaceae	Rare, WC, NC	Not recorded
Strumaria undulata	Amaryllidaceae	DDT, WC, NC	Not recorded. Karoo Endemic, taxonomically problematic.
Tanquana archeri	Aizoaceae	VU, WC, NC	Not recorded. Found south of the site in Koedoesberge-Moordenaars Karoo. Limited population, severely threatened by plant traded harvesting.
Tanquana hilmarii	Aizoaceae	CR, WC, NC	Not recorded, known locations to the south of Laingsburg
Thesium marlothii	Santalaceae	DDT	Not recorded. Karoo Endemic, taxonomically problematic.
Trachyandra sanguinorhiza	Asphodelaceae	Rare, WC, NC	Not recorded
Trichodiadema hallii	Aizoaceae	DDT, WC, NC	Not recorded. Karoo Endemic, taxonomically problematic.
Tritonia florentiae	Iridaceae	Rare, WC, NC	Not recorded. NEST projected
Tylecodon faucium	Crassulaceae	Rare, NC	Not recorded. Karoo Endemic, A range-restricted habitat specialist endemic to the Ceres Karoo and Roggeveld. Site overlaps with possible range, may be present in shaded crevices on south facing slopes.
Wurmbea capensis	Colchicaceae	VU	Not recorded. Outside of range (Swartland area).
Zaluzianskya mirabilis	Scrophulariaceae	Rare	Not recorded. NEST projected
Mammals			
Bunolagus monticularis (Riverine rabbit)	Lagomorpha	CR	**Not Present.** Confined to riparian bush on the narrow alluvial fringe of

Scientific Name	Family	Status*	Comment
			seasonally dry watercourses in the Central Karoo. Presence highly unlikely. Site is outside of known distribution range.
Felis nigripes (Black-footed cat)	Carnivora	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub. May a be transient species.
Birds			
Aquila verreauxii (Verreaux's Eagle)	Accipitridae	VU	Nesting pairs within or peripheral to the site and may be subject to loss of foraging habitat and the risk of collision with the turbine blades.
Polemaetus bellicosus (Martial Eagle)	Accipitridae	EN	Nesting pairs within or peripheral to the site and may be subject to loss of foraging habitat and the risk of collision with the turbine blades. (Vulnerable globally - IUCN)
Circus maurus (Black Harrier)	Accipitridae	EN	Nesting pairs within or peripheral to the site and may be subject to loss of foraging habitat and the risk of collision with the turbine blades. **(Endangered Globally - IUCN)**
Neotis ludwigii (Ludwig's Bustard)	Otididae	EN	Seasonal influxes of this threatened endemic may be displaced from foraging areas and exposed to collision risk with the turbine blades and with new power lines. (Endangered Globally - IUCN)
Reptiles			
Psammobates tentorius tentorius (Karoo Tent Tortoise)	Testudinidae	NT	Tortoises are highly susceptible to collisions with motor vehicles and trucks on new roads
Psammobates tentorius veroxii (Bushmanland Tent Tortoise)	Testudinidae	NT	Tortoises are highly susceptible to collisions with motor vehicles and trucks on new roads
Amphibians			
None of Concern			
Invertebrates			
Aloeides thyra orientis (Red copper)	Lycaenidae	LC	In vicinity of known distribution range of related subspecies (Brenton Blue). Host plants are not present on site.

* IUCN Red List Categories: LC – Least Concern; NT - Near Threatened; VU – Vulnerable; En – Endangered; CR – Critically Endangered; NE – Not Evaluated. WC – Western Cape Nature Conservation Laws Amendment Act (Act No 3 of 2000); NC – Northern Cape Naure Conservation Act (Act No 9 of 2009). ToPS – Threatened or Protected Species in terms of NEMBA.

16 Appendix 2: Flora Protected in Terms of Provincial Acts and Ordinance(s)

Highlighted species confirmed to be present.

Scientific Name	Family	Status*	Occurrence/Comment
Adromischus maculatus	Crassulaceae	LC, NC	Present on site
Adromischus mammillaris	Crassulaceae	EN, NC	Not recorded, known locations in Calitzdorp area
Adromischus phillipsiae	Crassulaceae	Rare, NC	Not recorded. NEST projected. Roggeveld Mountains to Kamiesberg. Sheltered rock crevices in loam soil.
Agathosma acocksii	Rutaceae	VU, NC	Not recorded. NEST projected. Witberg to the south, outside of project area in Fynbos.
Albuca concordiana	Hyacinthaceae	LC, WC, NC	Present on site
Aloe comptonii	Asphodelaceae	*LC, WC, NC*	Present on site
Aloe longistyla	Asphodelaceae	LC, WC, NC	Not recorded, Widespread species
Aloidendron dichotomum	Asphodelaceae	VU, WC, NC	Not recorded
Aloinopsis loganii	Aizoaceae	VU, WC, NC	Not recorded
Antimima androsacea	Aizoaceae	CR Rare, WC, NC	A range-restricted species (EOO 10km²), known from one site where it is not threatened. Sutherland, Roggeveld Escarpment.
Antimima emarcescens	Aizoaceae	VU, WC, NC	Not recorded. NEST projected
Antimima hamatilis	Aizoaceae	VU, WC, NC	Not recorded, known locations to the south in the Robertson/Worcester area
Antimima karroidea	Aizoaceae	LC, WC, NC	Not recorded. Karoo Endemic, widespread.
Antimima loganii	Aizoaceae	VU, WC, NC	Poorly known and apparently rare species. Its distribution range is not well known, but occurrence records suggest that it is very small. There is currently one known location, but it is likely an underestimate, as it may be overlooked due to taxonomic uncertainty. It is potentially threatened by overgrazing. Endemic to Roggeveld Escarpment near Sutherland in the Northern Cape.
Aspalathus intricata subsp. anthospermoides	Fabaceae	Rare, NC	Not recorded. NEST projected
Aspalathus intricata subsp. intricata	Fabaceae	Rare, NC	Not recorded. NEST projected
Aspalathus intricata subsp. oxyclada	Fabaceae	Rare, NC	Not recorded. NEST projected
Astroloba corrugata	Asphodelaceae	*LC, WC, NC*	Present on site
Astroloba herrei	Asphodelaceae	VU, WC, NC	Not recorded. NEST projected, known locations to the south in the Swartberg mountains around Matjiesfontein & Prince Albert
Astroloba robusta	Asphodelaceae	LC, WC, NC	Present on site
Babiana cuneata	Iridaceae	*LC, WC, NC*	Present on site
Babiana sambucina	Iridaceae	EN, WC, NC	Not recorded.
Boophone disticha	Amaryllidaceae	LC, WC,	Present on site

Scientific Name	Family	Status*	Occurrence/Comment
		NC	
Braunsia apiculata	Aizoaceae	LC, WC, NC	Present on site
Braunsia stayneri	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Brunsvigia comptonii	Amaryllidaceae	LC, WC, NC	Present on site. Widespread and not in danger of extinction. Common and widespread in project area.
Brunsvigia josephinae	Amaryllidaceae	VU, WC, NC	Long-lived bulb occurs as widely scattered subpopulations in lowland areas that are subject to continued habitat loss to. Herbarium specimens record about 18 subpopulations, and an estimated further 70 unrecorded subpopulations may exist. All subpopulations consist of fewer than 50 adult plants and are declining due to collection on an ongoing basis for medicinal purposes. Nieuwoudtville to Baviaanskloof.
Brunsvigia striata	Amaryllidaceae	LC, WC, NC	Present on site
Bulbine abyssinica	Asphodelaceae	LC, WC, NC	Present on site
Bulbine succulenta	Asphodelaceae	LC, WC, NC	Present on site
Bulbine torta	Asphodelaceae	Rare, WC, NC	Not recorded
Bulbinella cauda-felis	Asphodelaceae	LC, WC, NC	Present on site
Calamophyllum teretiusculum	Aizoaceae	DDT, WC, NC	Not recorded. Karoo Endemic, taxonomically problematic.
Cerochlamys gemina	Aizoaceae	LC, WC, NC	Not recorded. Karoo Endemic, localised population south of the site.
Cheiridopsis namaquensis	Aizoaceae	*LC, WC, NC*	Present on site
Cleretum booysenii	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Conophytum minimum	Aizoaceae	LC, WC, NC	Present on site
Conophytum truncatum	Aizoaceae	NE, WC, NC	Not recorded
Cotyledon cuneata	Crassulaceae	*LC, NC*	Present on site
Cotyledon orbiculata	Crassulaceae	*LC, NC*	Present on site
Cotyledon tomentosa	Crassulaceae	LC, NC	Present on site
Crassula alpestris subsp. massonii	Crassulaceae	Rare, NC	Not recorded
Crassula altropurpurea	Crassulaceae	LC, NC	Present on site
Crassula brachystachya	Crassulaceae	Rare, NC	Not recorded
Crassula clavata	Crassulaceae	*LC, NC*	Present on site
Crassula columnaris	Crassulaceae	*LC, WC, NC*	Present on site
Crassula congesta	Crassulaceae	LC, NC	Present on site
Crassula congesta subsp. laticephala	Crassulaceae	Rare, NC	Not recorded
Crassula cotyledonis	Crassulaceae	LC, NC	Present on site
Crassula dodii	Crassulaceae	DD, NC	Not recorded. Roggeveld-Hantam endemic, Known from general area. Widespread.
Crassula hemisphaerica	Crassulaceae	LC, NC	Not recorded, Widespread species

Scientific Name	Family	Status*	Occurrence/Comment
Crassula muscosa	Crassulaceae	LC, NC	Present on site
Crassula orbicularis	Crassulaceae	*LC, NC*	Present on site
Crassula pageae	Crassulaceae	LC, NC	Present on site
Crassula roggeveldii	Crassulaceae	Rare, NC	Not recorded
Crassula rupestris	Crassulaceae	*LC, NC*	Present on site
Crassula tecta	Crassulaceae	LC, NC	Present on site
Crassula tetragona	Crassulaceae	LC, NC	Present on site
Crassula tomentosa	Crassulaceae	LC, NC	Present on site
Crassula umbella	Crassulaceae	LC, NC	Present on site
Crassula vestita	Crassulaceae	Rare, NC	Not recorded
Deilanthe peersii	Aizoaceae	LC, WC, NC	Not recorded. Great Karoo endemic, Known from general area. Widespread.
Delosperma sphalmanthoides	Aizoaceae	VU, WC, NC	Not recorded. NEST projected
Diascia macrophylla	Scrophulariaceae	LC, WC, NC	Not recorded. Roggeveld-Hantam endemic, Known from general area. Widespread.
Didymaotus lapidiformis	Aizoaceae	VU, WC, NC	Not recorded, known locations generally to the south-west in Tanqua karoo and Wash Riviere.
Drimia arenicola	Hyacinthaceae	LC, WC, NC	Not recorded. Known from Northern Cape, range overlaps with site.
Drimia karooica	Hyacinthaceae	LC, WC, NC	Not recorded, Widespread species
Drosanthemum comptonii	Aizoaceae	DDT, WC, NC	Not recorded. Karoo Endemic, taxonomically problematic.
Drosanthemum framesii	Aizoaceae	*LC, WC, NC*	Present on site
Drosanthemum hispidum	Aizoaceae	LC, WC, NC	Present on site
Drosanthemum worcesterense	Aizoaceae	EN, WC, NC	Not recorded. NEST projected
Duvalia caespitosa	Apocynaceae	*LC, NC*	Present on site
Duvalia parviflora	Apocynaceae	VU, NC	Not recorded, known locations in the south around Ladismith & Oudshoorn
Erica glandulipila	Ericaceae	Rare, WC, NC	Not recorded. NEST projected
Euphorbia loricata	Euphorbiaceae	LC, NC	Present on site
Euphorbia mauritanica	Euphorbiaceae	*LC, NC*	Present on site
Euphorbia multiceps	Euphorbiaceae	LC, NC	Present on site
Euphorbia multifolia	Euphorbiaceae	LC, NC	Present on site
Gasteria disticha	Asphodelaceae	CR, WC, NC	Not recorded, known locations in Worcester area to the south-west
Geissorhiza karooica	Iridaceae	NT, WC, NC	A range restricted species, EOO 497 km², known from six locations where it is potentially threatened by habitat loss and degradation as a result of overgrazing and erosion. Known from Roggeveld Mountains to Matjiesfontein.
Geissorhiza spiralis	Iridaceae	VU, WC, NC	Not recorded. NEST projected
Gibbaeum gibbosum	Aizoaceae	LC, WC, NC	Present on site
Gibbaeum pubescens	Aizoaceae	LC, WC, NC	Present on site
Gladiolus venustus	Iridaceae	*LC, WC, NC*	Present on site
Gonialoe variegata	Asphodelaceae	*LC, WC, NC*	Present on site
Haemanthus coccineus	Amaryllidaceae	*LC, WC, NC*	Present on site
Haemanthus tristis	Amaryllidaceae	VU, WC,	Not recorded

Scientific Name	Family	Status*	Occurrence/Comment
		NC	
Haworthia arachnoidea	Asphodelaceae	LC, WC, NC	Present on site
Haworthia blackburniae	Asphodelaceae	NE, WC, NC	Not recorded
Haworthia cooperi	Asphodelaceae	NE, WC, NC	Not recorded
Haworthia cymbiformis	Asphodelaceae	NE, WC, NC	Not recorded
Haworthia lockwoodii	Asphodelaceae	VU, WC, NC	Not recorded
Haworthia marumiana	Asphodelaceae	NE, WC, NC	Not recorded
Haworthia mirabilis	Asphodelaceae	DDT, WC, NC	Not recorded, found to the west near Nieuwoudtville
Haworthia nortieri var. pehlemanniae.	Asphodelaceae	LC, WC, NC	Not recorded. Karoo Endemic, widespread.
Haworthia pulchella	Asphodelaceae	NE, WC, NC	Not recorded
Haworthia wittebergensis	Asphodelaceae	Rare, WC, NC	Not recorded. NEST projected
Hereroa crassa	Aizoaceae	LC, WC, NC	Not recorded. Great Karoo endemic, Known from general area. Widespread.
Hesperantha flava	Iridaceae	Rare, WC, NC	Not recorded. Present in area
Hesperantha glabrescens	Iridaceae	Rare, WC, NC	Not recorded. NEST projected
Holothrix aspera	Orchidaceae	LC, WC, NC	Present on site
Holothrix secunda	Orchidaceae	LC, WC, NC	Present on site
Holothrix villosa	Orchidaceae	LC, WC, NC	Present on site
Hoodia pilifera	Apocynaceae	NT, NC	Not recorded
Hypodiscus sulcatus	Restionaceae	VU, WC, NC	Not recorded, known locations in the south around Laingsburg/Touwsrivier (Matjiesfontein Shale Renosterveld)
Ixia mollis	Iridaceae	VU, WC, NC	Not recorded
Ixia oxalidiflora	Iridaceae	VU, WC, NC	Not recorded. Present in area
Ixia parva	Iridaceae	VU, WC, NC	Not recorded. NEST projected
Ixia rivulicola	Iridaceae	VU, WC, NC	Not recorded. NEST projected
Jamesbrittenia thunbergii	Scrophulariaceae	LC, NC	Not recorded. Roggeveld-Hantam endemic, Known from general area. Widespread.
Lachenalia aurioliae	Hyacinthaceae	*LC, WC, NC*	Present on site
Lachenalia comptonii	Hyacinthaceae	LC, WC, NC	Not recorded. Karoo Endemic, Tanqua Karoo to the Roggeveld Escarpment south-west of Sutherland and Matjiesfontein.
Lachenalia congesta	Hyacinthaceae	VU, WC, NC	Not recorded
Lachenalia ensifolia	Hyacinthaceae	LC, WC, NC	Present on site
Lachenalia isopetala	Hyacinthaceae	LC, WC,	Present on site

Scientific Name	Family	Status*	Occurrence/Comment
		NC	
Lachenalia juncifolia	Hyacinthaceae	LC, WC, NC	Present on site
Lachenalia longituba	Hyacinthaceae	VU, WC, NC	Not recorded
Lachenalia martinae	Hyacinthaceae	VU, WC, NC	Not recorded
Lachenalia obscura	Hyacinthaceae	LC, WC, NC	Present on site
Lachenalia violacea	Hyacinthaceae	*LC, WC, NC*	Present on site
Lachenalia whitehillensis	Hyacinthaceae	NT, WC, NC	Not recorded
Lachenalia zebrina	Hyacinthaceae	LC, WC, NC	Present on site
Lampranthus amoenus	Aizoaceae	EN, WC, NC	Not recorded, known locations in the Cape Flats to the south-west
Lampranthus haworthii	Aizoaceae	LC, WC, NC	Present on site
Leucadendron cadens	Proteaceae	Rare, WC, NC	Not recorded
Leucadendron sp. nov. (Acocks 23716 NBG)	Proteaceae	CR EN, WC, NC	Not recorded. NEST projected
Malephora lutea	Aizoaceae	LC, WC, NC	Present on site
Massonia depressa	Hyacinthaceae	LC, WC, NC	Present on site
Mesembryanthemum nodiflorum	Aizoaceae	LC, WC, NC	Present on site
Monsonia crassicaulis Sarcocaulon crassicaule)	Geraniaceae	*LC, NC*	Present on site
Moraea aspera	Iridaceae	VU, WC, NC	Not recorded. Outside of range (Hantam).
Moraea ciliata	Iridaceae	*LC, WC, NC*	Present on site
Moraea contorta	Iridaceae	Rare, WC, NC	Not recorded
Moraea cuspidata	Iridaceae	*LC, WC, NC*	Present on site
Moraea fenestrata	Iridaceae	NT, WC, NC	Not recorded
Moraea miniata	Iridaceae	*LC, WC, NC*	Present on site
Moraea polyanthos	Iridaceae	*LC, WC, NC*	Present on site
Moraea polystachya	Iridaceae	LC, WC, NC	Present on site
Moraea tanquana	Iridaceae	Rare, WC, NC	Not recorded
Moraea virgata subsp. karooica	Iridaceae	Rare, WC, NC	Not recorded
Nemesia anisocarpa	Scrophulariaceae	LC, NC	Not recorded. Roggeveld-Hantam endemic, Known from general area. Widespread.
Octopoma nanum	Aizoaceae	VU, WC, NC	Not recorded
Ornithogalum juncifolium	Hyacinthaceae	LC, WC, NC	Not recorded
Oxalis convexula	Oxalidaceae	LC, NC	Present on site
Oxalis dregei	Oxalidaceae	*LC, NC*	Present on site
Oxalis marlothii	Oxalidaceae	EN, NC	Not recorded. Present in area
Oxalis melanosticta	Oxalidaceae	LC, NC	Present on site
Oxalis pes-caprae	Oxalidaceae	LC, NC	Present on site

Scientific Name	Family	Status*	Occurrence/Comment
Pauridia breviscapa	Hypoxidaceae	Rare, WC, NC	Not recorded. NEST projected
Pectinaria articulata	Apocynaceae	LC, NC	Present on site
Pectinaria longipes subsp. longipes	Apocynaceae	LC, NC	Not recorded. Roggeveld-Hantam endemic, Known from general area. Widespread.
Peersia frithii	Aizoaceae	VU, WC, NC	Not recorded. Present in area
Pelargonim magenteum	Geraniaceae	*LC, NC*	Present on site
Pelargonium alternans	Geraniaceae	*LC, NC*	Present on site
Pelargonium magenteum	Geraniaceae	*LC, NC*	Not recorded. Roggeveld-Hantam endemic, Known from general area. Widespread.
Pelargonium stipulaceum subsp. ovato-stipulatum	Geraniaceae	*LC, NC*	Not recorded. Karoo Endemic, widespread.
Pelargonium torulosum	Geraniaceae	*Rare, NC*	Not recorded
Phiambolia hallii	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Phylica comptonii	Rhamnaceae	Rare, NC	Not recorded. NEST projected
Phylica retorta	Rhamnaceae	Rare, NC	Not recorded. NEST projected
Phyllobolus amabilis	Aizoaceae	Rare, WC, NC	Not recorded
Piaranthus comptus	Apocynaceae	LC, NC	Not recorded. Great Karoo endemic, Known from general area. Widespread.
Piaranthus geminatus	Apocynaceae	*LC, NC*	Present on site
Pleiospilos nelii	Aizoaceae	LC, WC, NC	Not recorded. Outside of range.
Polhillia involucrata	Fabaceae	EN, NC	Not recorded. NEST projected
Protea convexa	Proteaceae	CR EN, WC, NC	Not recorded. NEST projected, known locations in Northern Cederberg, Witteberg and Klein Swartberg mountains.
Protea lepidocarpodendron	Proteaceae	NT, WC, NC	Not recorded
Pterygodium inversum	Orchidaceae	EN, WC, NC	Not recorded, found to the west in the Ceres/Malmesbury area
Quaqua parviflora subsp. gracilis	Apocynaceae	LC, NC	Not recorded. Great Karoo endemic, Known from general area. Widespread.
Restio esterhuyseniae	Restionaceae	Rare, WC, NC	Not recorded. NEST projected
Restio karooicus	Restionaceae	LC, WC, NC	Not recorded. NEST projected
Rhinephyllum graniforme	Aizoaceae	LC, WC, NC	Not recorded. Great Karoo endemic, Known from general area. Widespread.
Rhodocoma vleibergensis	Restionaceae	Rare, WC, NC	Not recorded. NEST projected
Romulea eburnea	Iridaceae	VU, WC, NC	A rare, localized endemic to the Roggeveld Escarpment, where it is known from two locations and potentially threatened by habitat degradation due to overgrazing. Klein Roggeveld.
Romulea hallii	Iridaceae	VU [D2], WC, NC	A Roggeveld endemic known from two locations, (EOO 39km²). It is potentially threatened by road maintenance and expansion and livestock overgrazing. Roggeveld Plateau southwest of Sutherland.

Scientific Name	Family	Status*	Occurrence/Comment
Romulea multifida	Iridaceae	VU, WC, NC	Not recorded. Present in area. South African endemic. Roggeveld Plateau. Roggeveld Shale Renosterveld.
Romulea syringodeoflora	Iridaceae	NT, WC, NC	A range restricted Roggeveld endemic (EOO 474km²), known from nine location and possibly occurring at a few more in unsurveyed parts of its range. Experiencing ongoing decline of habitat to crop cultivation as well as habitat degradation as a result of livestock overgrazing. Stony shale flats and slopes, Roggeveld Plateau.
Romulea tortuosa	Iridaceae	LC, WC, NC	Present on site. Common on site on flat rocky outcrops. Widespread endemic. Occasional on south-facing slopes, not affected.
Ruschia acocksii	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Ruschia altigena	Aizoaceae	Rare, WC, NC	Not recorded. NEST projected
Ruschia cradockensis	Aizoaceae	LC, WC, NC	Present on site
Ruschia crassa	Aizoaceae	LC, WC, NC	Present on site
Ruschia karrooica	Aizoaceae	LC, WC, NC	Not recorded. Karoo Endemic, widespread.
Ruschia perfoliata	Aizoaceae	LC, WC, NC	Not recorded. Great Karoo endemic, Known from general area. Widespread.
Sericocoma pungens	Amaranthaceae	LC, WC, NC	Not recorded, Widespread species
Stapelia rufa	Apocynaceae	LC, NC	Present on site
Strumaria karooica	Amaryllidaceae	Rare, WC, NC	Not recorded
Strumaria karoopoortensis	Amaryllidaceae	VU, WC, NC	Not recorded
Strumaria pubescens	Amaryllidaceae	Rare, WC, NC	Not recorded
Strumaria undulata	Amaryllidaceae	DDT, WC, NC	Not recorded. Karoo Endemic, taxonomically problematic.
Tanquana archeri	Aizoaceae	VU, WC, NC	Not recorded. Found south of the site in Koedoesberge-Moordenaars Karoo. Limited population, severely threatened by plant traded harvesting.
Tanquana hilmarii	Aizoaceae	CR, WC, NC	Not recorded, known locations to the south of Laingsburg
Trachyandra sanguinorhiza	Asphodelaceae	Rare, WC, NC	Not recorded
Trichodiadema hallii	Aizoaceae	DDT, WC, NC	Not recorded. Karoo Endemic, taxonomically problematic.
Trichodiadema marlothii	Aizoaceae	LC, WC, NC	Present on site
Trichodiadema mirabile	Aizoaceae	LC, WC, NC	Present on site
Tridentea gemmiflora	Apocynaceae	LC, NC	Present on site
Tridentea parvipuncta subsp. parvipuncta	Apocynaceae	LC, NC	Not recorded. Great Karoo endemic, Known from general area. Widespread.
Tritonia florentiae	Iridaceae	Rare, WC, NC	Not recorded. NEST projected
Tylecodon faucium	Crassulaceae	Rare, NC	Not recorded. Karoo Endemic, A range-

Scientific Name	Family	Status*	Occurrence/Comment
			restricted habitat specialist endemic to the Ceres Karoo and Roggeveld Mountains (extent of occurrence 1516 km²), known from five subpopulations, this species has no recorded threats and is listed Rare nationally and Least Concern globally. Shaded rock crevices, often on south-facing slopes. Site overlaps with possible range, may be present in shaded crevices on south facing slopes.
Tylecodon paniculatus	Crassulaceae	LC, NC	Present on site
Tylecodon reticulatus	Crassulaceae	LC, NC	Present on site
Tylecodon wallichii	Crassulaceae	LC, NC	Present on site

* IUCN Red List Categories: LC – Least Concern; NT - Near Threatened; VU – Vulnerable; En – Endangered; CR – Critically Endangered; NE – Not Evaluated. WC – Western Cape Nature Conservation Laws Amendment Act (Act No 3 of 2000); NC – Northern Cape Naure Conservation Act (Act No 9 of 2009). ToPS – Threatened or Protected Species in terms of NEMBA.

17 Appendix 3 - About Trusted Partners

Trusted Partners is owned and managed by three Partners, two based in South Africa (Cape Town & Johannesburg) and one in England (London). The Partners have comprehensive experience across the continent and beyond, having collective experience in more than 30 African countries and islands, as well as in the Middle East and Europe. As such, Trusted Partners brings together reputable and experienced professionals and experts who are actively engaged in the African, Middle Eastern and European ESG Risk and Impact Management arenas.

The Partners actively lead projects in order to deliver bespoke ESG Risk Management and Impact Advisory to the Corporate, Financial and Industrial sectors, through our proven gravitas and extensive industry experience. Trusted Partners strives to unlock and drive effective sustainability into our clients' respective portfolios and projects. We take pride in our ability to respond rapidly and competitively.

Our three Partners and network of experienced Associate Partners believe in investing in long-term partnerships with our clients. We support our clients to achieve their strategic goals, rapidly respond to their needs and develop an intimate knowledge of their businesses. Our low-overheads and flexible resourcing model allows us to deliver a high-quality service at a much more affordable rate than our competitors.

Trusted Partners provides hands-on professional ESG risk management and impact advice across Africa. The Partners have extensive experience assessing and managing ESG risks and impacts across the continent in all major sectors on-behalf of investors, development finance institutions and businesses.

Our in-depth understanding of ESG risks and impacts coupled with our extensive knowledge of the Equator Principles, International Finance Corporation (IFC) Performance Standards, World Bank Environmental and Social Safeguards, European Bank for Reconstruction and Development (EBRD) Performance Requirements, and the Development Bank of Southern Africa (DBSA) Environmental and Social Safeguards as well as other International Development Financial Institutions Standards, and country specific environmental and social related regulations across Africa and the Middle East make us Trusted Advisors to our clients.

We are committed to ensuring the highest standards of integrity and honesty in our work and engagement with clients. Our low-overhead approach and flexible resourcing model allows the delivery of high-quality value for money service.

Our services include:

STRATEGIC ADVISORY

- Environmental & Social Impact Assessments
- Environmental & Social Risk Management
- Environmental & Social Management Systems (IFC/EBRD)
- ISO 14001 & ISO 45001
- Environmental & Social Strategic Planning
- Responsible Investment Advisory

TRANSACTION SERVICES

- Environmental & Social Governance Advisory
- Environmental & Social Due Diligence
- Corporate Governance Due Diligence & Assurance
- Equator Principles Assurance
- IFC Performances Standards Assurance
- EIB/EBRD Performance Requirements Assurance
- World Bank Environmental & Social Safeguards Assurance
- Lenders ESG/ESRM Technical Advisor

PROJECT SUPPORT

- Botanical and Ecological Assessments
- Critical Habitats & Biodiversity Assessments
- Stakeholder Engagement & Conflict Resolution
- Resettlement Action Plans & Livelihood Improvement Plans
- Advanced GIS Systems & Analysis
- High Resolution 3D Visualisations & Visual Impact Assessments
- Land Use Planning (Environmental & Social Planning)
- Environmental, Health & Safety Performance Assurance
- Environmental, Health & Safety Compliance Assurance
- Climate Change Risk Assessments
- Environmental, Health & Safety Site Assessments

17.1 Malcolme Logie, Partner

Malcolme Logie is a leading strategic thinking and performance-focused Environmental and Social Management Advisor with 30 years of experience in consulting across Africa and Eastern Europe. As a proven Advisor, Malcolme has guided public listed companies throughout Africa and Eastern Europe on their EHS & Social Strategies, Impacts and Liabilities. He is a motivational leader known for clearly defining mission and goals, aligning people and resources, and consistently delivering results that exceed expectations.

He is an expert in:

- Strategic Environmental Advisory;
- Environmental & Social Risk Management;
- Environmental & Social Governance;
- Equator Principles;
- World Bank - Environmental & Social Safeguards;
- International Finance Corporation - Environmental & Social Performance Standards;
- European Investment Bank - Environmental & Social Standards;
- European Bank for Reconstruction and Development - Environmental & Social Performance Requirements;
- Development Bank of Southern Africa - Environmental & Social Safeguards;
- Environmental & Social Due Diligence;
- Environmental & Social Impact Assessment;
- Critical Habitat & Biodiversity Assessments;
- EHS Compliance and Performance Assurance;
- ISO 14001/ISO 45001 Management Systems; and
- Technical Environmental Advisory.

As a recognised authority in Environmental & Social Risk Management he has led multi-disciplinary teams on projects in South Africa, Angola, Botswana, Cote de Ivoire, Czech Republic, Democratic Republic of Congo, Egypt, Ethiopia, Ghana, Hungary, Kenya, Madagascar, Mauritania, Mozambique, Namibia, Nigeria, Pakistan, Poland, Romania, Slovak Republic, South Sudan, Tanzania, Uganda, and Zambia.

Malcolme has consulted in the following industrial sectors: Aerospace, Agriculture, Forestry, Fisheries, Automotive and Rail Transport, Beverage and Foodstuff Industries, Chemicals and Chemical Products, Constructions, Education, Electricity Supply, Explosive and Munitions, Gas Supply, Glass Ceramics, Health Care Service, Processing of Minerals and Ores, Leather and Leather Products, Manufacture of Coke and Refined Petroleum Products, Manufacturing and Mechanical Engineering, Metals Refining and Processing and Production of Metals, Mining and Quarrying, Oil and Gas, Pharmaceuticals, Production of Cement and Concrete, Pulp and Paper, Renewable Energy, Rubber and Plastic Goods, Ship Building, Textile Industries, Transport and Communication, Waste and Recycling, Water Supply and Wood Industries.

In 2018/20 Malcolme led a Team of International Experts that developed the Environmental & Social Impact Assessment Guidelines for the Oil & Gas Sector in Kenya – encompassing the Onshore and Offshore Environmental, Social, Community, Health & Safety Risks in the Upstream, Midstream and Downstream Activities. The project was funded by the World Bank.

In 2020/21, Malcolme was part of an International team that developed the Environmental and Social Tariff for the Pakistan Energy Sector: Wind, Solar, Run-of-River Hydro, Large Hydro, Biogas, and Fossil Fuel (Coal, HFO, LNG). The project was funded by the IFC.

Malcolme was a specialist Environmental & Social Risk Management Advisor to the IFC (Johannesburg) during the period November 2017- July 2021, where he has provided expert advice on Environmental & Social Risk Management and Management Systems the Consulting and Financial Sectors in South Africa, Ghana and Nigeria. The ESRM Programme aims to increase the uptake of Environmental and Social standards by financial intuitions and loan clients in the sub-Saharan region. Malcolme has also lectured at the Rhodes University Business School on Industrial Environmental Management and EHSS Management Systems.

Malcolme was a member on the South African committee SABS:TC207 which formed part of the global committee that wrote the original ISO 14001:1996 Environmental Management Systems specifications standard. Malcolme was also responsible for the development of the SAATCA requirements for the registration of Environmental Auditors and was elected (under a Grandfather clause) as the first Environmental Verification Auditor in South Africa. Malcolme has more than 16 800 hours of EHS Auditing experience and has led integrated EHSQ certification level audits.

During 2006-2010 Malcolme served on the Education Review Panel for the South African Council for Natural Scientific Professions (SACNASP) where his role was to review the suitability of education and experience of individuals applying for registration as Professional Natural Scientists. Malcolme served on the Application Review Panel at SACNASP for 2016-2017.

Education

- PhD (Biotechnology), Rhodes University, 1995
- MSc (Botany), Rhodes University, 1992
- BSc Honours (Botany), Rhodes University 1990
- BSc (Plant Science & Biochemistry), Rhodes University, 1989

*Certificates available on request

Professional Memberships

- South African Council of Natural Scientific Professions – Environmental Scientist (N#: 400102/95)
- Environmental Assessment Practitioners Association of South Africa (EAPASA: N#: 2020/1403)
- International Association of Impact Assessors
- Royal Society of South Africa

*Certificates available on request

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

BRAND VALLEY WEF: TERRESTRIAL BIODIVERSITY ASSESSMENT

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	**Trusted Partners**			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	**4**	Percentage Procurement recognition	**100 %**
Specialist name:	**Malcolme Logie**			
Specialist Qualifications:	**BSc; BSc (Hons); MSc; PhD**			
Professional affiliation/registration:	**SACNASP Environmental Scientist** **Reg. EAP (EAPASA N# 2020/1403)**			
Physical address:	**27 Lighthouse Rd, Kommetjie, 7976, Cape Town**			
Postal address:	**PO Box 48148, Kommetjie, 7975, Cape Town**			
Postal code:	**7975**	Cell:	**083 655 6123**	
Telephone:		Fax:		
E-mail:	**Malcolme@TrustedPartners.Africa**			

2. DECLARATION BY THE SPECIALIST

I, Dr Malcome Logie Malcolme Logie, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Trusted Partners

Name of Company:

2021/10/06

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Malcolm Isaacs, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Trusted Partners

Name of Company

2021/10/06

Date

7609222-0
ISAACS

Signature of the Commissioner of Oaths

2021/10/06

Date

SUID-AFRIKAANSE POLISIEDIENS
COMMUNITY SERVICE CENTRE
06 OCT 2021
OCEAN VIEW W.C
SOUTH AFRICAN POLICE SERVICE

17.2 Jamie Pote, Associate Partner

Jamie is a highly experienced Biodiversity consultant, specialising in terrestrial Ecological and Vegetation Assessments. Over the past 16 years, he has been involved in a diverse range of projects and regions, primarily in Southern but also Western and Central Africa as part of multidisciplinary teams. His experience in South Africa includes most provinces (in particular the Eastern Cape, Western Cape, Northern Cape and Limpopo provinces) and a wide range of bio-geographic regions, and has also worked professionally in Namibia, Mozambique, Democratic Republic of Congo, Republic of Congo and Ghana.

He is an expert in:

- Botanucal and Terrestrial Ecology Assessments
- Critical Habitat & Biodiversity Assessments.
- Terrestrial Biodiversity Assessments
- GIS mapping and analysis

Projects include over 300 independent Biodiversity, Ecological and/or Botanical Assessments throughout Southern, Western and Central Africa within the Energy, Infrastructure, Housing, Agriculture, Forestry, Mining and Industrial Sectors.

In addition, he recently initiated and grew a leading Environmental Business unit at a Civil Engineering company in Port Elizabeth and was the Senior Ecologist and Environmental Assessment Practitioner (EAP) on over 50 environmental applications in the infrastructure, housing, agricultural and mining sectors. He has furthermore played a key role within the road maintenance and construction sphere within the Eastern Cape, undertaking key projects for both the Department of Roads and Public Works and SANRAL, which includes over 40 mining applications for the licensing of more than 300 gravel borrow pits in districts throughout the Eastern Cape.

Jamie has also been lead environmental consultant in construction compliance and monitoring on over 50 civil infrastructure and housing projects.

Key fields of expertise include Terrestrial Biodiversity and Ecological Assessments, Environmental and Ecological Risk-Assessments, Rehabilitation and Restoration Plans, Environmental Management Plans & Programmes, GIS Mapping & Analysis, Alien Invasive Plant Management Plans, Environmental Compliance & Monitoring, Flora Relocation Plans (including implementation), Environmental and Mining applications and Permits and Licensing (including Water Use licensing and Protected Trees, Flora and Fauna).

Jamie's Tertiary Education Qualifications are:

- BSc Honours (Botany), Rhodes University 2003
- BSc (Botany & Environmental Science), Rhodes University, 2002

*Certificates available on request

Jamie's Professional Registrations/Memberships are:

- South African Council of Natural Scientific Professions – Professional Natural Scientist: Ecological Science (N#: 115233)
- International Association of Impact Assessors (N#: 5045)

*Certificates available on request

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

BRAND VALLEY WEF: TERRESTRIAL BIODIVERSITY ASSESSMENT

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	N/A			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100 %
Specialist name:	Jamie Pote			
Specialist Qualifications:	BSc (Hons)			
Professional affiliation/registration:	SACNASP			
Physical address:				
Postal address:	Postnet Suite 13130, P Bag X13130			
Postal code:	6013	Cell:	076 888 9890	
Telephone:		Fax:		
E-mail:	jamiepote@live.co.za			

2. DECLARATION BY THE SPECIALIST

I, Mr Jamie Pote_____, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

N/A

Name of Company:

25/08/2021

Date:

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Mr Jamie Pote _____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Jamie Pote

Signature of the Specialist

N/A

Name of Company

25 August 2021

Date

2713057.8

Signature of the Commissioner of Oaths

SUID-AFRIKAANSE POLISIEDIENS
HILLCREST
2021-08-25
HUMEWOOD
SOUTH AFRICAN POLICE SERVICE

2021-08-25

Date

THIS PAGE INTENTIONALLY LEFT BLANK

END

APPENDIX

J VISUAL WALKDOWN REPORT

BRANDVALLEY WIND FARM (PTY) LTD

Proposed Construction of the Brandvalley Wind Energy Facility near Matjiesfontein, Western Cape Province

Visual Specialist Comment – Part 2 Amendment

DFFE Reference: 14/12/16/3/3/2/900/AM1
Issue Date: 18 November 2021
Version No.: **3**
Project No.: 17026

Date:	18-11-21
Document Title:	Visual specialist comment in respect of the proposed amendment to the authorised Brandvalley Wind Energy Facility near Matjiesfontein, Western Cape Province
Version Number:	3
Author:	**Kerry Schwartz**
Checked by:	
Approved by:	
Signature:	
Client:	Brandvalley Wind Farm (Pty) Ltd

Confidentiality Statement

BRANDVALLEY WIND FARM (PTY) LTD

PROPOSED CONSTRUCTION OF THE BRANDVALLEY WIND ENERGY FACILITY NEAR MATJIESFONTEIN, WESTERN CAPE PROVINCE

VISUAL SPECIALIST COMMENT – PART 2 AMENDMENT

Contents Page

List of Figures

GLOSSARY OF TERMS

ABBREVIATIONS

BA	Basic Assessment
DBAR	Draft Basic Assessment Report
DEM	Digital Elevation Model
DFFE`	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EMP	Environmental Management Plan
FBAR	Final Basic Assessment Report
GIS	Geographic Information System
MW	Megawatt
NEMA	National Environmental Management Act
OHP	Overhead power line
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
VIA	Visual Impact Assessment
VR	Visual Receptor
WEF	Wind Energy Facility

DEFINITIONS

Sense of place: The unique quality or character of a place, whether natural, rural or urban. It relates to uniqueness, distinctiveness or strong identity.

Scenic route: A linear movement route, usually in the form of a scenic drive, but which could also be a railway, hiking trail, horse-riding trail or 4x4 trail.

Sensitive visual receptors: An individual, group or community that is subject to the visual influence of the proposed development and is adversely impacted by it. They will typically include locations of human habitation and tourism activities.

Viewpoint: A point in the landscape from where a particular project or feature can be viewed.

Viewshed / Visual Envelope: The geographical area which is visible from a particular location.

Visual character: The pattern of physical elements, landforms and land use characteristics that occur consistently in the landscape to form a distinctive visual quality or character.

Visual contrast: The degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would conform with the land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape.

Visual exposure: The relative visibility of a project or feature in the landscape.

Visual impact: The effect of an aspect of the proposed development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.

Visual receptors: An individual, group or community that is subject to the visual influence of the proposed development but is not necessarily adversely impacted by it. They will typically include commercial activities, residents and motorists travelling along routes that are not regarded as scenic.

Visual sensitivity: The inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (visual character), spatial distribution of potential receptors, and the likely value judgements of these receptors towards the new development, which are usually based on the perceived aesthetic appeal of the area.

BRANDVALLEY WIND FARM (PTY) LTD

PROPOSED CONSTRUCTION OF THE BRANDVALLEY WIND ENERGY FACILITY NEAR MATJIESFONTEIN, WESTERN CAPE PROVINCE

VISUAL SPECIALIST COMMENT – PART 2 AMENDMENT

1 INTRODUCTION

Brandvalley Wind Farm (Pty) Ltd, (hereafter referred to as “Brandvalley") was issued with an Environmental Authorisation (EA) for the proposed 140MW Brandvalley Wind Energy Facility (WEF) and its associated infrastructure, near Matjiesfontein in the Western Cape Province on 23 November 2016 (DFFE Reference 14/12/16/3/3/2/900). This authorisation made provision for the construction of a total number of 58 wind turbines, each with a hub height of 120m and a rotor diameter of 140m, and maximum generating capacity of 140MW.

Subsequent to this, the EA was amended (under DFFE Reference 14/12/16/3/3/2/900/AM1 dated 14 February 2019) to allow for:

- Changes to turbine specifications, increasing the hub height to 125m and the rotor diameter to 160m;
- An increase to the height of the wind measuring mast from 120m to 125m;
- Increasing the individual energy generation capacity of the turbines from a range of between 1.5MW and 4MW to a range of between 2 and 5.5MW; and
- A change to the name of the holder of the holder of the EA.

Electrical infrastructure to serve the Brandvalley WEF was authorised on 23 November 2016, under DFFE Ref No. 14/12/16/3/3/1/1591.

Brandvalley is now proposing to submit a Part 2 Amendment application in respect of changes to the approved turbine specifications, the project layout and the Environmental Management Plans (EMPrs) for the proposed WEF and associated grid connection infrastructure. SiVEST has been requested to provide visual specialist comment in respect of the proposed amendments and also to provide visual specialist inputs for the updated EMPrs.

2 METHODOLOGY

2.1 Part 2 Amendment and Update of Associated EMPrs

An assessment of the proposed amendement for the proposed Brandvalley WEF from a visual perspective will involve the tasks as outlined below.

- A review of the original VIAs undertaken for project as well as Visual Specialist inputs in respect of any subsequent amendments;
- An assessment of the proposed new turbine specifications and layout changes in relation to the findings of the original VIAs, including:
  - A re-assessment of potential turbine visibility (viewshed) from previously identified receptor locations;
  - An assessment of potential visual sensitivity in relation to the outputs from the National Web Based Environmental Screening Tool, specifically outputs from the Landscape and Flicker Themes.
- Compilation of a Visual Specialist Assessment Report outlining the findings of the assessment and:
  - identifying whether the proposed amendments will result in any additional visual impacts or exacerbate the impacts previously identified in the VIA for this development; and
  - providing additional recommendations or mitigation measures (if necessary) for inclusion in the respective EMPrs for these projects.
- Compilation of a Site Sensitivity Verification Report in accordance with the Assessment Protocols for specialist studies[1].
- Provision of updated inputs where necessary for the respective EMPrs based on the findings of the assessment.

2.2 Update of EMPr for 132kV Power Lines

Updates to the EMPr for the associated 132kV power line will involve the tasks as outlined below.

- A review of the original VIA (where available) undertaken for the project as well as Visual Specialist inputs in respect of any subsequent amendments to identify visual specialist recommendations and mitigation measures relevant to the proposed power line development.
- Provision of updated inputs where necessary for the respective EMPrs.

3 ASSUMPTIONS AND LIMTATIONS

Given the fact that the proposed WEF and associated power line is within the project area originally assessed for the Brandvalley WEF VIA, it has been assumed that the baseline conditions and receptor locations in the area remain largely unchanged. This assumption was confirmed by way of a desktop assessment and as such, additional fieldwork was not considered necessary.

[1] Formally gazetted on 20 March 2020 (GN No. 320)

4 SUMMARY OF PREVIOUS VIA FINDINGS

EOH Coastal and Environmental Services (EOH CES) undertook a VIA for the proposed 140 megawatt (MW) Brandvalley Wind Energy Facility (WEF) in March 2016. Visual special comment in respect of the amended layout was provided by way of a single page addendum letter dated 02 August 2016, and further comment was provided in respect of the proposed EA amendment (14/12/16/3/3/2/900/AM1) in a letter dated 28 June 2018.

In summary, the original VIA described the landscape in the vicinity of the Brandvalley WEF project area as typically “Karoo”, largely undeveloped with sheep farming being the dominant activity. The prevailing sense of place is largely associated with remoteness, low levels of development and peace and tranquility. High voltage power lines are the only features which detract from the high scenic quality of the area.

The proposed WEF covers a large area of land and the development will contrast strongly with the existing Karoo landscape. Given the height of the proposed turbines and the absence of screening vegetation, turbines are expected to be at least partially visible from a number of local farmhouses, a few guest houses and sections of the R354 main road. Generally however, the level visibility from the identified receptors would vary depending on the presence or absence of topographic screening and the distance from the turbines.

The need for a separate full VIA for the proposed grid connection infrastructure to serve the Brandvalley WEF was not identified as part of the BA process undertaken in for this development. However, potential visual impacts were discussed in the Basic Assessment Report (BAR) for the proposed power line development dated 8 August 2016. It was stated in this report that although the proposed power line will affect the sense of place, the proposed power line route alignment is in close proximity to existing Eskom power lines, and as such the resultant visual impacts would be very low.

4.1 Sensitive Receptors

The previous visual assessment identified thirty (30) farmsteads within a 20 km radius of the Brandvalley WEF turbine layout. The visual impact of the WEF on these homesteads is dependent on the number of turbines visible and their proximity to the turbines (i.e. their visual exposure to the development). It was pointed out that not all of these homesteads are necessarily sensitive to the proposed WEF, as this depends on the occupants’ perception of wind turbines. As such, for the purposes of the VIA, only tourist facilities and the homesteads of interested and affected parties (I&APs) that have objected to the WEF development were considered to be particularly sensitive. In terms of tourist facilities, the Gatsrivier guest farm and Saaiplaas guest farm were identified as sensitive. In addition, homesteads on the farms Zeekoegat and Keurkloof were identified as sensitive receptors due to objections raised by their respective owners.

Although the R354 main road which passes within 5km of the proposed turbines is recognised as a scenic route, it was not identified in the VIA as a potential receptor. However, an

examination of the viewsheds generated for the proposed WEF showed that only a few turbines would be partially visible from very limited sections of this road. From a visual perspective however, the project needs to be seen within the context of the area being a designated Renewable Energy Development Zone (REDZ).

4.2 Identified Impacts

In the previous VIA, the assessment and mitigation of impacts involved the following:

- An assessment of the proposed project against the visual impact criteria (visibility, visual exposure, sensitivity of site and receptor, visual absorption capacity and visual intrusion) for the site;
- An assessment of the impacts based on a synthesis of criteria for each site (criteria = nature of impact, extent, duration, intensity, probability and significance); and
- The formulation of mitigation measures/recommendations with regards to minimising visual impacts.

4.3 Impact Rating

4.3.1 Construction Phase

Two potential causes of visual impact during construction were identified as outlined below.

- Various activities during the construction phase will have impacts on sensitive visual receptors, and the overall significance of these impacts was rated as **Moderate Negative**.
- Construction camps associated with the proposed facility will have a visual impact, affecting the landscape and rural sense of the place of the area, although the degree of impact varies depending on the visibility of the different site alternatives. The overall significance of these impacts was however rated as **Low Negative**.

4.3.2 Operations Phase

Four potential causes of visual impact during operation were identified as outlined below.

- During operation, the WEF is expected to impact visually on sensitive receptors in the area. The overall significance of these impacts was rated as **High Negative**, with few mitigation measures available to reduce the impacts.
- The access roads associated with the proposed facility will result in visual impacts affecting the landscape and rural sense of the place of the area. The overall significance of these impacts was however rated as **Moderate Negative**.
- On-site substations associated with the proposed facility will also result visual impacts affecting the landscape and rural sense of the place of the area. The overall significance of these impacts was however rated as **Moderate Negative**.

- Shadow flicker, resulting from the shade cast by a wind turbine and its rotating blades, may impact on any residences in close proximity to the wind turbines. As there are no buildings within 800m of a wind turbine, there no impacts are anticipated as a result of shadow flicker.

4.3.3 Decommissioning Phase

Impacts during the decommissioning phase will be very similar to those identified in the construction phase and the overall significance of these impacts was rated as **Moderate Negative**.

4.3.4 Cumulative Impacts

The VIA recognised that there are a number of other existing and proposed renewable energy and electrical infrastructure developments in close proximity to the Brandvalley WEF. During construction and operation, these facilities would inevitably change the visual character of the area and alter the inherent sense of place, thus giving rise to significant cumulative impacts. The overall significance of these impacts was rated as **High Negative**, with few mitigation measures available to reduce the impacts.

It was further noted however that the study area is located within the Komsberg REDZ (REDZ 2), and thus the relevant authorities support the concentration of renewable energy developments in this area.

5 SPECIALIST COMMENT

5.1 Proposed WEF

The layout of the proposed WEF, as depicted in **Figure 1** was fully assessed in the VIA undertaken in March 2016, with further visual comment being provided in respect of proposed amendments in August 2016, and in June 2018. It has been established, via desktop assessment using Google Earth imagery, that although the landscape to the north and north-east of Brandvalley WEF is undergoing significant change as a result of the development of the the Roggeveld, Karusa and Soetwater WEFs, there has been little change since 2018 in the baseline characteristics and the number of sensitive receptors across the remainder of the study area.

5.1.1 Amendments to Turbine Specifications

The proposed new turbine specifications would allow for a hub height of 125m and a rotor diameter of 180m, resulting in a maximum height at the blade tip of 215m, some 10m higher than the height currently authorised. While an increase in the height of the turbines would increase the visibility of the WEF, a GIS-based visibility analysis has shown that, in this instance the increase in visibility would be marginal. Visual impacts resulting from the larger turbines would be greatest within a 1km to 2km radius, from where the increased height of the structure would be most noticeable. However, no potentially sensitive receptors were identified within

2km of a wind turbine placement, and the larger turbines as proposed are not expected to increase the impacts experienced by any of the identified receptors.

In addition, the change in the turbine specifications being proposed for the Brandvalley WEF has allowed for a reduction in the number of turbines required for the facility. Hence, a total of twenty-four (24) turbines have now been removed from the layout depicted in **Figure 1**. This has in turn resulted in a slight reduction in the area from which the turbines will be visible (viewshed). In addition, with fewer turbines in evidence, there will be less visual clutter in the landscape and the cumulative impacts would be slightly reduced.

In light of this, and the limited human habitation and relatively remote location of the proposed Brandvalley WEF, the proposed changes in the turbine specifications are not expected to result in any increased visual impacts on the identified receptors, or affect any additional receptors in the surrounding area.

5.1.2 Updates to WEF Layout

As part of this amendment application, Specialists are being asked to assess an updated layout for the proposed Brandvalley WEF as depicted in the Google Earth Layout (WIN-0253-MD-DWG-001-A_Brandvalley Wind Farm EMPr Layout.kmz) received on 29th October 2021. Updated aspects of the layout include:

- A reduction in the number of turbines, resulting in the removal of 24 turbines from the layout. The remaining 34 turbines remain in place (subject to micro-siting);
- An indicative hardstand footprint has been included in the updated layout. The exact orientation, position and dimensions of the hardstands will be subject to minor change pending the final selection of the TSA;
- •Roads with a width of between 9m and 12m widths as stipulated in the respective EIAs (excluding additional width for cut / fill earthworks);
- Substation & O&M facility as per the size and position stipulated in the original EIA;
- MV Collectors will be in the form of cables buried along the roads;
- Site Camp, Laydown Area and Batch Plant have been shifted in line with recommendations made by the contractors.

Considering the fact that the proposed updates in the WEF layout as outlined above do not deviate significantly from the layout assessed in the original EIA and subsequent amendments, it is not anticipated that the final layout will result in any changes in the significance of the impacts identified in the VIA, nor will it result in any additional visual impacts.

5.1.3 Cumulative Impacts

Although the previous VIA considered a number of other existing and proposed renewable energy and electrical infrastructure developments in close proximity to the Brandvalley WEF, it should be noted that there have been some changes in the status of some of these projects in the interim. Construction is either well under way or has been completed in respect of three of

the identified projects, namely Roggeveld, Karuso and Soetwater WEFs. Hence the landscape has already undergone noticeable change.

In addition, Rietkloof and Brandvalley WEFs have both been awarded preferred bidder status and one new project in the broader area has been granted EA and awarded preferred bidder status. This project, namely Oya Energy Facility is a combined Solar PV and Fuel-based Generator Facility (FBGF), located some 15kms north-west of the proposed Brandvalley WEF. Although the different technologies are expected to have different impacts, all renewable energy developments and associated grid connection infrastructure are relevant as they contribute to the alteration of the visual character of the broader area. In this instance however, given the distance from the Brandvalley WEF and the hilly topography in the broader area which limits the visibility of the facility, it is not anticipated that this development will result in any significant increase in the cumulative impacts affecting the landscape or the visual receptors **within** the assessment area for the Brandvalley project.

Having considered the new information relating to renewable energy developments in the broader area, the overall significance of cumulative impacts remains as **High Negative**, with few mitigation measures available to reduce the impacts.

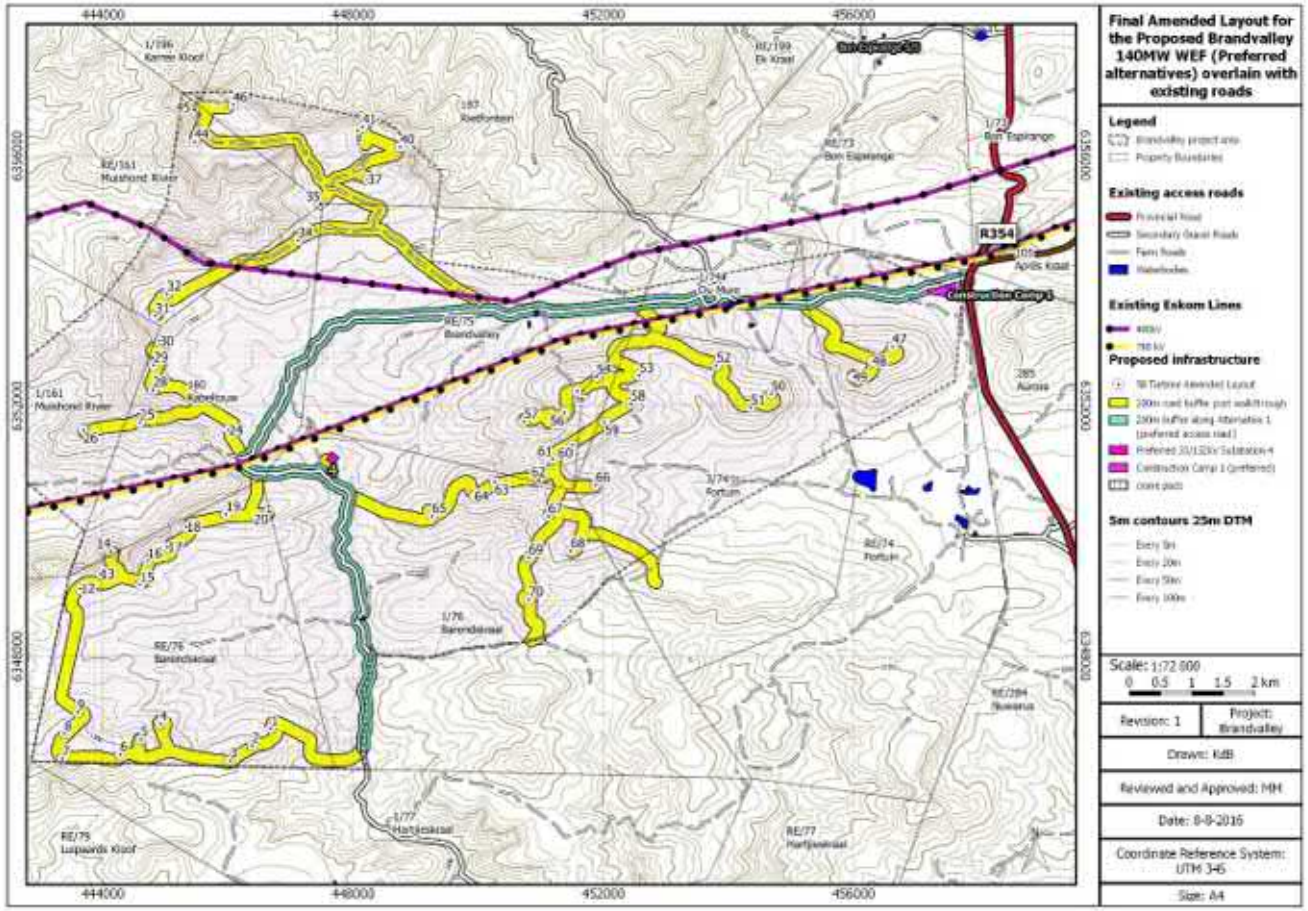


Figure 1: Amended Brandvalley WEF layout

5.2 Sensitivities identified by the National Web-Based Environmental Screening Tool

5.2.1 Proposed WEF

In support of this visual specialist comment report, consideration was given to the Landscape and Flicker Themes of the National Environmental Screening Tool. Under the Landscape Theme, as shown in **Figure 2** below, the tool identifies areas of Very High and High sensitivity in respect of WEF development within the Brandvalley WEF project area. According to the Screening Tool, the high sensitivity rating applied to the project area is associated with the presence of natural features such as mountain tops, high ridges and steep slopes. Based on these criteria, a significant portion of the site would be ruled out for WEF development.

The Screening Tool is however a very high level, desktop study and as such the results of the study must be viewed against factors affecting visual impact, such as:

- the presence of visual receptors;
- the distance of those receptors from the proposed development; and
- the likely visibility of the development from the receptor locations.

As most of the turbines are located on these ridges, they will theoretically be visible from a number of visual receptors. In general however, the development is positioned in such a way that, in many cases the turbine structures will be partially screened from view by topographic features. In addition, viewing distance must be considered when assessing visual impacts, as beyond a certain distance, even large developments tend to be much less visible, and are difficult to differentiate from the surrounding landscape. The visibility and degree of likely exposure of the proposed development from the identified receptors was examined in detail in the original VIA for the Brandvalley WEF. Aside from the fact that most of the receptors are more than 5km from the nearest wind turbine, many of the receptors identified as being “highly exposed” to the proposed development are in fact homesteads located on farms that are within the project areas for other proposed WEF projects. In light of this, visual impacts of turbine development on the ridges will be reduced to some degree.

In addition, the proposed development is located within a designated REDZ, and thus the relevant authorities support the concentration of renewable energy developments and associated transformation in this area.

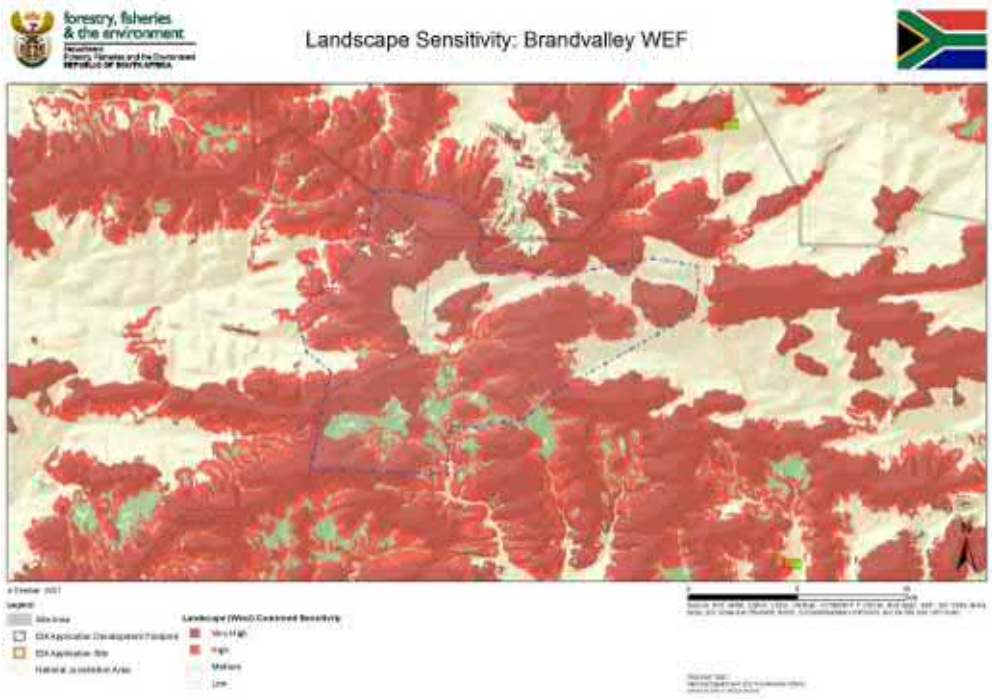


Figure 2: Relative Landscape Sensitivity (October 2021)

The flicker theme demarcates areas (1 km buffers) of sensitivity around identified receptors in the area (**Figure 3**). Under this theme, several "receptors" have been identified within the Brandvalley WEF project area, and the buffers demarcated around these receptors have been assigned a "very high" sensitivity rating. Based on the findings of the original VIA as well recent field investigations conducted for another VIA in this area, it has been determined that many of the receptors identified by the Screening Tool are not in fact receptors. In addition, potential impacts resulting from shadow flicker were assessed in the previous VIA for the Brandvalley WEF and it was concluded that there are no buildings within 800m of a wind turbine and as such the proposed turbine layout is not expected to result in any flicker impacts affecting the identified receptors.

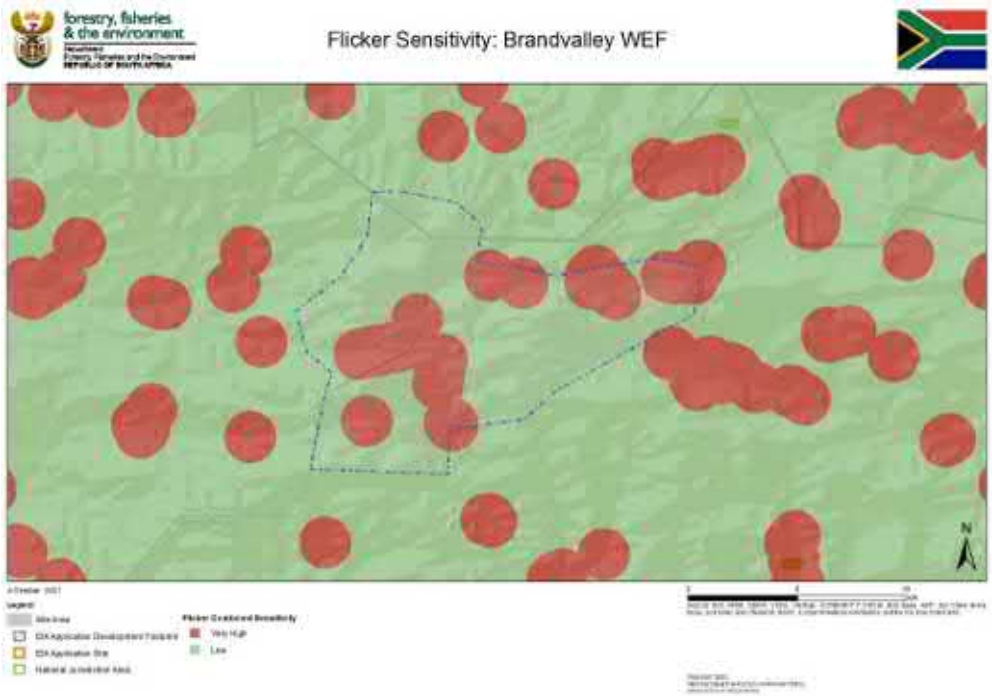


Figure 3: Flicker Sensitivity (October 2021)

5.2.2 Proposed Grid Connection Infrastructure

The National Environmental Screening Tool does not identify any landscape sensitivities in respect of the proposed grid connection.

6 132KV POWER LINE EMPR

A Draft EMPr for the proposed 132kV power line to serve Brandvalley WEF was compiled by EOH CES in June 2016 and was included in the BAR submitted for the proposed development. This EMPr does not however include any specific mitigation measures in respect of visual impacts resulting from the proposed power line. In light of this, the potential visual impacts that may result from the power line development have been re-assessed with a view to formulating mitigtiation measures for inclusion in the EMPr. Consideration has been given in this assessment to the proposed power line route alignment and substation layout as presented in the Google Earth file (WIN-0253-IN-DWG-007-A_Brandvalley EMPr Layout - 132kV BV to Bon Espirange.kmz) received on 29th October 2021.

6.1 Identification of Potential Impacts associated with power lines

Potential visual issues / impacts resulting from the proposed development of the power line and associated electrical infrastructure to serve the proposed Brandvalley WEF are outlined below.

6.1.1 Construction Phase

- Potential visual intrusion resulting from large construction vehicles and equipment;

- Potential visual impacts of increased dust emissions from construction activities and related traffic;
- Potential visual scarring of the landscape as a result of site clearance and earthworks; and
- Potential visual pollution resulting from littering on the construction site.

6.1.2 Operational Phase

- Potential alteration of the visual character of the area;
- Potential visual intrusion resulting from infrastructure dominating the skyline in a largely natural / rural area;
- Potential visual effect on surrounding farmsteads; and
- Potential alteration of the night time visual environment as a result of operational and security lighting at the associated substations .

6.1.3 Decommissioning Phase

- Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process;
- Potential visual impacts of increased dust emissions from decommissioning activities and related traffic; and
- Potential visual intrusion of any remaining electrical infrastructure on the site.

6.2 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

Impact	Mitigation / Management Objectives	Mitigation / Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
A. CONSTRUCTION PHASE					
A.1. VISUAL IMPACTS					
Potential impact on visual resources as a result of the proposed power line and electrical infrastructure.	Avoid or minimize construction impacts on existing visual resources and potentially sensitive receptor locations in the surrounding area. .	○ Carefully plan to minimise the construction period and avoid construction delays. ○ Inform any receptors within 500m of construction works of the construction programme and schedules. ○ Position storage/stockpile areas in unobtrusive positions in the landscape, where possible. ○ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ○ Vegetation clearing should take place in a phased manner. ○ Make use of existing gravel access roads where possible. ○ Limit the number of vehicles and trucks travelling to and from the construction, where possible. ○ Ensure that dust suppression techniques are implemented: ○ on all access roads;	Ensure that visual management measures are monitored by an ECO. This will include monitoring activities associated with visual impacts such as the siting and management of soil stockpiles, screening and dust suppression. Regular reporting to an environmental management team must also take place during the construction phase.	Ongoing during construction	▪ Main Contractor (MC), Environ-mental Officer (EO) and ECO

Impact	Mitigation / Management Objectives	Mitigation / Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		○ in all areas where vegetation clearing has taken place; ○ on all soil stockpiles. ○ Maintain a neat construction site by removing litter, rubble and waste materials regularly.			
B. OPERATION PHASE					
B.1. VISUAL IMPACTS					
Potential impact on visual resources as a result of the proposed grid connection infrastructure.	Avoid or minimize operational impacts on existing visual resources and potentially sensitive receptor locations in the surrounding area.	○ Where possible, limit the amount of security and operational lighting present at substations. ○ Where possible, avoid placing lights on pylon structures. ○ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ○ Lighting fixtures should make use of minimum lumen or wattage. ○ Mounting heights of lighting fixtures should be limited, or alternatively, foot-light or bollard level lights should be used. ○ Where possible, limit the number of maintenance vehicles using access roads. ○ Buildings on the substation sites should be painted with natural	Ensure that visual mitigation measures are monitored by the management team on an on-going basis. This will include monitoring activities associated with visual impacts such as the control of signage, lighting and maintenance vehicles on access roads.	Ongoing during operation	▪ ESKOM

Impact	Mitigation / Management Objectives	Mitigation / Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		tones that fit with the surrounding environment. ○ Non-reflective surfaces should be utilised where possible.			
C. DECOMISSIONING PHASE					
C.1. VISUAL IMPACTS					
Potential impact on visual resources as a result of the proposed grid connection infrastructure.	Avoid or minimize impacts of decommissioning activities on existing visual resources and potentially sensitive receptor locations in the surrounding area.	○ Carefully plan to reduce the decommissioning period. ○ Inform receptors within 500m of decommissioning works of the decommissioning programme and schedules. ○ All infrastructure that is not required for post-decommissioning use should be removed. ○ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ○ Make use of existing gravel access roads where possible. ○ Limit the number of vehicles and trucks travelling to and from the proposed sites, where possible. ○ Ensure that dust suppression techniques are implemented: ○ on all access roads;	Ensure that procedures for the removal of structures and stockpiles during decommissioning are implemented, including recycling of materials. In addition, it must be ensured that rehabilitation of the site to a visually acceptable standard is undertaken.	During decommissioning	▪ MC, EO and ECO

Impact	Mitigation / Management Objectives	Mitigation / Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		○ in all areas where vegetation clearing has taken place; and ○ on all soil stockpiles.			

7 CONCLUSION

7.1 Brandvalley WEF

SiVEST has assessed the previous VIAs undertaken in respect of the proposed Brandvalley WEF in conjunction with the proposed changes to the turbine specifications and the updated layout (*WIN-0253-MD-DWG-001-A_Brandvalley Wind Farm EMPr Layout.kmz received on 29th October 2021*). Based on this assessment, it is SiVEST's opinion that the proposed amendments do not give rise to any additional impacts or exacerbate the impacts previously identified in the VIA for this development. No additional mitigation measures or specialist input into the EMPr are deemed necessary. Given the low level of human habitation and the relative absence of sensitive receptors in the area, the amended turbine specifications and updated site layout are deemed acceptable from a visual perspective and the Environmental Authorisation (EA) should be amended. SiVEST is of the opinion that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.

7.2 132kV Power Line

From a visual perspective, potential impacts of the proposed power line have been identified and suitable mitigation measures have been recommended for input into the updated EMPr for the proposed power line.

8 REFERENCES

- Barthwal, R. 2002. Environmental Impact Assessment. New Age International Publishes, New Delhi.
- Breedlove, G., 2002. A systematic for the South African Cultural Landscapes with a view to implementation. Thesis – University of Pretoria.
- Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: *Edition 1.* CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.
- Treasure Karoo Action Group website: http://treasurethekaroo.co.za/
- Vissering, J., Sinclair, M., Margolis, A. 2011. State Clean Energy Program Guide: A Visual Impact Assessment Process for Wind Energy Projects. Clean Energy State Alliance.

SiVEST Environmental Division
12 Autumn, Rivonia. 2128. South Africa
PO Box 2921, Rivonia. 2128. South Africa

Tel + 27 11 798 0600
Fax +27 11 803 7272
Email info@sivest.co.za
www.sivest.co.za

Contact Person:Kerry Schwartz
Tel No.: +27 11 798 0632
Email: kerrys@sivest.co.za

APPENDIX

K HERITAGE WALKDOWN REPORT

HERITAGE WALKDOWN REPORT

for the approved Brandvalley WEF near Matjiesfontein in the Western and Northern Cape

Prepared by

CTS HERITAGE

In Association with

WSP

September 2021

EXECUTIVE SUMMARY

Brandvalley Wind Farm (Pty) Ltd, a subsidiary of G7 Renewable Energies (Pty) Ltd, has received approval to develop a 140 megawatt (MW) Wind Energy Facility (WEF) near Laingsburg, on the border of the Northern Cape Province and the Western Cape Province in South Africa. The authorised WEF is located in the Karoo Hoogland, the Witzenberg (Ceres) and the Laingsburg Local Municipalities, which fall within the Namakwa, the Cape Winelands and the Central Karoo District Municipalities, respectively. It comprises of up to 58 turbines, with a generating capacity of between 1.5MW and 4MW each.

In response to the original Heritage Impact Assessment completed by Booth in 2016, it was recommended by SAHRA and HWC that a more detailed archaeological assessment be conducted of the final layout of the proposed infrastructure to be developed as part of the Brandvalley WEF project. This recommendation was reiterated as a condition of authorisation in the original EA granted for the Brandvalley WEF project in 2016. The final layout for the Brandvalley WEF avoids impact to all known significant heritage resources present within the development area. The walkdown of the final layout revealed no new significant heritage resources that are likely to be impacted. It is therefore recommended that this report is accepted as satisfying this condition of the Environmental Authorisation issued for the Brandvalley West WEF project.

One of the other conditions of the EA issued was that "After initial vegetation clearance has taken place but before the ground is levelled for construction, a professional palaeontologist must undertake a walkthrough and document any identified paleontological findings. The survey/walkthrough must be conducted as per the South African Heritage Resources Agency (SAHRA) requirements."

However, the PIA completed for this project concluded that "The overall impact significance of the construction phase of the proposed wind energy project is assessed as LOW (negative) in terms of palaeontological heritage resources." The one area of high palaeontological significance identified in the PIA i.e. the occurrence of very rare tetrapod burrows and associated skeletal remains within the Abrahamskraal Formation along the Kabeltou Pass (Muishond Rivier 161) is located well away from all proposed WEF infrastructure and no negative impact to this area is anticipated.

Almond (2016) concludes that "The great majority of the Brandvalley WEF study area is assessed as being of low palaeontological sensitivity due to the scarcity of significant fossil vertebrate, plant and other remains here. Sensitive no-go areas within the proposed development footprint itself have not been identified in this study… Highly sensitive "no-go" areas within the proposed development footprint itself have not been identified in this study. Pending the potential discovery of substantial new fossil remains during construction, specialist palaeontological mitigation is not recommended for the Brandvalley WEF project." It is therefore recommended that the condition of the EA regarding the palaeontological walkdown is not appropriate for this project.

A Conservation Management Plan will be drafted for the Brandvalley WEF as required by SAHRA and in the EA for the project.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

CTS HERITAGE

CONTENTS

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

1. INTRODUCTION

1.1 Background Information on Project

Brandvalley Wind Farm (Pty) Ltd, a subsidiary of G7 Renewable Energies (Pty) Ltd, has received approval to develop a 140 megawatt (MW) Wind Energy Facility (WEF) near Laingsburg, on the border of the Northern Cape Province and the Western Cape Province in South Africa. The authorised WEF is located in the Karoo Hoogland, the Witzenberg (Ceres) and the Laingsburg Local Municipalities, which fall within the Namakwa, the Cape Winelands and the Central Karoo District Municipalities, respectively. It comprises of up to 58 turbines, with a generating capacity of between 1.5MW and 4MW each.

The Brandvalley Wind Energy Facility (WEF) is proposed on the border of the Northern Cape and Western Cape along the R354 road which connects Matjiesfontein to Sutherland. This project is the third phase (Phase 3) of a series of projects which started in 2011 with the proposed establishment of the Roggeveld Wind Energy Facility (CaseID 473). The original Roggeveld WEF project was broken down into smaller WEFs in 2013. The first of these was the Roggeveld Wind Farm Phase 1 (CaseID 4503). This was followed by the Karreebosch Wind Energy Project (Roggeveld Phase 2) (CaseID 6884) in 2014/2015. The proposed Brandvalley and Rietkloof WEFs are Phases 3 and 4 of the original project although the extent of the farms affected by the various developments have changed since the inception of the project.

The authorised Brandvalley Wind Energy Facility (WEF) falls within both the Western Cape and the Northern Cape and as such, falls under the jurisdiction of two separate Heritage Authorities. Heritage Western Cape (HWC) is the authority with the competence to manage heritage resources in the Western Cape and the National Authority, the South African Heritage Resources Agency (SAHRA) manages heritage resources in the Northern Cape.

On 2 September 2016, SAHRA issued a Final Comment on the Brandvalley WEF development in terms of section 38(8) of the NHRA. In this comment, SAHRA endorsed and supported the recommendations made in the Heritage Impact Assessment and made a number of recommendations (see attached Annexure A). SAHRA's Final Comment stated:

- If the layout of the turbines, roads and other associated infrastructure proposed for the Northern Cape section of the development is altered, a heritage walk-down including a palaeontological walk-down must be conducted prior to construction. A Walk-Down report must be submitted to SAHRA for comment. No construction may commence without comments from SAHRA;
- It is noted that Turbine 42 has now been excluded from the proposed revised layout. Previously issued comments noted an indirect impact on palaeontological resources, as Turbine 42 would have been located approximately 100m from plant stem casts or burrows (Loc 194). As this turbine has been removed, the impact should decrease, however careful monitoring of the area near Loc 194 during the construction of the access roads must be conducted by the ECO for any additional plant stem casts or burrows;
- If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted. If unmarked human burials are uncovered, the

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

SAHRA Burial Grounds and Graves (BGG) Unit (Itumeleng Masiteng/Mimi Seetelo 012 320 8490), must be alerted immediately. A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the findings. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required.

- SAHRA must be informed if the Environmental Authorisation for the project is granted and the relevant documents should be uploaded to the case file.

On 20 October 2016, HWC issued a Final Comment on the Brandvalley WEF development in terms of section 38(8) of the NHRA. and made a number of recommendations (see attached Annexure B). HWC's Final Comment stated:
The Committee supports the recommendations of the HIA, subject to the following conditions:

- The 20-30 metre buffers proposed in the archaeological specialist study for archaeological sites (BV SAI, BV SA2, BV SA3, BV SA4, BV SA5, BV SAZ, BV SW2, BV SW16), graveyard (BVGI) and built environment sites (BV HS3, BV HS5 and BV SW12) should be implemented and respected throughout the lifetime of the project, unless mitigation measures are undertaken in terms of a workplan;
- The standard buffer of 500 meters from any wind turbine that applies to occupied buildings must be equally applied to all unoccupied buildings, older than 60 years, on the site.
- All stone-walled sites, regardless of whether they have been identified prior to construction or not, should be regarded as no-go areas. If they cannot be avoided then they should be reported to an archaeologist who would advise on the need for mitigation;
- The highly sensitive palaeontological area (very rare tetrapod li.e. terrestrial vertebrate) burrows and associated skeletal remains within the Abrahamskraal Formation along the Kabeltou Pass (Muishond Rivier 161) in the northwest of the study area should be regarded as a no-go area at all times;
- A targeted walk-down of the final layout must be conducted by an archaeologist, approved by the responsible heritage authority (and with relevant qualifications and experience and professional standing in heritage management in terms of S 38 (2) (a)), at least six months prior to construction in order to determine whether any archaeological recording and mitigation measures may still be required and to identify any further sites in proximity to the footprint that need to be mitigated or treated as no go areas during all phases of the project. A report to HWC is required for approval;
- The ECO must be briefed on what to look out for in terms of archaeological and palaeontological heritage resources that might be revealed during construction and must monitor all major surface clearance and deeper (>1m) excavations for fossil material (bones, teeth, petrified wood etc.) in the construction phase; The ECO must report as mentioned below.
- If any archaeological material, palaeontological material or human burials are uncovered during the course of development then work in the immediate area must be halted and the find protected *in situ* as far as is possible. The find would need to be reported to the heritage authorities and may require inspection by an appropriate heritage practitioner. Such heritage is the property of the state and may require excavation and curation in an approved institution.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

EA was granted for the Brandvalley WEF on 23 November 2016. In the EA, various requirements were stipulated in terms of impacts to Historical, Cultural and Palaeontological sites (Table 1 below).

Table 1: EA requirements for Heritage

EA Requirements	*Implementation*
A conservation management plan as required by SAHRA	To be completed
A 30m buffer must be applied around all identified archaeological sites	Adhered to in the final layout
After initial vegetation clearance has taken place but before the ground is levelled for construction, a professional palaeontologist must undertake a walkthrough and document any identified paleontological findings. The survey/walkthrough must be conducted as per the South African Heritage Resources Agency (SAHRA) requirements.	At construction
Should any archaeological sites, artefacts, paleontological fossils or graves be exposed during construction work, work in the immediate vicinity of the find must be stopped, SAHRA must be informed and the services of an accredited heritage professional obtained for an assessment of the heritage resources to be made	During construction
Construction managers/foremen must be informed before construction starts on the possible types of heritage sites and cultural material that may be encountered and the procedures to follow when they find sites.	At construction
All buffers and no-go areas stipulated in this report must be adhered to for both the facilities and all roads and powerlines.	During construction
Should any human remains be uncovered during development they must be immediately protected in situ and reported to the heritage authorities or to an archaeologist. The remains will need to be exhumed at the cost of the developer.	During construction
All construction and maintenance crew and vehicles (except small vehicles which may use existing farm tracks) should be kept out of the buffer zones.	During construction
The final layout should be shown to the appointed archaeologist before implementation to confirm that all significant heritage resources have been adequately protected.	This report satisfies this requirement

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

1.2 Description of Property and Affected Environment

The Brandvalley WEF is nearly 30km north of Matjiesfontein on the western side of the R354 that connects Sutherland to Matjiesfontein. This WEF is one of a number of other WEFs that are proposed in the area between Sutherland, Matjiesfontein, the Ceres Karoo and the Moordenaars Karoo. The turbines are mainly located on the top of a series of moderately high ridges and koppies that characterise the study area. The WEF can be accessed via Brandvalley and Fortuin farms or via Barendskraal farm when driving up through the kloofs on the southwestern end of the area. The Snydersberg is a prominent landmark in the northwestern area.

The agricultural activities have predominantly consisted of sheep farming with very small scale crop agriculture such as onion seeds accompanied by subsistence farming. Ruins dot the area along the gravel access roads linking up the old farms but the extended drought in the mid 2010s has made a noticeable impact on the vegetation and water levels available. A prolonged water shortage is still in place at Sutherland to the north and much of the farming activities have been scaled back to adapt to the intensely arid conditions experienced here. The vegetation consists of succulent karoo bushes and much of the terrain is broken and rocky.

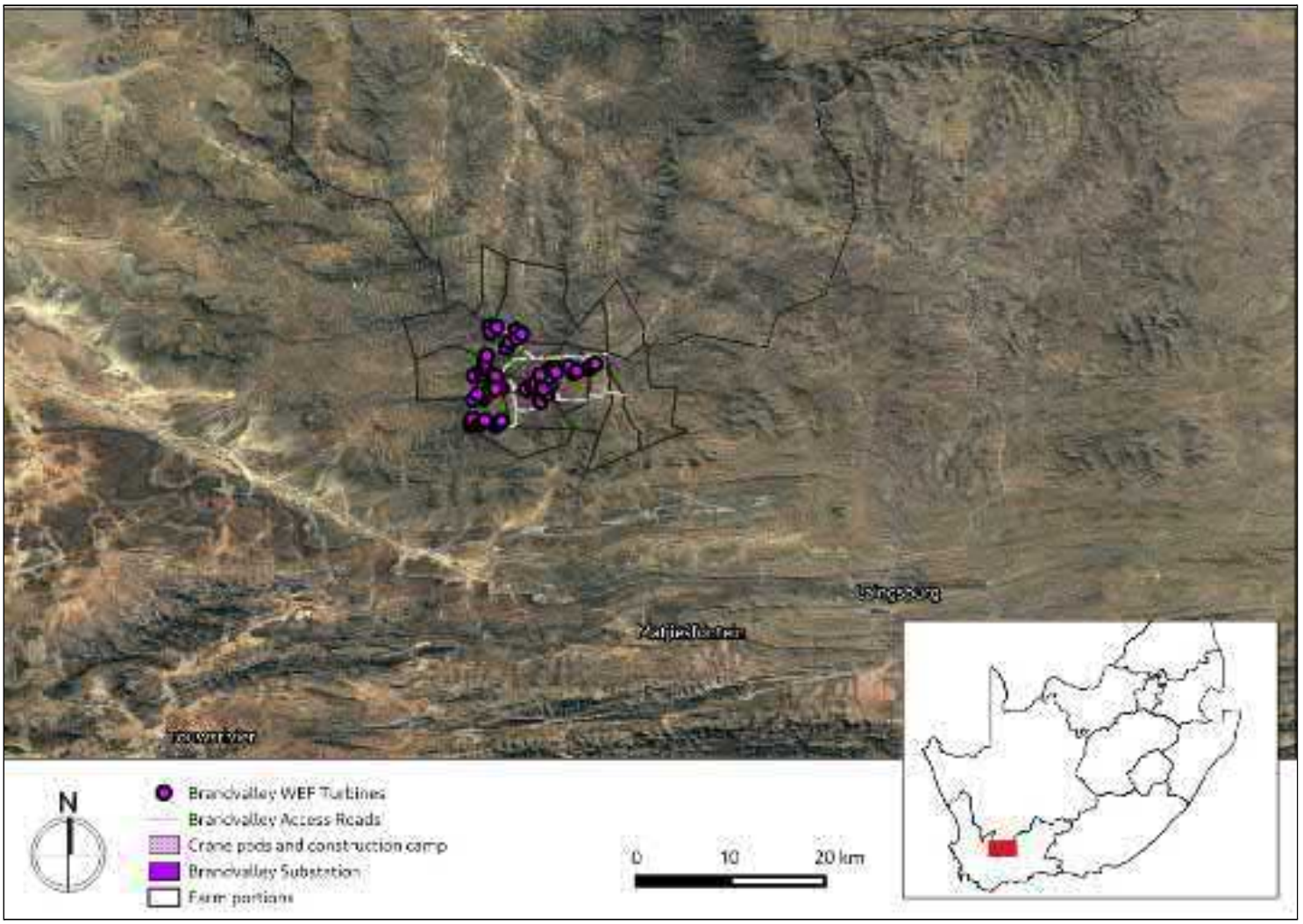


Figure 1.1: Close up satellite image indicating proposed location of the Brandvalley WEF development

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

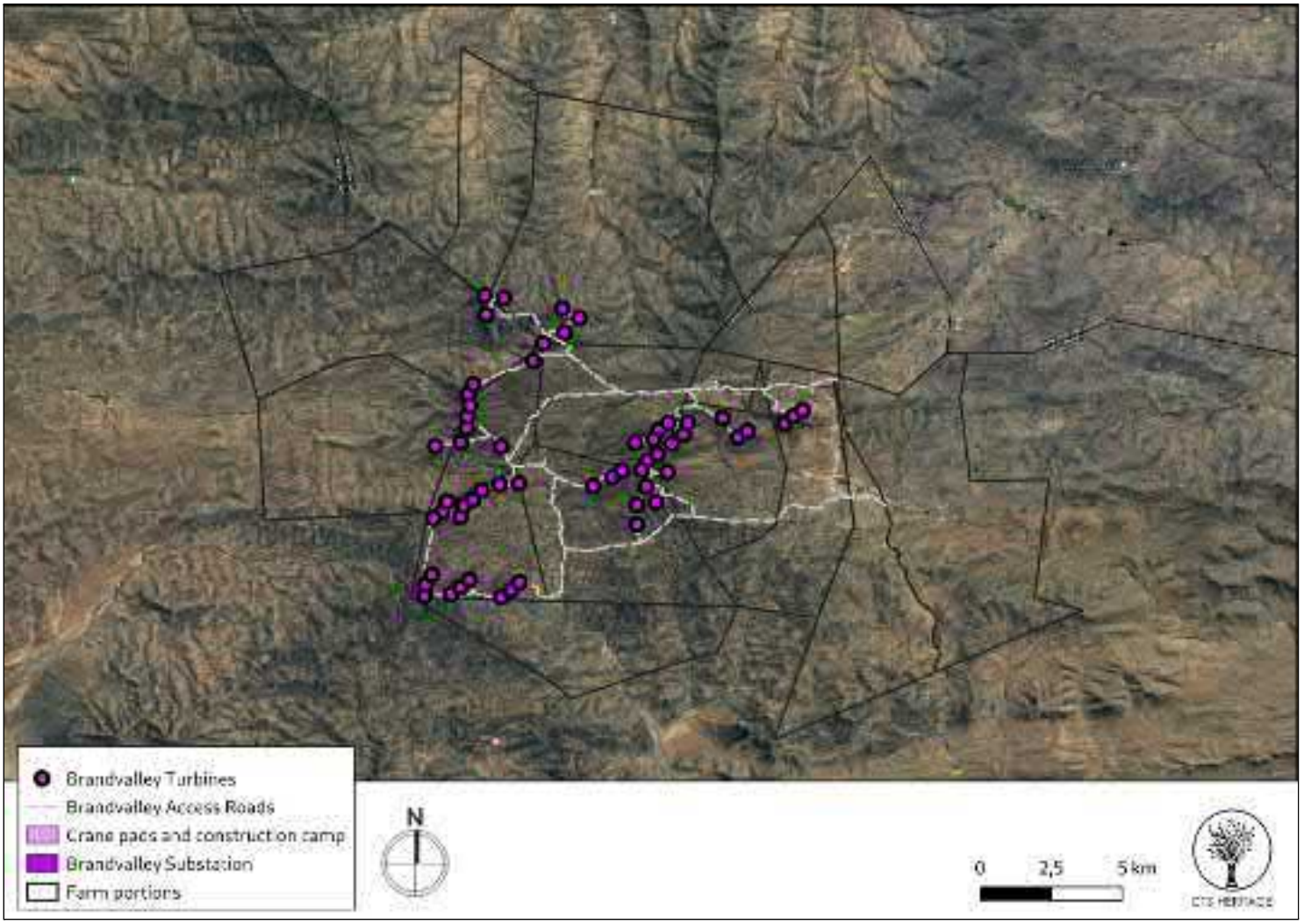


Figure 1.2: Final proposed layout for the Brandvalley WEF development

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

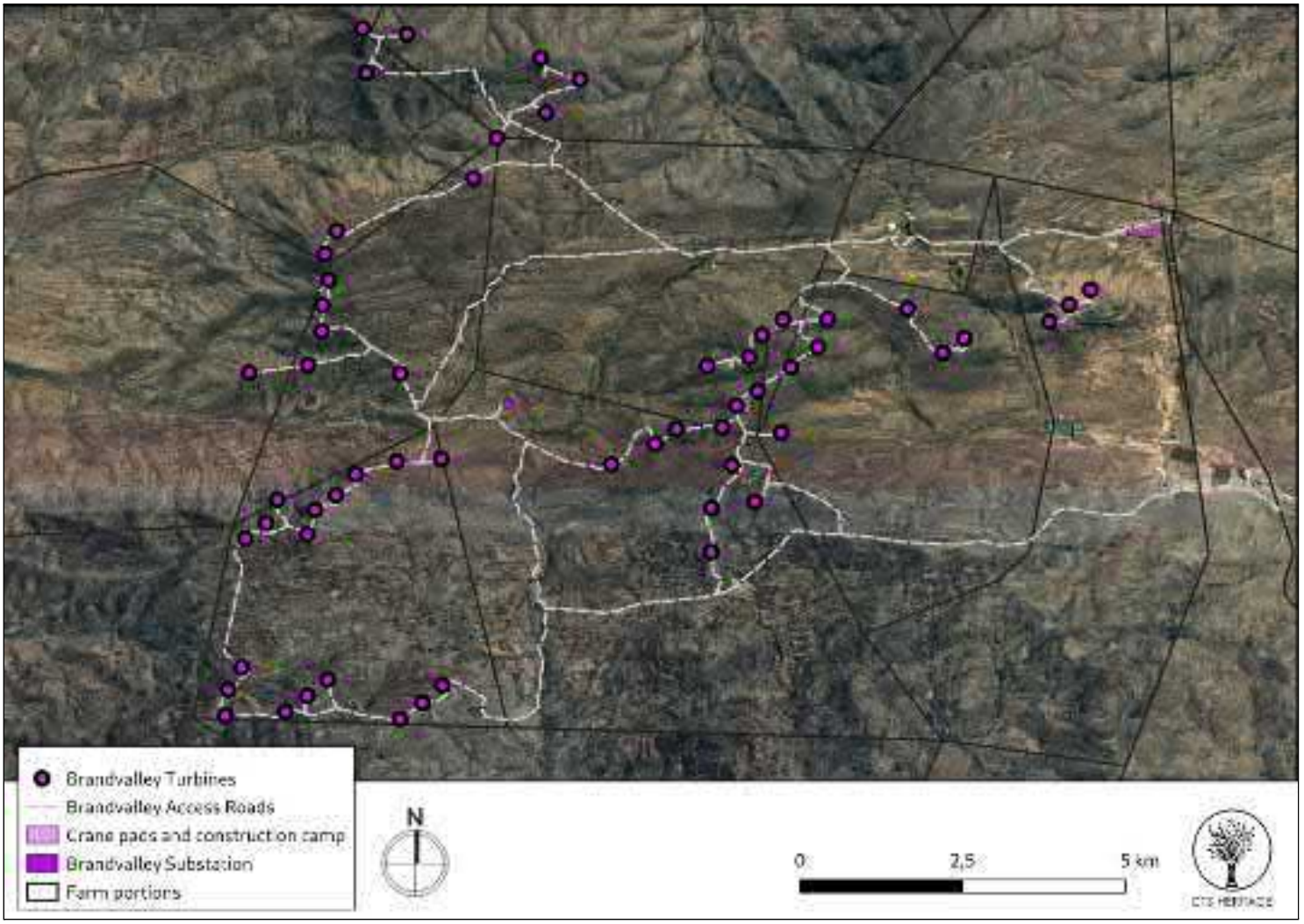


Figure 1.3: Final proposed layout for the Brandvalley WEF development

2. METHODOLOGY

2.1 Purpose of Walkdown

In the conditions of the Environmental Authorisation (2016), it was required that the final layout should be shown to the appointed archaeologist before implementation to confirm that all significant heritage resources have been adequately protected. This was also required by both HWC and SAHRA. As the final layout of the Brandvalley WEF has changed, an archaeological walkdown was completed.

2.2 Summary of steps followed

- An archaeologist conducted a full detailed walkdown and micro-siting of the Final development footprint for the Brandvalley WEF between 24 and 28 July 2021 to determine what archaeological resources are likely to be impacted by the approved development.
- The area proposed for development was assessed on foot and by 4x4 vehicle, photographs of the context and finds were taken, and tracks were recorded (at 20m intervals) using a GPS.
- The identified resources were assessed to evaluate their heritage significance in terms of the grading system outlined in section 3 of the NHRA (Act 25 of 1999).

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

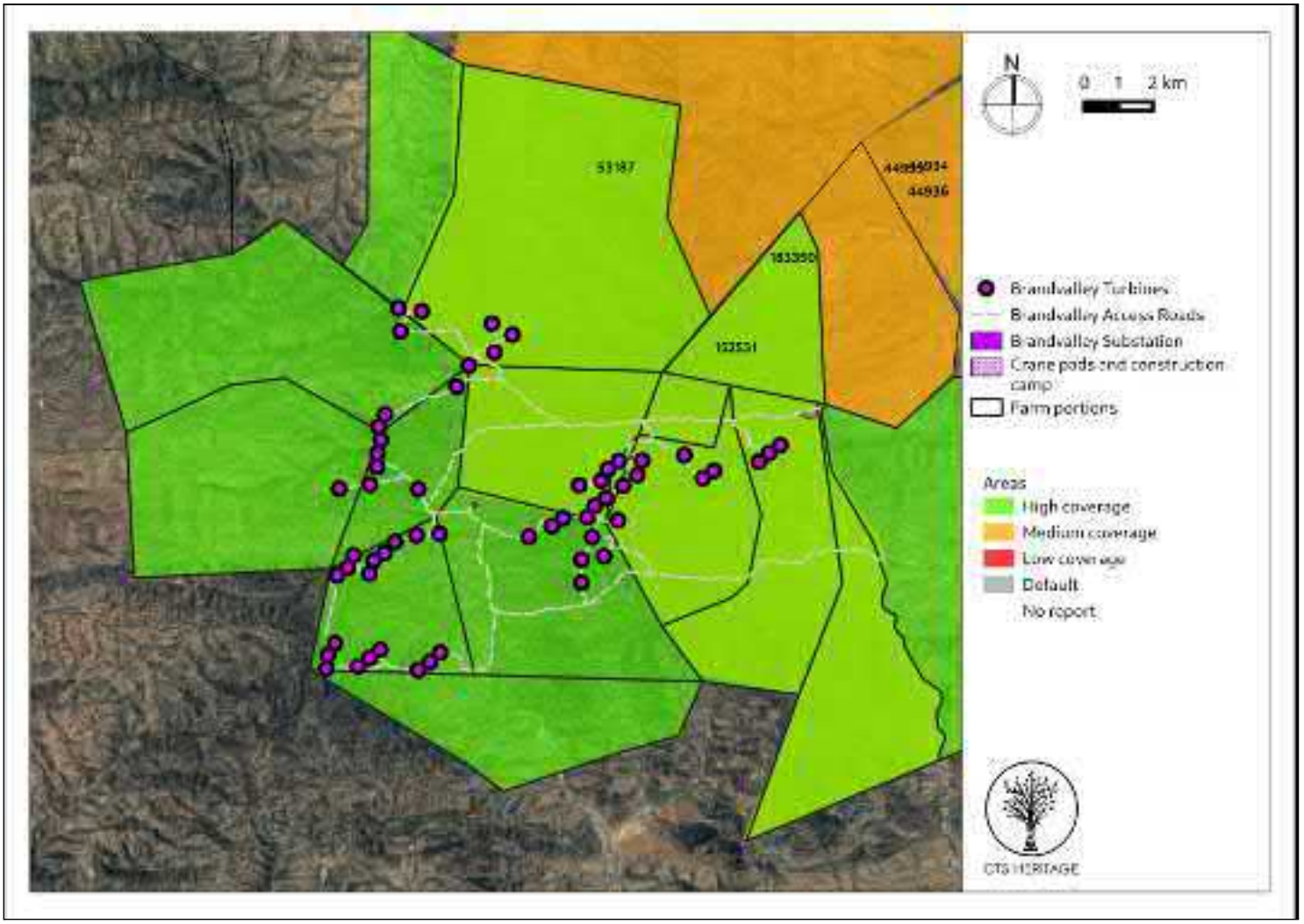


Figure 2: Close up satellite image indicating proposed location of development in relation to heritage studies previously conducted

2.3 Constraints & Limitations

While the overall archaeological visibility was high as the vegetation cover is relatively sparse, movement across this terrain is challenging underfoot as the ridges are covered with eroding sandstone, slates and greywhacke. Recording of historical layering of heritage resources such as stock kraals, ruins, windmills and dams was relatively unencumbered as the ridges and access roads provided ample access to identify these structures. Stone Age material was concentrated lower down the valleys, albeit rarely in great densities, while isolated flakes were encountered higher up on the ridges.

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

The area proposed for the Brandvalley WEF is located immediately adjacent to the proposed Karreebosch and Rietkloof WEFs and is located within a REDZ area. The results of the heritage assessments completed for these projects have relevance here.

The area proposed for development is located approximately 30km north of Matjiesfontein and is in the southern

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Roggeveld. This part of the Karoo is prized for its wide-open spaces and expansive vistas. Hart et al. (2016) note that the cultural landscape of this area is agricultural in nature, and consists of mostly stock farming with very occasional agriculture. The area is isolated with natural qualities and semi-desert landscapes. The interaction between the topography, geology, flora and historical remnants of human occupation of the area form a unique cultural landscape.

The Karrebosch HIA (2015) "revealed that the study area is relatively austere in terms of pre-colonial heritage, however valley bottoms contain evidence of early trekboer cultural landscapes – ruins, graves and occasional middens. These consist of collections of ruined stone and mud buildings, threshing floors and kraals located exclusively in the valley areas between the high longitudinal ridges that characterise the study area. There are a number of existing farm houses that contain 19th century fabric, however very few of these have anything more than moderate heritage significance. Parts of the study area enjoy very high aesthetic qualities with the area known by locals as "Gods Window" having grade II aesthetic qualities, hence the significance of the study area lies mainly with its undeveloped wilderness qualities. Interestingly, pre-colonial or stone age heritage and archaeology is extremely scarce in the areas that were searched. Very few archaeological sites of these kinds were recorded despite the fact that overall 9 experienced archaeologists were involved in scouring the landscape."

The HIA for the Karrebosch WEF notes that "The most important colonial archaeological sites in the study area are associated with Ekkraal Valley, the Rietfontein-Wilgebosch River valley and the Krans Kraal-Karrekraal valley. The valley bottoms are archaeologically sensitive…". Similar findings were made by ACO in their report (2010, SAHRIS Ref: 53187) for developments in close proximity. According to the ACO reports (2011, 2013 and 2015), parts of the study area enjoy very high aesthetic qualities hence the significance of the study area lies mainly with its undeveloped wilderness qualities which may be negatively impacted by the development of the proposed development.

Similar findings were made by Booth in HIA completed for the Rietkloof WEF HIA (2016). Booth (2016) notes that the Rietkloof WEF area "held several historical features (stone walling kraals and cottages) some with associated historical artefacts situated along the access roads in the valleys and associated with the homestead settlements. The area, however, also held evidence of both Middle and Later Stone Age stone artefacts alongside water courses and on the flat floodplains."

However, it must be noted that the proposed development is located within a Renewable Energy Development Zone which has been identified for this kind of development. In REDZ areas, there is a reasonable expectation that the cultural landscape of an area will be changed to be dominated, or at least heavily altered, by renewable energy development and its associated infrastructure. In fact, this is the intention of the REDZ areas.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

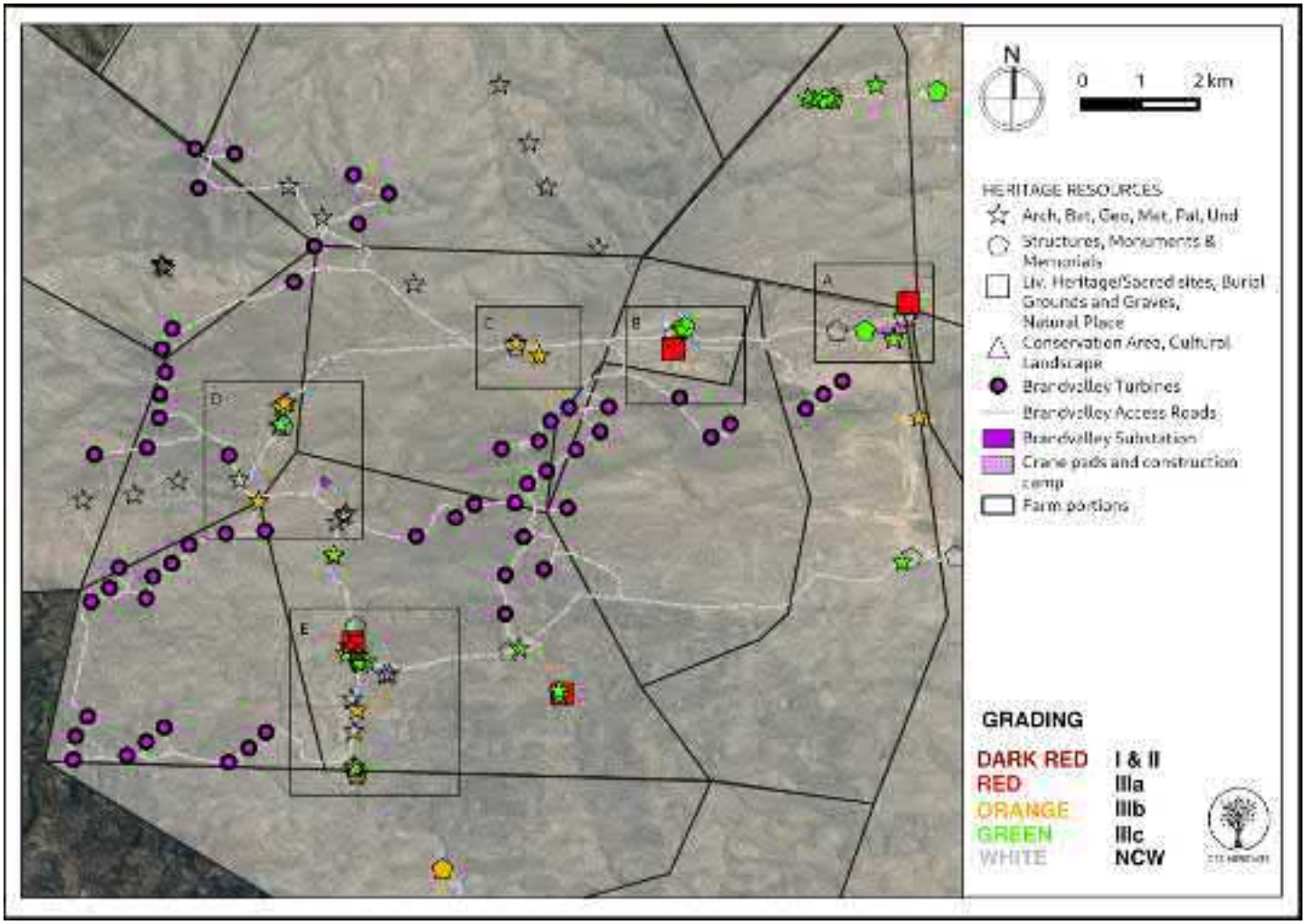


Figure 3. Heritage Resources Map. Heritage Resources previously identified in and near the study area from SAHRIS

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

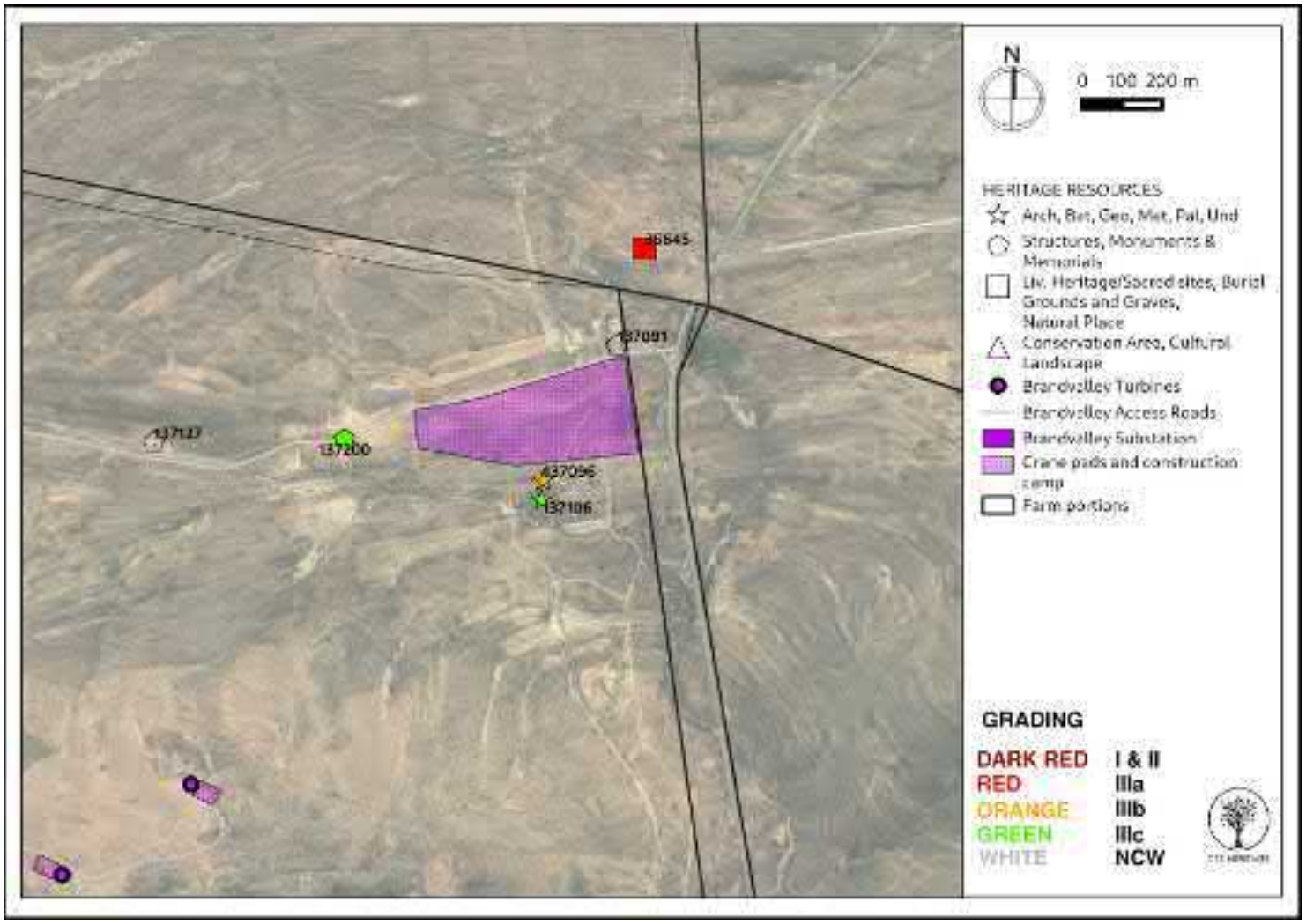


Figure 3.1. Heritage Resources Map. Inset A

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

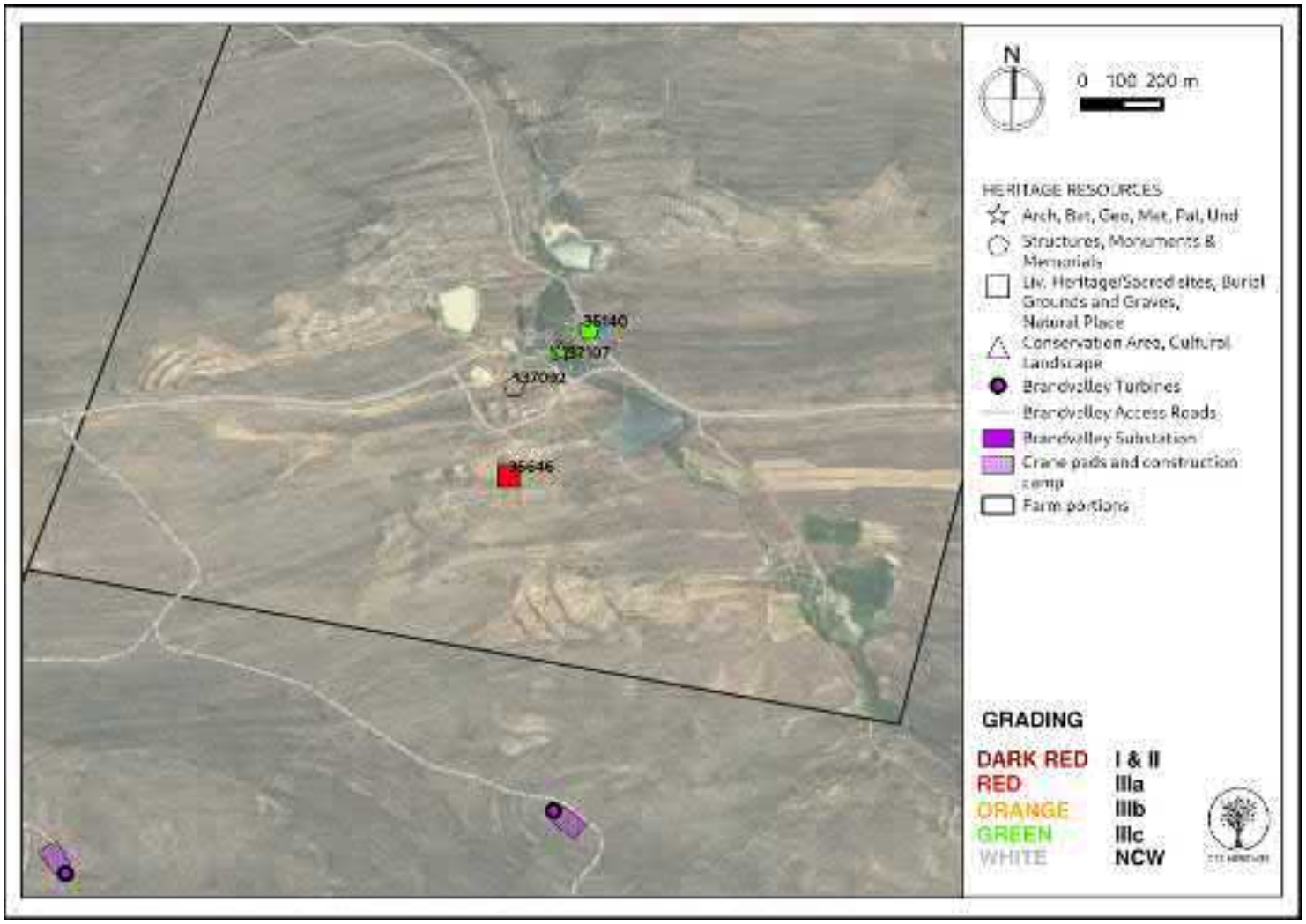


Figure 3.2. Heritage Resources Map. Inset B

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 3.3. Heritage Resources Map. Inset C

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

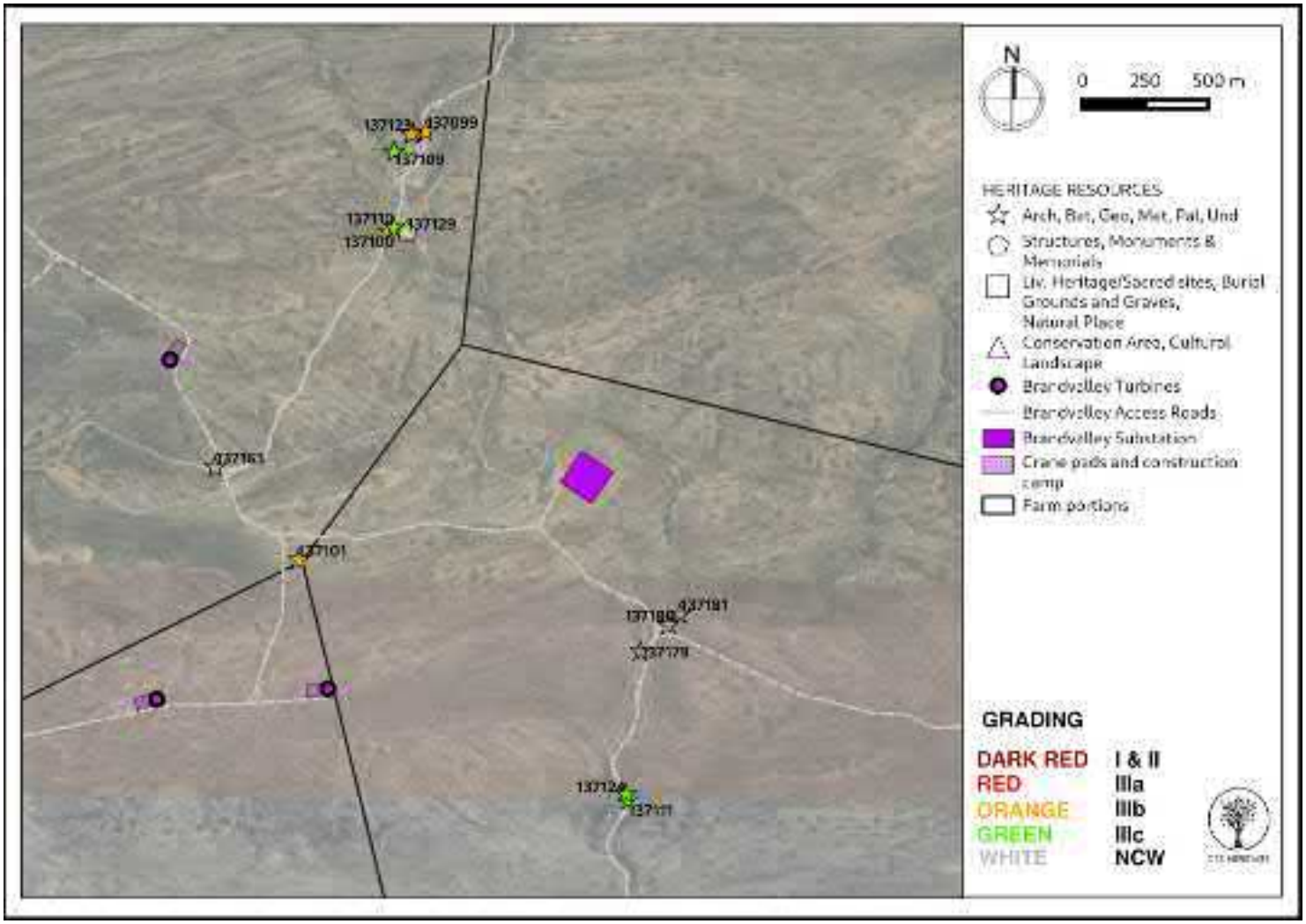


Figure 3.4. Heritage Resources Map. Inset D

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

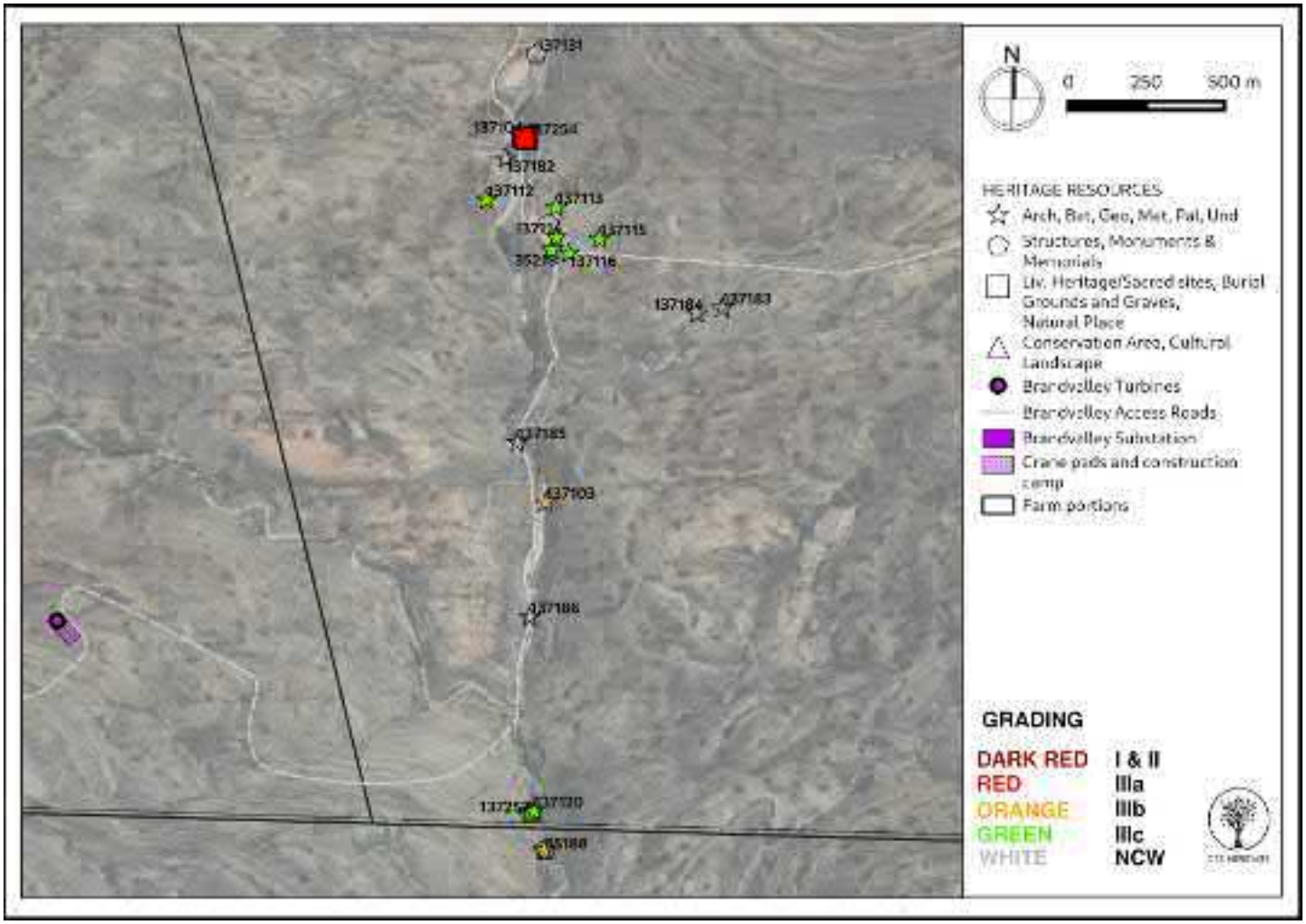


Figure 3.5. Heritage Resources Map. Inset E

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Findings of previous assessments

Archaeology, Graves and the Built Environment

A Heritage Impact Assessment was completed by Booth (2016) for the Brandvalley WEF. Booth (2016) notes that the area held several historical features (stone walling kraals and cottages) some with associated historical artefacts situated along the access roads in the valleys and associated with the homestead settlements. The area, however, also held evidence of both Middle and Later Stone Age stone artefacts alongside water courses and on the flat floodplains.

All of the heritage resources identified by Booth (2016) have been recorded on SAHRIS and mapped relative to the final proposed layout. The previously identified heritage resources located in close proximity to the development area have been listed in Table 2 and mapped in Figure 3.

Table 2: Archaeological, palaeontological and built environment observations noted during the HIA (2016) completed for the Brandvalley WEF and associated infrastructure, and from other relevant heritage assessments (Mapped in Figure 3)

Site ID	Site no	Full Site Name	Site Type	Grading
35140	ROG009	Roggeveld 009	Building	Grade IIIc
35141	ROG010	Roggeveld 010	Building	Grade IIIc
35578	GK056	Gamma Kappa 056	Artefacts	Grade IIIb
35188	ROG024	Roggeveld 024	Ruin > 100 years	Grade IIIb
35217	ROG035	Roggeveld 035	Ruin > 100 years	Grade IIIc
35218	ROG036	Roggeveld 036	Stone walling	Grade IIIc
35185	ROG023	Roggeveld 023	Burial Grounds & Graves	Grade IIIa
35645	GK122	Gamma Kappa 122	Burial Grounds & Graves	Grade IIIa
35646	GK123	Gamma Kappa 123	Burial Grounds & Graves	Grade IIIa
137160	BWE-052	Brandvalley Wind Energy	Deposit	
137161	BWE-053	Brandvalley Wind Energy	Deposit	
137162	BWE-054	Brandvalley Wind Energy	Deposit	
137163	BWE-055	Brandvalley Wind Energy	Deposit	
137164	BWE-056	Brandvalley Wind Energy	Deposit	
137165	BWE-057	Brandvalley Wind Energy	Deposit	
137166	BWE-058	Brandvalley Wind Energy	Deposit	
137176	BWE-068	Brandvalley Wind Energy	Deposit	
137177	BWE-069	Brandvalley Wind Energy	Deposit	
137178	BWE-070	Brandvalley Wind Energy	Deposit	
137179	BWE-071	Brandvalley Wind Energy	Deposit	

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

137180	BWE-072	Brandvalley Wind Energy	Deposit	
137181	BWE-073	Brandvalley Wind Energy	Deposit	
137182	BWE-074	Brandvalley Wind Energy	Deposit	
137183	BWE-075	Brandvalley Wind Energy	Deposit	
137184	BWE-076	Brandvalley Wind Energy	Deposit	
137185	BWE-077	Brandvalley Wind Energy	Deposit	
137186	BWE-078	Brandvalley Wind Energy	Deposit	
137199	KWF-014	KAREEBOSCH WIND FARM	Building	
137200	KWF-015	KAREEBOSCH WIND FARM	Building	
137252	KWF-040	KAREEBOSCH WIND FARM	Structures	
137253	KWF-041	KAREEBOSCH WIND FARM	Stone walling	
137254	KWF-042	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137255	KWF-043	KAREEBOSCH WIND FARM	Structures	
137065	RFWE-007	RIETKLOOF WIND ENERGY	Stone walling	Grade IIIc
137091	BWE-001	Brandvalley Wind Energy	Building	
137092	BWE-002	Brandvalley Wind Energy	Building	
137093	BWE-003	Brandvalley Wind Energy	Building	
137094	BWE-004	Brandvalley Wind Energy	Building	
137095	BWE-005	Brandvalley Wind Energy	Building	
137096	BWE-006	Brandvalley Wind Energy	Artefacts	Grade IIIb
137097	BWE-007	Brandvalley Wind Energy	Artefacts	Grade IIIb
137098	BWE-008	Brandvalley Wind Energy	Artefacts	Grade IIIb
137099	BWE-009	Brandvalley Wind Energy	Artefacts	Grade IIIb
137100	BWE-010	Brandvalley Wind Energy	Artefacts	Grade IIIb
137101	BWE-011	Brandvalley Wind Energy	Artefacts	Grade IIIb
137102	BWE-012	Brandvalley Wind Energy	Artefacts	Grade IIIb
137103	BWE-013	Brandvalley Wind Energy	Artefacts	Grade IIIb
137104	BWE-014	Brandvalley Wind Energy	Burial Grounds & Graves	Grade IIIa
137105	BWE-015	Brandvalley Wind Energy	Burial Grounds & Graves	Grade IIIa
137106	BWE-016	Brandvalley Wind Energy	Stone walling	Grade IIIc
137107	BWE-017	Brandvalley Wind Energy	Stone walling	Grade IIIc
137108	BWE-018	Brandvalley Wind Energy	Stone walling	Grade IIIc

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

137109	BWE-019	Brandvalley Wind Energy	Stone walling	Grade IIIc
137110	BWE-020	Brandvalley Wind Energy	Stone walling	Grade IIIc
137111	BWE-021	Brandvalley Wind Energy	Stone walling	Grade IIIc
137112	BWE-022	Brandvalley Wind Energy	Stone walling	Grade IIIc
137113	BWE-023	Brandvalley Wind Energy	Stone walling	Grade IIIc
137114	BWE-024	Brandvalley Wind Energy	Stone walling	Grade IIIc
137115	BWE-025	Brandvalley Wind Energy	Stone walling	Grade IIIc
137116	BWE-026	Brandvalley Wind Energy	Stone walling	Grade IIIc
137117	BWE-027	Brandvalley Wind Energy	Stone walling	Grade IIIc
137118	BWE-028	Brandvalley Wind Energy	Stone walling	Grade IIIc
137119	BWE-029	Brandvalley Wind Energy	Stone walling	Grade IIIc
137120	BWE-030	Brandvalley Wind Energy	Stone walling	Grade IIIc
137122	BWE-032	Brandvalley Wind Energy	Stone walling	Grade IIIc
137123	BWE-033	Brandvalley Wind Energy	Artefacts	Grade IIIb
137124	BWE-034	Brandvalley Wind Energy	Artefacts	Grade IIIc
137125	BWE-035	Brandvalley Wind Energy	Artefacts	Grade IIIc
137127	BWE-037	Brandvalley Wind Energy	Structures	
137128	BWE-039	Brandvalley Wind Energy	Structures	
137129	BWE-040	Brandvalley Wind Energy	Structures	
137131	BWE-042	Brandvalley Wind Energy	Structures	
137132	BWE-043	Brandvalley Wind Energy	Structures	
137133	BWE-044	Brandvalley Wind Energy	Structures	
137136	BWE-047	Brandvalley Wind Energy	Deposit	
137137	BWE-048	Brandvalley Wind Energy	Deposit	
137138	BWE-049	Brandvalley Wind Energy	Deposit	

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Palaeontology

According to the SAHRIS Palaeosensitivity Map, the area proposed for development is underlain by sediments that are of moderate and very high palaeontological sensitivity (Figure 4.1). According to the extract from the Council for GeoScience Map 3220 for Sutherland (Figure 4.2), the area proposed for development is underlain by sediments of the Karoo Supergroup assigned to the Abrahamskraal Formation (Pa) of the Beaufort Group and the Waterford Formation (Pw or Pwa) of the Ecca Group.

The Palaeontological assessment completed for the Brandvalley WEF by Almond (2016) notes that "The Brandvalley WEF study area lies in the mountainous Klein-Roggeveldberge region and is underlain by several formations of potentially fossil bearing sedimentary rocks. The majority of the bedrocks are of Late Palaeozoic age (Middle Permian) and belong to the Karoo Supergroup which is internationally famous for its rich fossil record. Palaeontological field assessment of the Brandvalley WEF study area shows that in this portion of the southwestern Karoo:

- Waterford Formation (Upper Ecca Group) deltaic bedrocks have small outcrop areas crossing the central part of the study area. These small areas lie largely outside the main development footprint and are generally fossil-poor, apart from low-diversity trace fossil assemblages. However, isolated blocks and rare logs of well-preserved petrified wood recorded from this formation just to the south of the study area (Rietkloof WEF project area) are of high scientific and conservation value and similar material might also be present in the Brandvalley WEF study area.
- Abrahamskraal Formation (Lower Beaufort Group) fluvial bedrocks underlying the great majority of the study area are generally considered to be of high palaeontological sensitivity. However, in this area of the south-western Karoo they are generally fossil-poor, apart from occasional horizons with plant debris or low-diversity trace fossils. A few examples of large tetrapod (i.e. terrestrial vertebrate) burrows as well as disarticulated skeletal remains (dispersed bones, teeth) recorded from these beds during the present field assessment are of considerable scientific interest but are very rare indeed.
- Late Caenozoic superficial sediments (alluvium, colluvium, calcretes, soils, surface gravels etc) overlying the Palaeozoic bedrocks are of low palaeontological sensitivity. Pediment and surface gravels along the foot of the Klein-Roggeveld Escarpment and elsewhere locally contain numerous clasts of petrified wood reworked from the Karoo Supergroup (probably Waterford Formation).

The overall impact significance of the construction phase of the proposed wind energy project is assessed as LOW (negative) in terms of palaeontological heritage resources. This is a consequence of (1) the paucity of irreplaceable, unique or rare fossil remains within the development footprint as well as (2) the extensive superficial sediment cover overlying most potentially-fossiliferous bedrocks within the Brandvalley WEF study area. This assessment applies to the wind turbines, laydown areas, access roads, substations, construction camps including a batching plant area, 33kV powerlines and associated WEF infrastructure within the study area. A comparable low impact significance is inferred for all project infrastructure alternatives and layout options under consideration, including different options for routing of access roads, turbine layouts and siting of construction camps and substations.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Almond (2016) also notes that "The great majority of the Brandvalley WEF study area is assessed as being of low palaeontological sensitivity due to the scarcity of significant fossil vertebrate, plant and other remains here. Sensitive no-go areas within the proposed development footprint itself have not been identified in this study. The occurrence of very rare tetrapod (i.e. terrestrial vertebrate) burrows and associated skeletal remains within the Abrahamskraal Formation along the Kabeltou Pass (Muishond Rivier 161) is a notable exception. This highly sensitive area, which lies within the Western Cape and outside the WEF development footprint, should not be disturbed. Highly sensitive "no-go" areas within the proposed development footprint itself have not been identified in this study. Pending the potential discovery of substantial new fossil remains during construction, specialist palaeontological mitigation is not recommended for the Brandvalley WEF project."

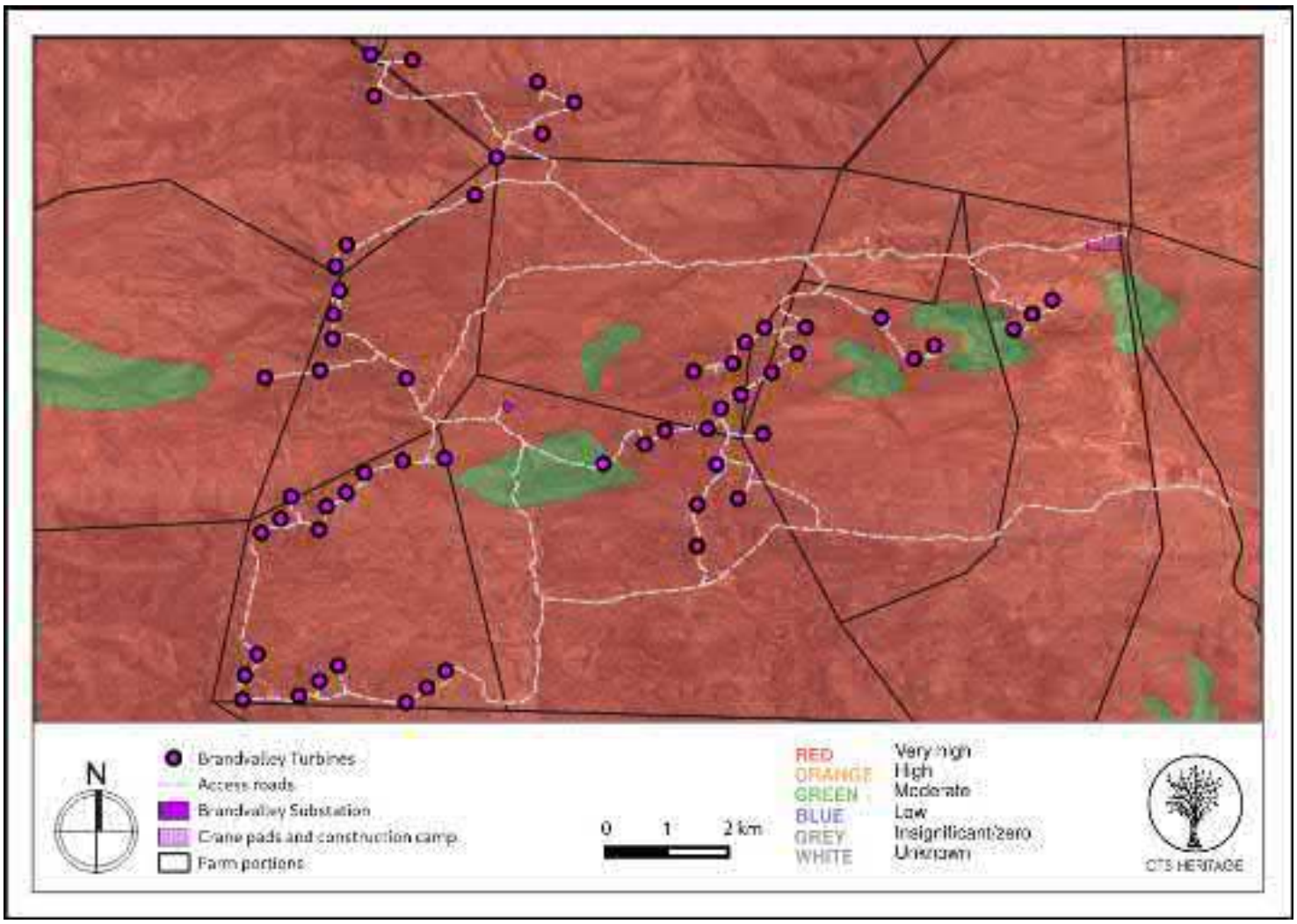


Figure 4.1: Palaeosensitivity Map. Indicating fossil sensitivity underlying the study area

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

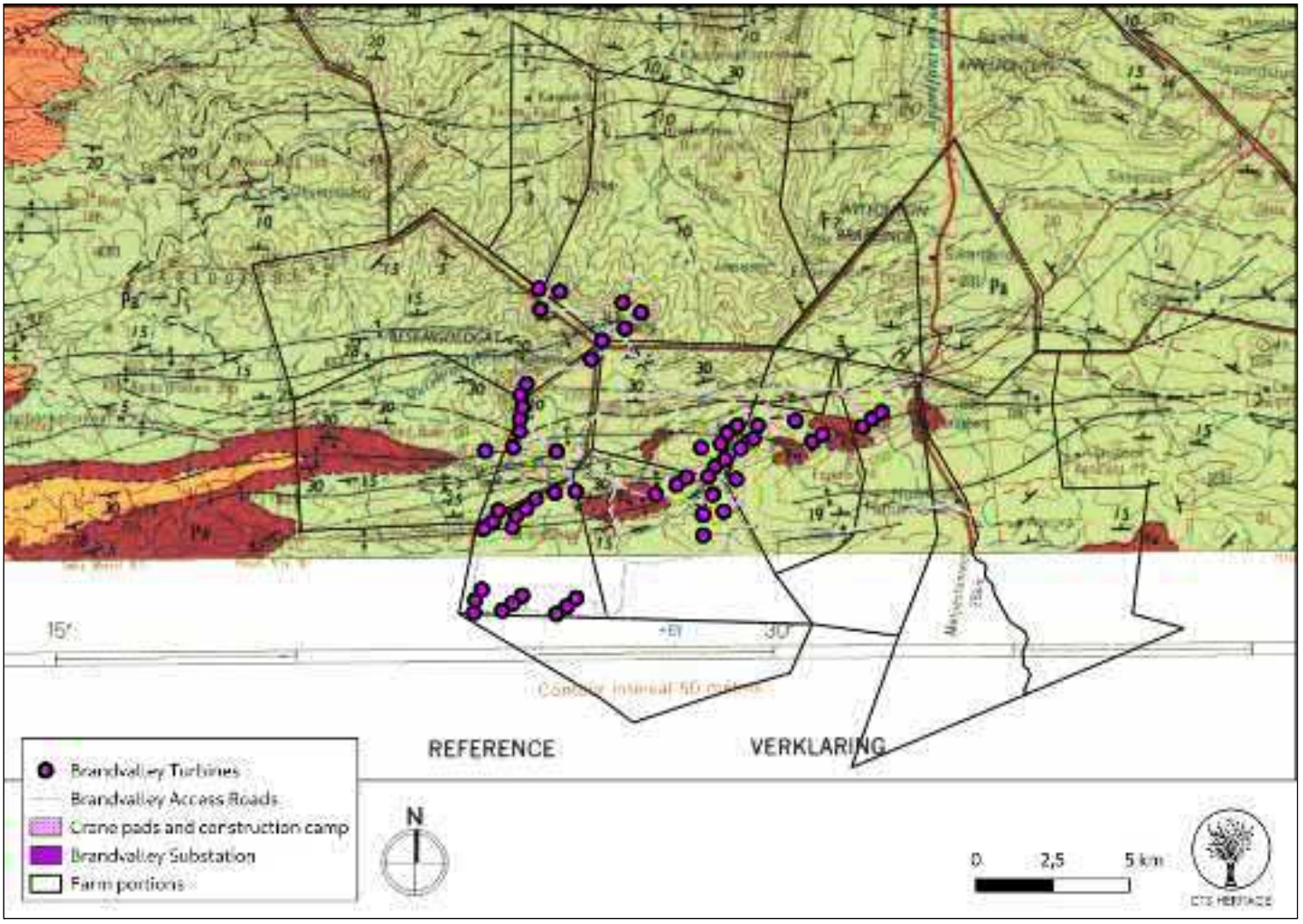


Figure 4.2: Geology Map. Extract from the CGS 3220 Sutherland Map indicating that the development area is underlain by sediments of the Karoo Supergroup assigned to the Dwyka group (C-Pd), as well as the Prince Albert (Pp), Tierberg (Pt) and Collingwood (Pc) formations of the Ecca Group, as well as the Blinkberg (Dbl), Witpoort (Dwi), Floriskraal (Cf), Swartruggens (Ds), Waaipoort (Cw) and Kweekvlei (Ck) formations of the Witteberg Group and Quaternary Sands

Summary of heritage recommendations from the completed reports:

The overall area is considered as having a medium - high heritage significance. The proposed development of the Brandvalley WEF may proceed, however, the following recommendations must be considered prior to the development activities:

- This report must be submitted to Heritage Western Cape (HWC), the heritage authority for any Western Cape developments, and as a commenting authority in terms of the National Heritage Resources Act 25 of 1999, Section 38.
- This report must be submitted to the South African Heritage Resources Agency (SAHRA) to comment on the portion of the proposed development that occurs within the Northern Cape Province. Nine proposed turbines are situated on the Farm Rietfontein 197 in the Karoo Hoogland Local Municipality, Namakwa District Municipality, Northern Cape Province. No archaeological or other heritage resources were documented within

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

this area. No further studies or mitigation is required, unless the layout of these nine turbines and associated infrastructure and access roads change.

- The power lines routes were not assessed as part of this study, but is a separate study as part of the Basic Assessment Process. The recommendations of this report should not be read in isolation from the report prepared for the Basic Assessment.
- Substations: Substation 1 (SS1) situated south of the internal access road on the Farm Fortuin 74 is the preferred option for the establishment of the substation. However, if the preferred Substation option (SS1) is not feasible according to input from other studies conducted the appropriate mitigation measures should be followed with regards to the other three substation alternatives. It is recommended that a survey focusing on the area along the watercourse be conducted between Substation 2 (SS2) and Substation 4 (SS4) to establish the real extent of the artefact occurrences prior to development. Consultation with local Western Cape archaeological repositories (generally museums and universities) can be made to determine whether it would be necessary for to make a collection of artefacts.
- Construction Camps: Construction Camp 2 (CC2) situated on the Farm Fortuin 74 is the preferred option for the establishment of the construction camp. However, if the preferred Construction Camp 2 option (CC2) is not feasible according to input from other studies conducted the appropriate mitigation measures should be followed with regards to the other two substation alternatives. Similarly to the recommendation made for the substation option, a survey focusing on the area along the watercourse be conducted between the proposed Substation 2 (SS2) and Substation 4 (SS4) which would include Construction Camp 2 (CC2) to establish the real extent of the artefact occurrences. Consultation with local Western Cape archaeological repositories (generally museums and universities) can be made to determine whether it would be necessary for to make a collection of artefacts
    - Although the Construction Camp 1 option (CC1) is not the preferred option, several mitigation measures could be considered, similarly if the proposed area for Construction Cape 2 (CC2) is not feasible.
        - One suggestion is that a 30 m buffer be established around the stone packed walling feature (BV_SW1) situated on the southern boundary and clearly demarcated to avoid any damage by the construction camp activities and other possibly negative human impact.
        - Another suggestion is that, if relevant to an archaeological repository (usually a museum or university) in the Western Cape, the real extent of the stone artefact scatters and types could be recorded in detail and collected prior to development activities.
        - A third suggestion is that the location of the proposed Construction Camp 1 (CC1) be shifted to an alternative area, possible west along the existing access road.
- Upgrading of the internal access roads: The existing internal access roads be upgraded up to the 12 m wide proposed expansion except in the cases that heritage resources (including archaeological, historical and palaeontological) as well as the other studies conducted may be negatively impacted and recommend differently. Recommendations for the establishment of 20 m – 30 m buffer zones that are clearly demarcated and in some instances the possible rerouting of the proposed road to avoid negative impact and promote the

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

implementation of precautionary measures be adopted for heritage resources occurring along the route (stone and historical artefact scatters, stone walling features, graveyards, etc.) have been detailed in the report.

- If any of the old farm buildings are to intended for rehabilitation or re-use or demolition a qualified and experienced professional (historical archaeologist / historical architect) must be consulted.
- No turbines are to be located on Tafelkop or Spitskop. 9. An archaeological heritage walk-through survey must be conducted if any changes to the positions of the wind turbines, associated infrastructure and roads outside the scope of this study are made for the final layout and further recommendations and mitigation measures be suggested if necessary.
- If concentrations of historical and pre-colonial archaeological heritage material and/or human remains (including burials and graves) are uncovered during construction, all work within close vicinity of the find must cease immediately and be reported the South African Heritage Resources Agency (SAHRA) (021 462 4502) or Heritage Western Cape (HWC) (021 483 5959) so that systematic and professional investigation/excavation can be undertaken. Phase 2 mitigation in the form of testpitting/sampling or systematic excavations and collections of the pre-colonial shell middens and associated artefacts will then be conducted to establish the contextual status of the sites and possibly remove the archaeological deposit before development activities within the specific area can continue.
- Construction managers/foremen and/or the Environmental Control Officer (ECO) should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.

Figure 5.1: Contextual Image of development area

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 5.2: Contextual Image of development area

Figure 5.3: Contextual Image of development area

Figure 5.4: Contextual Images of Development Area

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 5.5: Contextual Images of Development Area

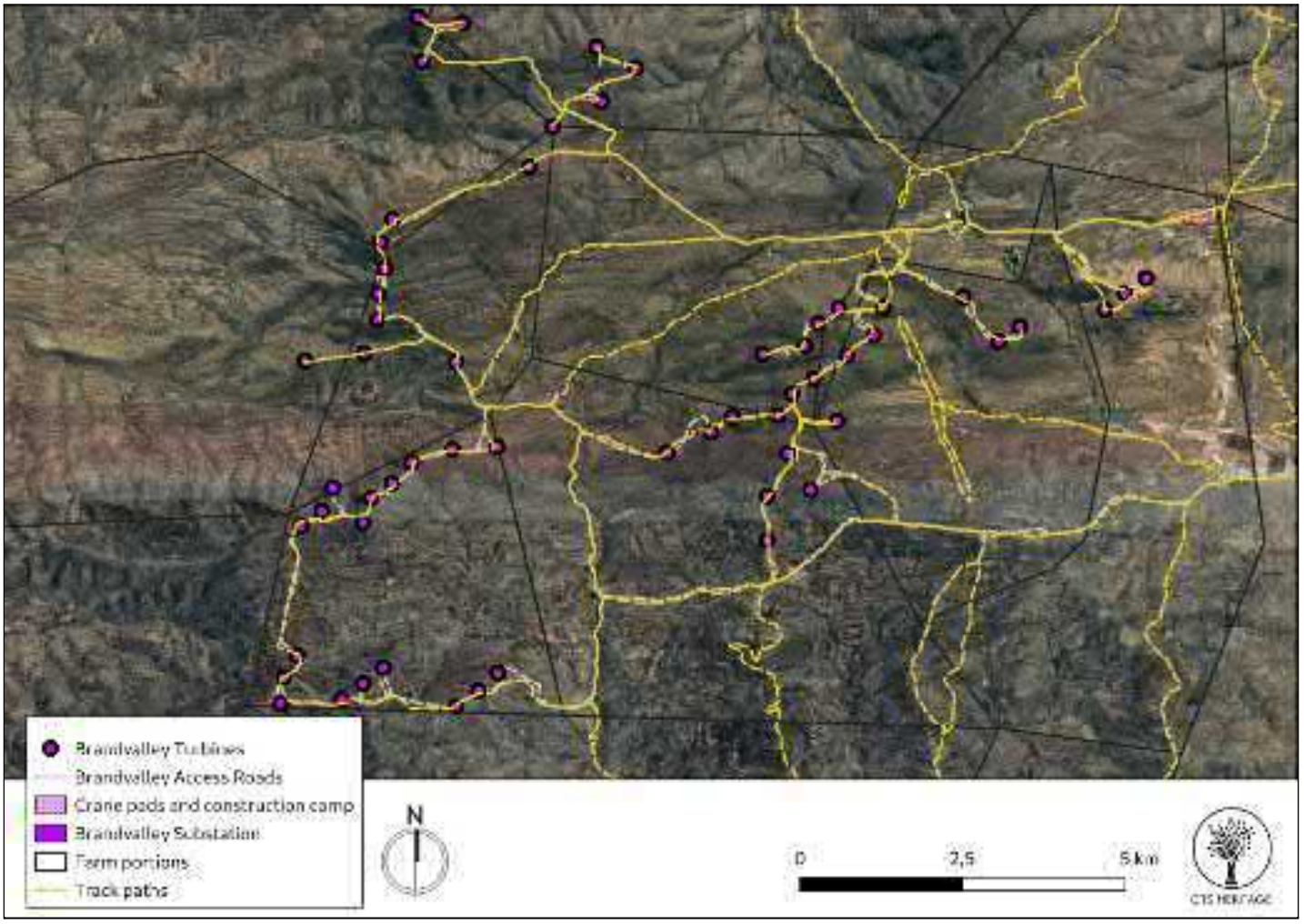


Figure 6.: Overall track paths of foot survey

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

4.2 Heritage Resources identifiedin the Walkdown

The locations of recordings made during the previous studies were included in the planning of the walkdown to ensure that additional ruins and historical infrastructure wasn't overlooked due to potential changes in the layout of the final design of the WEF and access roads. No obvious omissions were found during the survey of the Brandvalley WEF and the coverage along existing jeep tracks and gravel farm roads was therefore deemed to have adequately recorded the historical archaeology and built environment heritage of the area. Stone Age sites were expected to be very scarce and this was borne out yet again in the foot survey of the ridges where the WEF roads and turbine positions have been planned. Only a couple of isolated Later and Middle Stone Age sites were located and the artefacts showed signs of retouch. These locations have therefore been interpreted as representing temporary hunting and foraging locales taking advantage of the wide views down onto the valleys either side of the ridges. Less than 1% of the overall archaeological material found in the area is therefore located on the ridges that are windswept, highly rocky and difficult to move through on foot. No overhangs or even substantial outcrops of boulders providing natural shelter were found on the ridges.

Table 3: Archaeological and built environment observations noted during the walk down for the WEF and associated infrastructure

Obs #	SIte Name	Description	Period	Co-ordinates		Grading
012	Brandvalley 012	Chert, hornfels, quartzite flakes	LSA, MSA	-32.99232	20.5421	NCW
014	Brandvalley 014	Farmers trap, corrugated sheet, wire, wooden post	Modern	-33.02031	20.41447	IIIB
015	Brandvalley 015	Chert flake prominent dorsal scars	LSA	-33.01957	20.39709	NCW

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

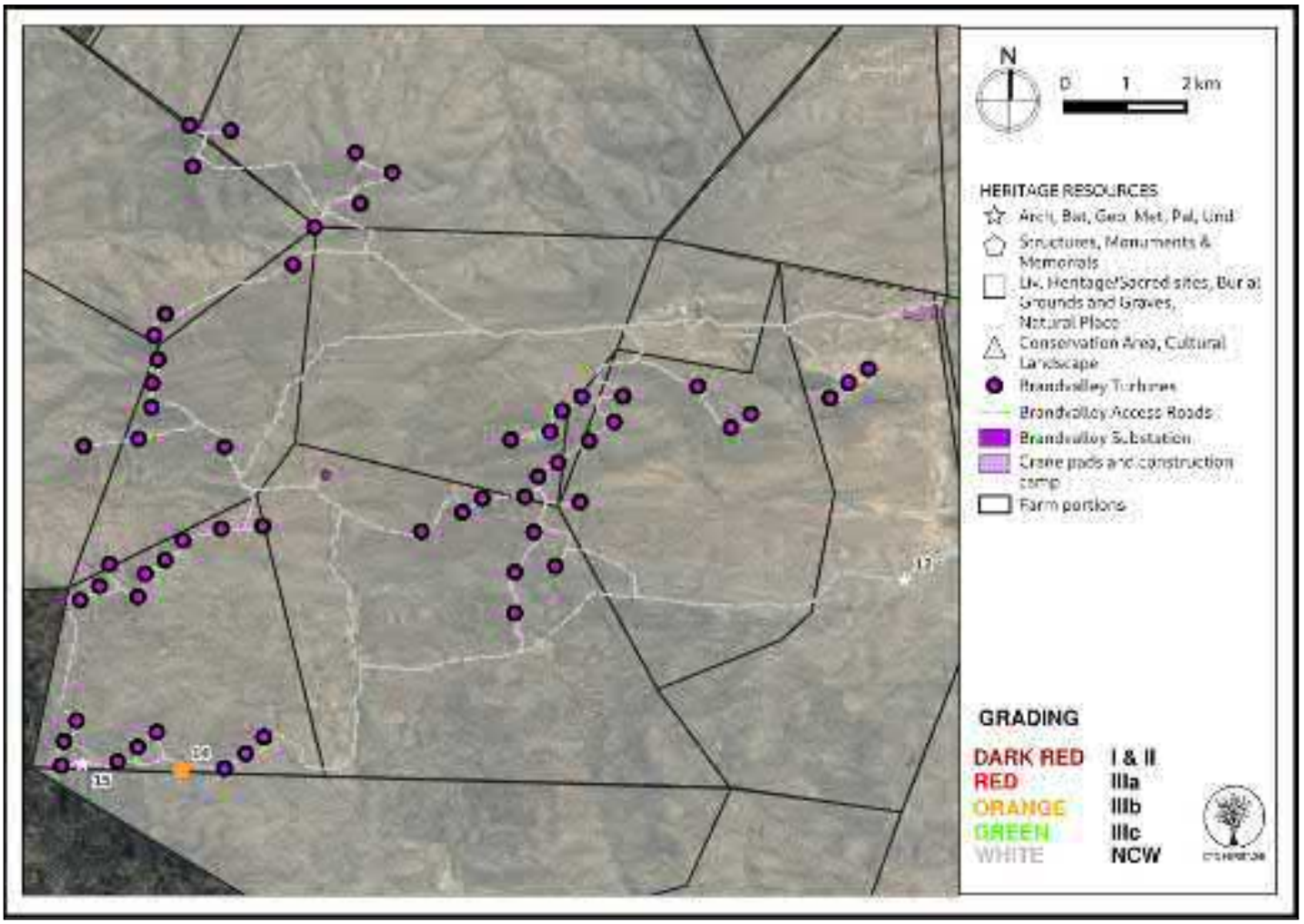


Figure 7.: Location of observations recorded during the walkdown

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

4.3 Selected photographic record

(a full photographic record is available upon request)

Figure 8.1: Observation 012

Figure 8.2: Observation 014

Figure 8.3: Observation 015

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Figure 8.4: Observation 014

Figure 8.5: Observation 015

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Archaeological Resources

The survey provided a very good account of the generally ubiquitous MSA material spread across the study area in low densities. No impacts on significant heritage resources are anticipated as the layout of the WEF has been drawn up to avoid the previously recorded sites of significance by Booth in 2016.

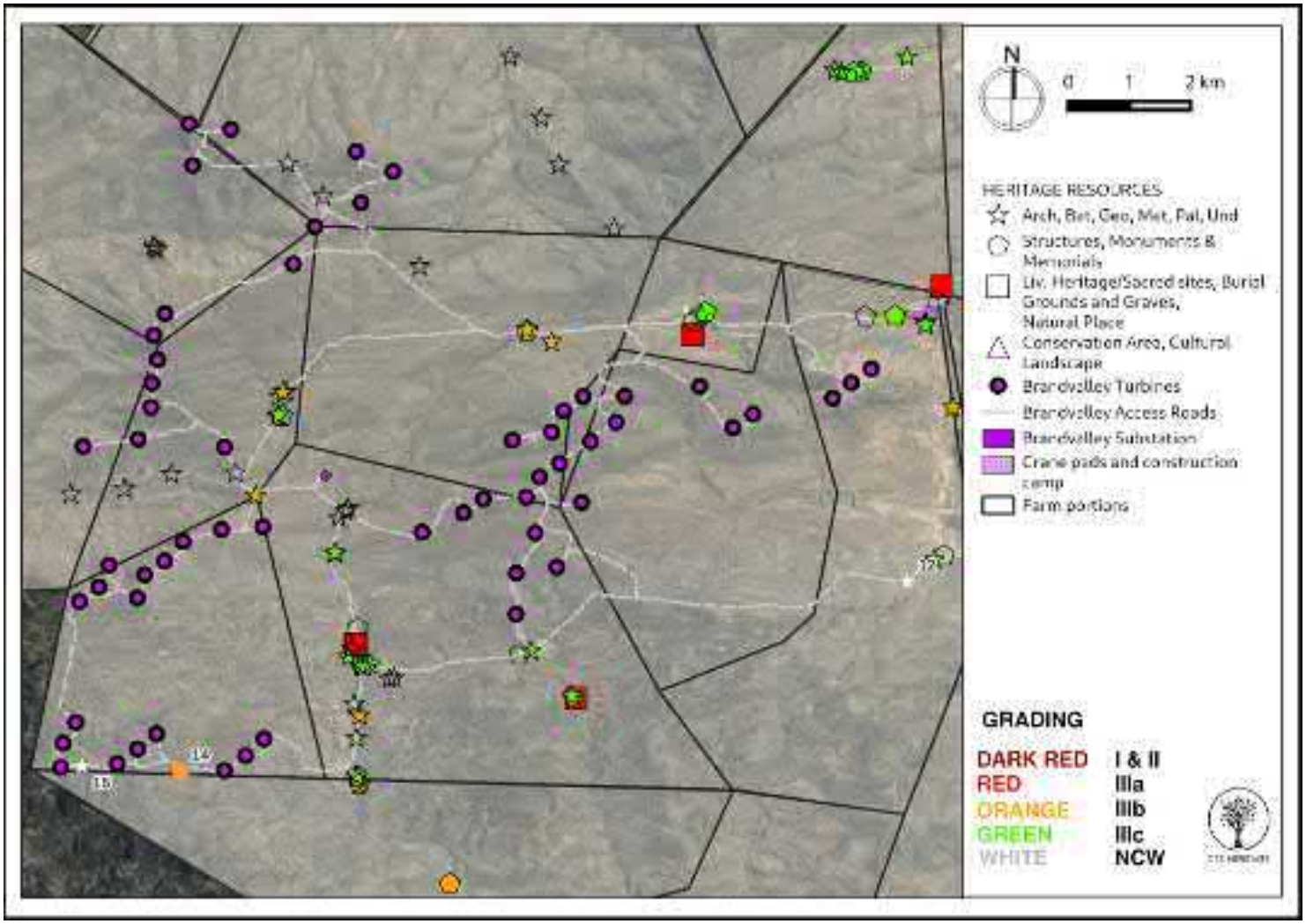


Figure 9: Map of all known heritage resources relative to the final proposed development footprint

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

6. CONCLUSION AND RECOMMENDATIONS

In response to the original Heritage Impact Assessment completed by Booth in 2016, it was recommended by SAHRA and HWC that a more detailed archaeological assessment be conducted of the final layout of the proposed infrastructure to be developed as part of the Brandvalley WEF project. This recommendation was reiterated as a condition of authorisation in the original EA granted for the Brandvalley WEF project in 2016.

The final layout for the Brandvalley WEF avoids impact to all known significant heritage resources present within the development area. The walkdown of the final layout revealed no new significant heritage resources that are likely to be impacted. It is therefore recommended that this report is accepted as satisfying this condition of the Environmental Authorisation issued for the Brandvalley West WEF project.

One of the other conditions of the EA issued was that "After initial vegetation clearance has taken place but before the ground is levelled for construction, a professional palaeontologist must undertake a walkthrough and document any identified paleontological findings. The survey/walkthrough must be conducted as per the South African Heritage Resources Agency (SAHRA) requirements."

However, the PIA completed for this project concluded that "The overall impact significance of the construction phase of the proposed wind energy project is assessed as LOW (negative) in terms of palaeontological heritage resources." The one area of high palaeontological significance identified in the PIA i.e. the occurrence of very rare tetrapod burrows and associated skeletal remains within the Abrahamskraal Formation along the Kabeltou Pass (Muishond Rivier 161) is located well away from all proposed WEF infrastructure and no negative impact to this area is anticipated.

Almond (2016) concludes that "The great majority of the Brandvalley WEF study area is assessed as being of low palaeontological sensitivity due to the scarcity of significant fossil vertebrate, plant and other remains here. Sensitive no-go areas within the proposed development footprint itself have not been identified in this study… Highly sensitive "no-go" areas within the proposed development footprint itself have not been identified in this study. Pending the potential discovery of substantial new fossil remains during construction, specialist palaeontological mitigation is not recommended for the Brandvalley WEF project."

It is therefore recommended that the condition of the EA regarding the palaeontological walkdown is not appropriate for this project.

A Conservation Management Plan will be drafted for the Brandvalley WEF as required by SAHRA and in the EA for the project.

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

7. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
359488	Heritage Screener	Mariagrazia Galimberti, Kyla Bluff, Nicholas Wiltshire	09/03/2016	Brandvalley Wind Energy Facility
53187	HIA Phase 1	Timothy Hart, Lita Webley	01/03/2011	HERITAGE IMPACT ASSESSMENT PROPOSED WIND ENERGY FACILITY
337370	PIA Phase 1	Duncan Miller	01/03/2011	Palaeontological Impact Assessment Proposed Roggeveld Wind Energy Facility
356316	Heritage Screener	Mariagrazia Galimberti, Kyla Bluff, Nicholas Wiltshire	02/02/2016	Heritage Screener CTS15_015b EOH Brandvalley Wind Energy Facility
356318	Heritage Screener	Mariagrazia Galimberti, Kyla Bluff, Nicholas Wiltshire	01/02/2016	Heritage Screener CTS15_015a EOH Rietkloof Wind Energy Facility
364162	PIA Phase 1	John E Almond	01/04/2016	PALAEONTOLOGICAL HERITAGE ASSESSMENT: COMBINED DESKTOP & FIELD-BASED STUDY - PROPOSED BRANDVALLEY WIND ENERGY FACILITY LAINGSBURG, WESTERN & NORTHERN CAPE PROVINCES
364163	AIA Phase 1	Celeste Booth	01/04/2016	A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE PROPOSED BRANDVALLEY WIND ENERGY FACILITY (WEF) SITUATED IN THE KAROO HOOGLAND LOCAL MUNICIPALITY (NAMAKWA DISTRICT MUNICIPALITY), THE WITZENBURG LOCAL MUNICIPALITY (CAPE WINELANDS DISTRICT MUNICIPALITY) AND LAINGSBURG LOCAL MUNICIPALITY (CENTRAL KAROO DISTRICT MUNICIPALITY).
4843	AIA Phase 1	Hilary Deacon	28/03/2008	Archaeological Impact Assessment: Proposed Breede Valley De Doorns Housing Project
	HIA	Dave Halkett, Lita Webley	11/04/2011	HERITAGE IMPACT ASSESSMENT: PROPOSED PERDEKRAAL WIND AND SOLAR ENERGY FACILITY , WESTERN CAPE PROVINCE

Additional References:

Hart, T. et al. (2016). **HERITAGE IMPACT ASSESSMENT (SCOPING) FOR THE PROPOSED KOLKIES WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION TO BE SITUATED IN THE SOUTHERN TANKWA KAROO.** (Assessment conducted under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999) as part of an EIA). For Arcus Consulting. Unpublished and not submitted.

Hart, T. et al. (2016). **HERITAGE IMPACT ASSESSMENT (SCOPING) FOR THE PROPOSED KAREE WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION TO BE SITUATED IN THE SOUTHERN TANKWA KAROO.** (Assessment conducted under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999) as part of an EIA). For Arcus Consulting. Unpublished and not submitted.

Shaw, Matthew & Ames, Christopher & Phillips, Natasha & Chambers, Sherrie & Dosseto, Anthony & Douglas, Matthew & Goble, Ron & Jacobs, Zenobia & Jones, Brian & Lin, Sam & Low, Marika & Mcneil, Jessica-Louise & Nasoordeen, Shezani

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

& O'driscoll, Corey & Saktura, Rosaria & Sumner, T. & Watson, Sara & Will, Manual & Mackay, Alex. (2020). **The Doring River Archaeology Project: Approaching the Evolution of Human Land Use Patterns in the Western Cape, South Africa.**

Smith, Andrew B., and Michael R. Ripp. "**An Archaeological Reconnaissance of the Doorn/Tanqua Karoo.**" The South African Archaeological Bulletin, vol. 33, no. 128, 1978, pp. 118–133

CTS Heritage
34 Harries Street, Plumstead, Cape Town
Tel: +27 (0)82 3037870 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

CTS HERITAGE

14 April 2022

Ashlea Strong
WSP

Dear Ms Strong,

RE: AMENDED LAYOUT FOR THE APPROVED BRANDVALLEY WEF NEAR MATJIESFONTEIN IN THE WESTERN AND NORTHERN CAPE

Brandvalley Wind Farm (Pty) Ltd, a subsidiary of G7 Renewable Energies (Pty) Ltd, has received approval to develop a 140 megawatt (MW) Wind Energy Facility (WEF) near Laingsburg, on the border of the Northern Cape Province and the Western Cape Province in South Africa. The authorised WEF is located in the Karoo Hoogland, the Witzenberg (Ceres) and the Laingsburg Local Municipalities, which fall within the Namakwa, the Cape Winelands and the Central Karoo District Municipalities, respectively. It comprises of up to 58 turbines, with a generating capacity of between 1.5MW and 4MW each.

The Brandvalley Wind Energy Facility (WEF) is proposed on the border of the Northern Cape and Western Cape along the R354 road which connects Matjiesfontein to Sutherland. This project is the third phase (Phase 3) of a series of projects which started in 2011 with the proposed establishment of the Roggeveld Wind Energy Facility (CaseID 473). The original Roggeveld WEF project was broken down into smaller WEFs in 2013. The first of these was the Roggeveld Wind Farm Phase 1 (CaseID 4503). This was followed by the Karreebosch Wind Energy Project (Roggeveld Phase 2) (CaseID 6884) in 2014/2015. The proposed Brandvalley and Rietkloof WEFs are Phases 3 and 4 of the original project although the extent of the farms affected by the various developments have changed since the inception of the project.

EA was granted for the Brandvalley WEF on 23 November 2016. In the EA, various requirements were stipulated in terms of impacts to Historical, Cultural and Palaeontological sites. In their responses, both SAHRA and HWC, as well as the EA, required that the Final Layout of the proposed development be subject to a walkdown by an archaeologist. This walkdown was completed by CTS Heritage between 24 and 28 July 2021 with the Walkdown Report completed in September 2021. Subsequent to the completed walkdown assessment, the layout was amended in November 2021 and again in April 2022.

Cedar Tower Services (Pty) Ltd t/a CTS Heritage
Reg: 2013/211135/07 VAT No: 4160278950
34 Harries Street, Plumstead, Cape Town, 7945
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

Table 1: EA requirements for Heritage

EA Requirements	*Implementation*
A 30m buffer must be applied around all identified archaeological sites	Adhered to in the final layout
After initial vegetation clearance has taken place but before the ground is levelled for construction, a professional palaeontologist must undertake a walkthrough and document any identified paleontological findings. The survey/walkthrough must be conducted as per the South African Heritage Resources Agency (SAHRA) requirements.	At construction
Should any archaeological sites, artefacts, paleontological fossils or graves be exposed during construction work, work in the immediate vicinity of the find must be stopped, SAHRA must be informed and the services of an accredited heritage professional obtained for an assessment of the heritage resources to be made	During construction
Construction managers/foremen must be informed before construction starts on the possible types of heritage sites and cultural material that may be encountered and the procedures to follow when they find sites.	At construction
All buffers and no-go areas stipulated in this report must be adhered to for both the facilities and all roads and powerlines.	During construction
Should any human remains be uncovered during development they must be immediately protected in situ and reported to the heritage authorities or to an archaeologist. The remains will need to be exhumed at the cost of the developer.	During construction
All construction and maintenance crew and vehicles (except small vehicles which may use existing farm tracks) should be kept out of the buffer zones.	During construction
The final layout should be shown to the appointed archaeologist before implementation to confirm that all significant heritage resources have been adequately protected.	Final Layout Walkdown Report drafted September 2021

CTS HERITAGE

The proposed amendments consist of minor deviations (maximum deviation of approx. 600m). As with the previous layout, some of the heritage resources known from this area are located along the proposed road alignments. The road alignments have been slightly amended in the proposed amended layout, however it is not anticipated that these amended road alignments will negatively impact on significant archaeological heritage.

This letter is therefore drafted to confirm that the amended layout dated April 2022 for the Brandvalley WEF does not impact any known heritage resources and adheres to the recommendations included in the CTS Heritage Walkdown report for this development (September 2021) which concludes that "The final layout for the Brandvalley WEF avoids impact to all known significant heritage resources present within the development area. The walkdown of the final layout revealed no new significant heritage resources that are likely to be impacted. It is therefore recommended that this report is accepted as satisfying this condition of the Environmental Authorisation issued for the Brandvalley West WEF project."

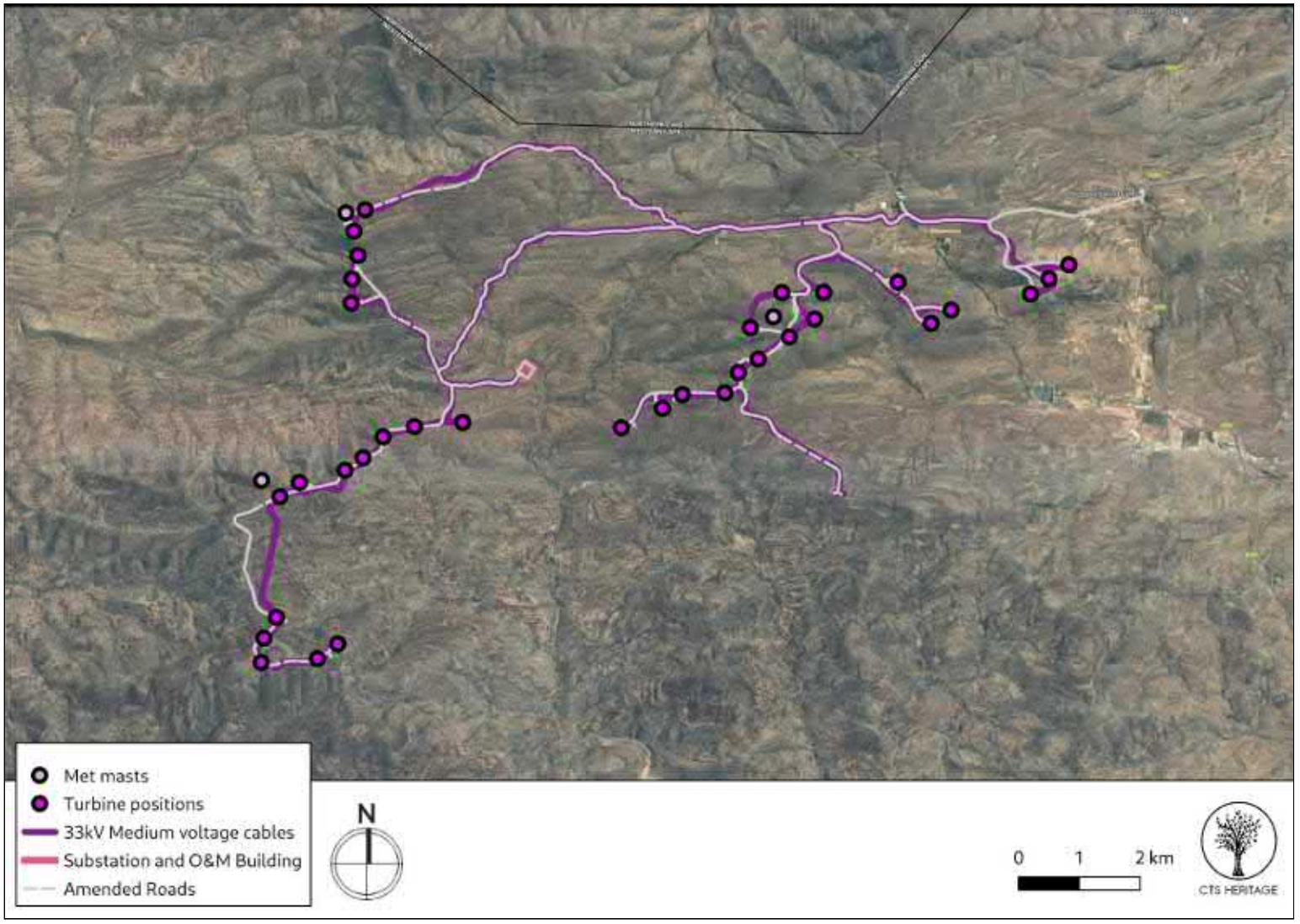
Please see the attached maps as confirmation.

Please feel free to contact me should you have any further questions or concerns in this regard.

Yours sincerely

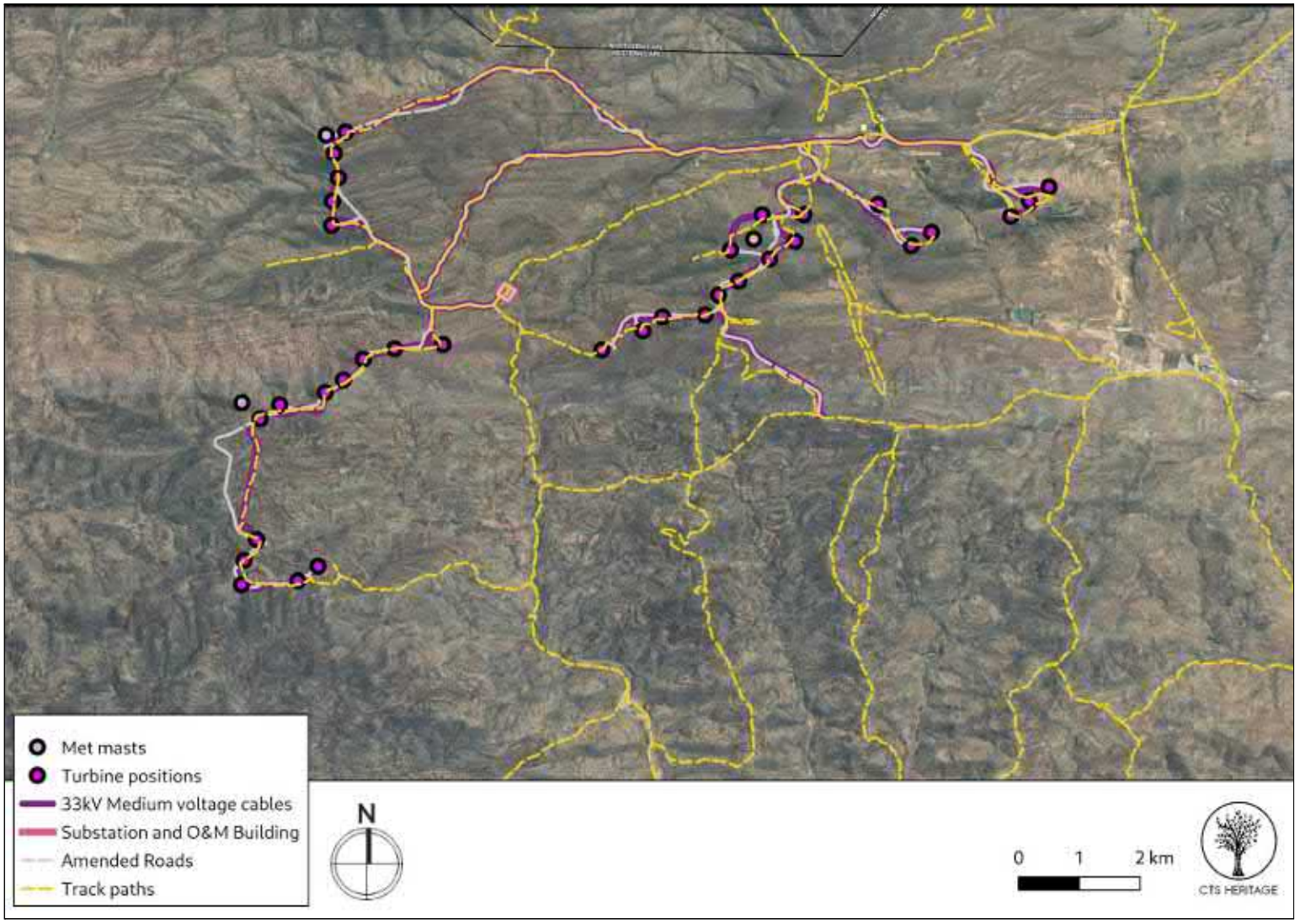
Jenna Lavin
Archaeologist
Heritage Assessment Practitioner

CTS HERITAGE



Map 1: Amended final layout of the Brandvalley WEF

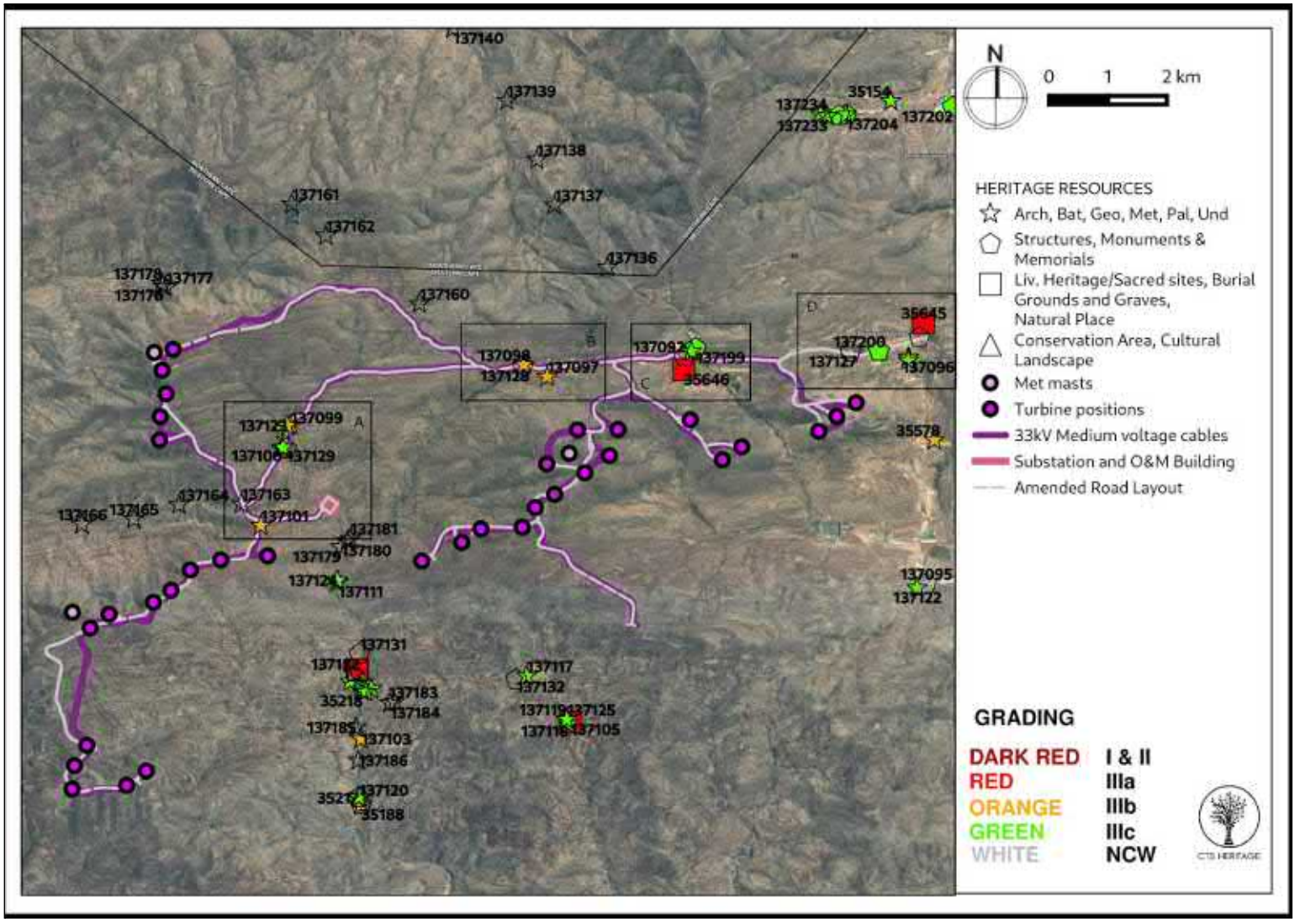
Cedar Tower Services (Pty) Ltd t/a CTS Heritage
Reg: 2013/211135/07 VAT No: 4160278950
34 Harries Street, Plumstead, Cape Town, 7945
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com



Map 2: Track paths followed for the walkdown of the Final Layout

Cedar Tower Services (Pty) Ltd t/a CTS Heritage
Reg: 2013/211135/07 VAT No: 4160278950
34 Harries Street, Plumstead, Cape Town, 7945
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

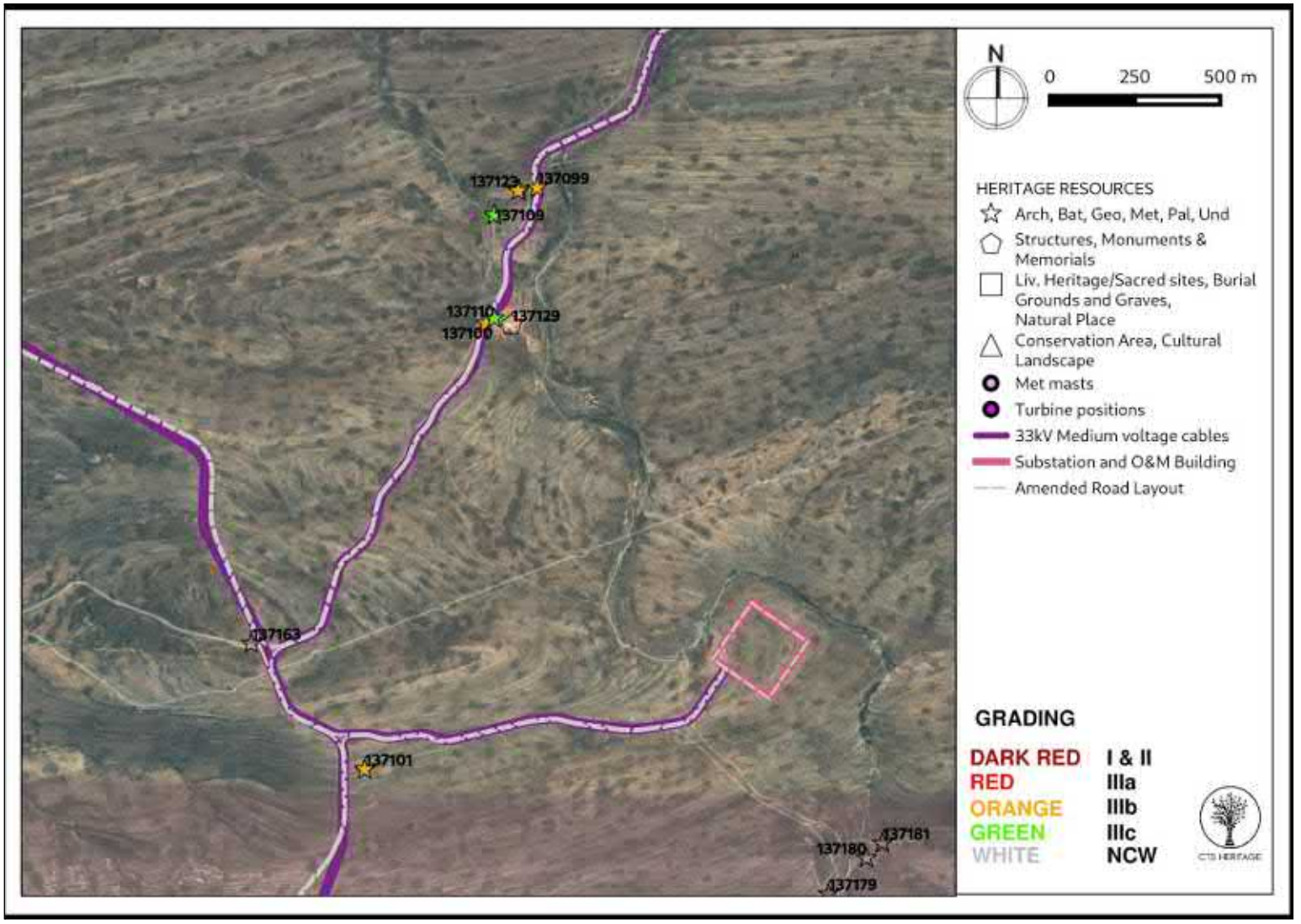
CTS HERITAGE



Map 3: Known heritage resources overlain with the proposed amended layout (refer to Walkdown Report September 2021 for the Site details)

Cedar Tower Services (Pty) Ltd t/a CTS Heritage
Reg: 2013/211135/07 VAT No: 4160278950
34 Harries Street, Plumstead, Cape Town, 7945
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

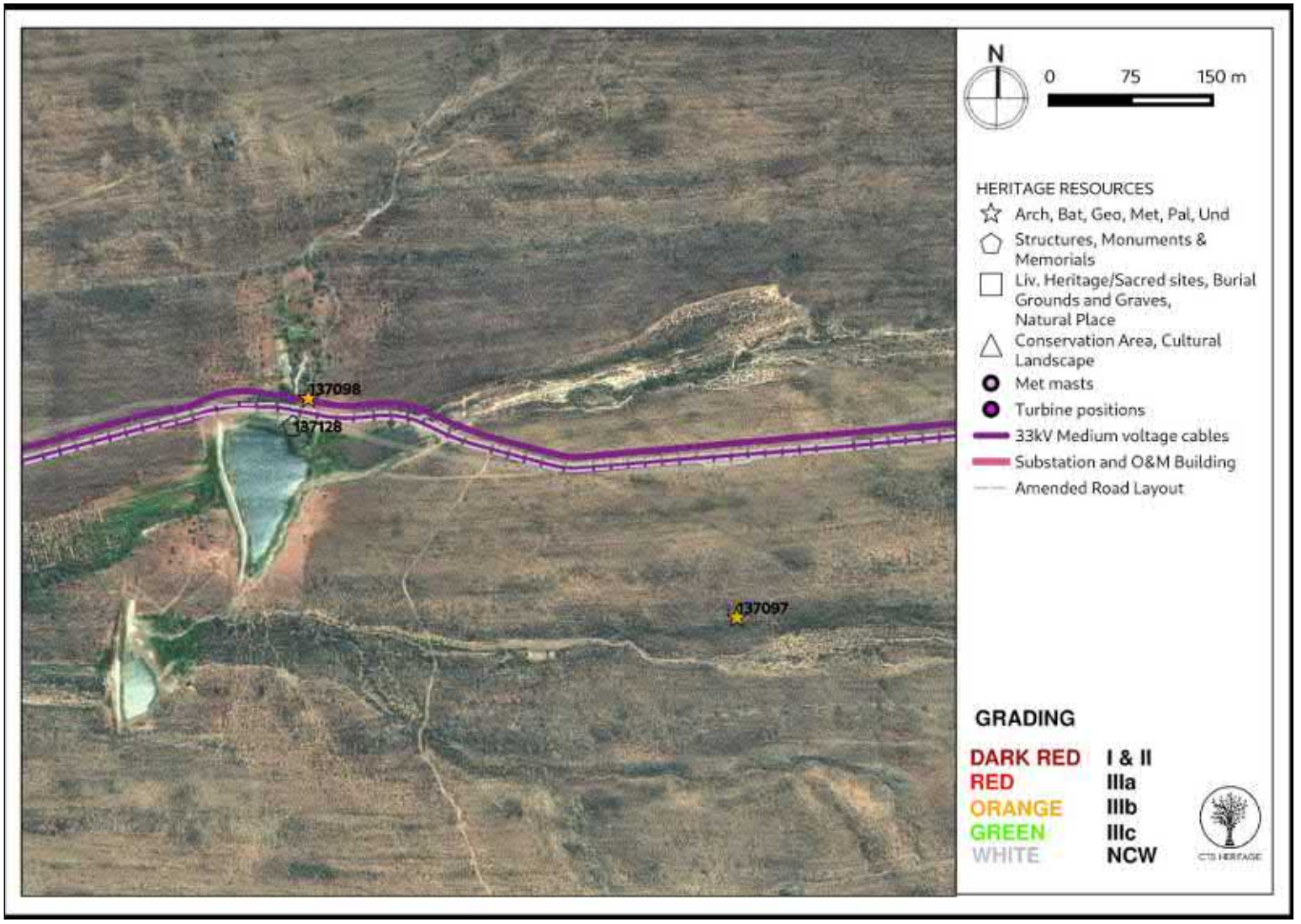
CTS HERITAGE



Map 3a: Known heritage resources overlain with the proposed amended layout - Inset A

Cedar Tower Services (Pty) Ltd t/a CTS Heritage
Reg: 2013/211135/07 VAT No: 4160278950
34 Harries Street, Plumstead, Cape Town, 7945
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

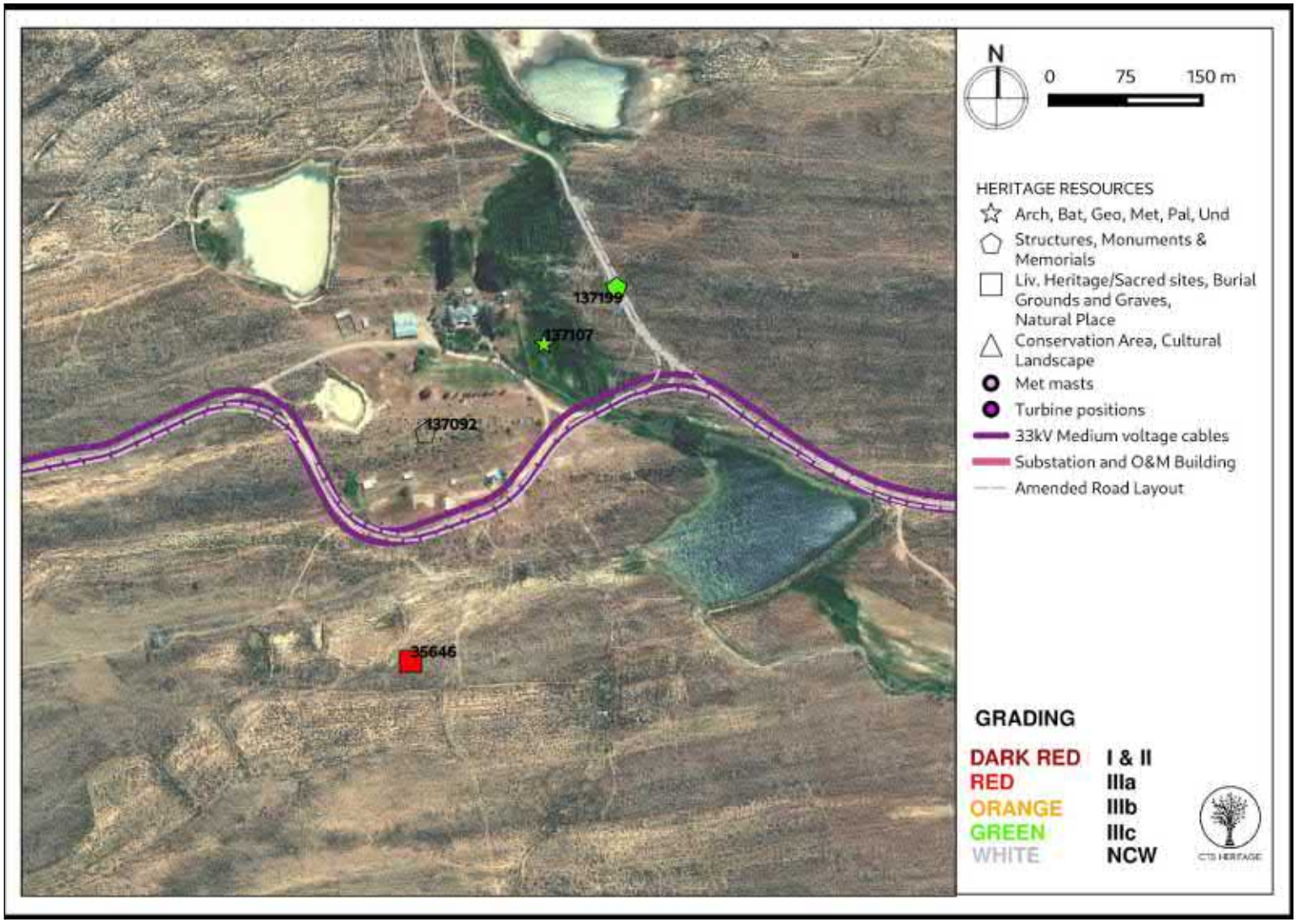
CTS HERITAGE



Map 3b: Known heritage resources overlain with the proposed amended layout - Inset B

Cedar Tower Services (Pty) Ltd t/a CTS Heritage
Reg: 2013/211135/07 VAT No: 4160278950
34 Harries Street, Plumstead, Cape Town, 7945
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

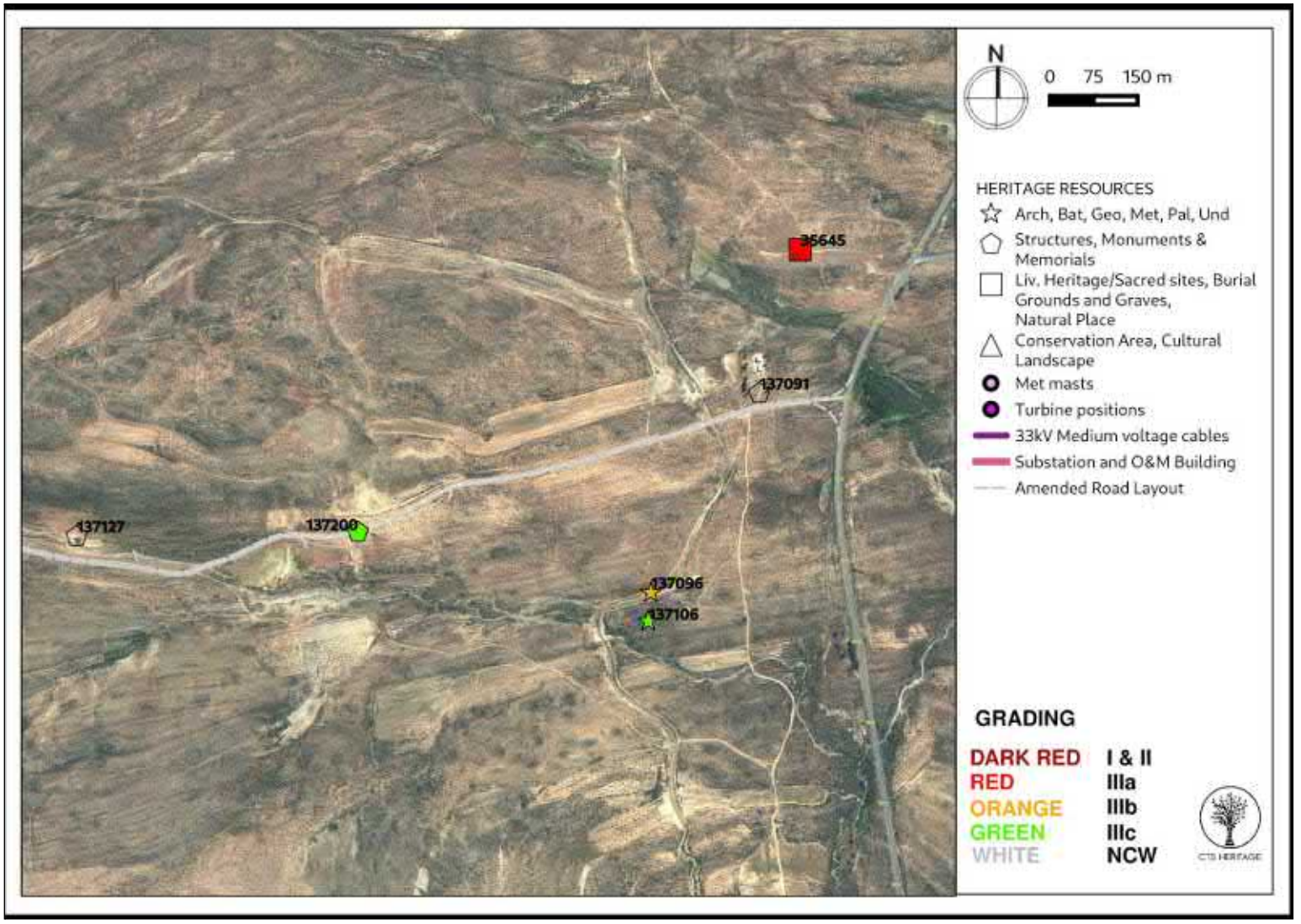
CTS HERITAGE



Map 3c: Known heritage resources overlain with the proposed amended layout - Inset C

Cedar Tower Services (Pty) Ltd t/a CTS Heritage
Reg: 2013/211135/07 VAT No: 4160278950
34 Harries Street, Plumstead, Cape Town, 7945
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

CTS HERITAGE



Map 3d: Known heritage resources overlain with the proposed amended layout - Inset D

Cedar Tower Services (Pty) Ltd t/a CTS Heritage
Reg: 2013/211135/07 VAT No: 4160278950
34 Harries Street, Plumstead, Cape Town, 7945
Tel: +27 (0)87 073 5739 **Email:** info@ctsheritage.com **Web:** www.ctsheritage.com

APPENDIX

L SURFACE WATER WALKDOWN REPORT

FEN CONSULTING

Reg No. 2019/432634/07
VAT Reg No. TBC
PO Box 751779
Gardenview
2047
Tel: 011 616 7893
Fax: 086 724 3132
Email: admin@sasenvgroup.co.za
www.sasenvironmental.co.za

FRESHWATER ECOLOGICAL ASSESSMENT AS PART OF THE WATER USE AUTHORISATION PROCESS FOR THE PROPOSED BRANDVALLEY WIND ENERGY FACILITY (WEF), BETWEEN SUTHERLAND AND MATJIESFONTEIN IN THE NORTHERN AND WESTERN CAPE PROVINCE

Prepared for

Brandvalley Wind Farm (Pty) Ltd

July 2021

Prepared by: Scientific Aquatic Services
Report author: C. du Preez (Pr. Sci. Nat)
Report reviewers: K. Marais (Pr. Sci. Nat)
S. van Staden (Pr. Sci. Nat)
Report reference: FEN 20-2113

EXECUTIVE SUMMARY

FEN Consulting was appointed to conduct a specialist freshwater ecological assessment as part of the Water Use Authorisation (WUA) process for the proposed Brandvalley Wind Energy Facility (WEF) and associated infrastructure. The proposed development includes the construction of various turbines linked via underground cabling, wherever technically feasible, to an onsite 33/132 kV substation. A construction camp will be developed that will play host to the on-site batching plant for use during the construction phase as well as offices, administration and operations and maintenance (O&M) buildings during the operational phase. Groundwater abstraction by means of boreholes is proposed and the sustainable yield of the boreholes has been proven. Constructing new watercourse road crossings, upgrading existing watercourse road crossings and the upgrading of existing roads where necessary are proposed.

A large drainage network of ephemeral watercourses, associated with the Groot, Roggeveld, Muishond and Wilgebos Rivers were identified as well as various Channelled Valley Bottom Wetlands. Most of these watercourses are considered to be in a largely natural to moderately modified ecological condition and of high ecological importance and sensitivity.

Only access road crossings as well as trenching of cabling within these crossings will directly impact on the watercourses. All other proposed infrastructure will be located outside of the delineated extent of the watercourses; however, some will be located within the 100 m/500 m regulated area. The proposed overhead collector powerlines will directly traverse watercourses, however, as far as feasible, all powerline support structures will be located at least 32 m from the delineated extent.

It was determined that the proposed development will have a Negative Moderate to Low risk significance on the watercourses with implementation of mitigation measures. A direct negative risk to the watercourses is expected due to the upgrading of watercourse crossings and the upgrading of an extensive section of access road located adjacent to a channelled valley bottom wetland and the Groot River.

Based on the findings of the assessment, no fatal flaws from a freshwater resource management point of view were identified. With adherence to cogent, well-conceived and ecologically sensitive construction plans and the implementation of the mitigation measures provided in this report and provided that general good construction practice is adhered to, from a freshwater conservation perspective the proposed development is considered acceptable. Authorisation by means of a Water Use Licence Application (WULA) in terms of Sections 21 (a), (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) must be obtained from the Department of Water and Sanitation (DWS).

MANAGEMENT SUMMARY

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Water Use Authorisation (WUA) process for the proposed Brandvalley Wind Energy Facility (WEF) and associated infrastructure between Matjiesfontein and Sutherland in the Northern and Western Cape Province (hereafter referred to as the 'proposed development'). The development entails:

- 58 turbines and associated crane pads;
- Internal access roads, with underground cables installed along these roads as far as feasible;
- Collector overhead powerlines (3 options proposed)
- Substation
- Construction camp
- Groundwater abstraction from boreholes

The purpose of this report is to provide a description and assessment of the ecology of the watercourses associated with the proposed development including mapping of the natural watercourses, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES). The Department of Water and Sanitation (DWS) Risk Assessment Matrix as promulgated in Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the impacts associated with the proposed development and mitigatory measures were identified which aim to minimise the potential impacts.

A desktop study was conducted, in which the watercourses were identified prior to the on-site investigation, and relevant national and provincial databases were consulted. The results of the desktop study are contained in Section 5 of this report.

During the site visit undertaken on the undertaken on the May 2021, watercourses associated with the Groot River system, Roggeveld River system, Muishond River system and Wilgebos River system were identified to be traversed by the proposed development. The Groot River are proposed to be traversed several times by access roads. Most of the watercourses to be traversed by the proposed development and those identified within the investigation area can best be described as headwater episodic[1] drainage lines (EDLs) without riparian vegetation which flow into larger ephemeral tributaries with riparian vegetation, which ultimately flow into the larger riverine systems located outside the investigation area. Although these EDLs cannot be classified as riparian resources in the traditional sense, due to the lack of saturated soil and riparian vegetation, they do still function as waterways, through episodic conveyance of water. However, based on the definition of a watercourse water flows regularly or intermittently within these EDLs, conveying water from the upgradient catchment area into the downgradient tributaries and eventually into the larger river systems. As such, they can be considered as watercourses due to their importance for hydrological functioning as they do function as waterways and therefore enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998). Ephemeral tributaries with riparian vegetation and associated channelled valley bottom wetlands were also identified to be traversed by the proposed development. The results of the ecological assessment of the watercourses are discussed in Section 5 of this report is summarised in the table below.

Table A: Summary of results of the ecological assessment as discussed in Section 5.

Watercourse	Present Ecological State (PES)	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS)
Channelled valley bottom wetland	B/C (Largely natural with few modifications)	Intermediate (1,5)	High	REC: Category B (Largely natural with few modifications) BAS: Category B RMO: B/C (Improve)
Ephemeral river (Groot River) and tributaries with riparian vegetation	C (Moderately modified)	Intermediate (1,5)	High	REC: Category C (Moderately modified) BAS: Category B RMO: B/C (Improve)
Episodic drainage line (EDL)	B (Largely natural with few modifications)	Intermediate (1,4)	High	REC: B (Largely natural with few modifications) BAS: Category B RMO: B (Improve)

Proposed new watercourse road crossings, the upgrading of existing watercourse crossings and the upgrading of roads directly adjacent to watercourses pose a direct negative impact to the watercourses. All other infrastructures are located outside the delineated extent of watercourses. Four (4) crane pads, and the construction camp are located within the 100 m GN509 Zone of Regulation (all located at least 53 m from a watercourse). Two (2) crane pads and the substation are located in the 500m GN509 Zone of Regulation (all located at least 90 m from a wetland). Although the collector overhead powerlines directly traverse the watercourses, all powerline support structures will be constructed outside of the delineated extent of the watercourses and as far as feasible, at least 32 m from its delineated extent.

The DWS Risk Assessment was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the assessed watercourses. A summary of the outcome of the risk assessment is provided in Table B.

Table B: Summary of the outcome of the DWS Risk Assessment for the proposed development (with the implementation of mitigation measures).

	Impact and Aspect	Risk
Construction Phase	Site preparation prior to construction activities of the proposed construction camp, substation, overhead powerline support structures as listed in Table 9 located within the 100m GN509 ZoR but at least 32 m from the delineated extent of the watercourses, and general movement of construction personnel within the 100m/500m GN509 ZoR but outside the delineated extent of watercourses. • Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; • Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles; • Proliferation of alien and/or invasive vegetation as a result of disturbances.	**Low**
	Site preparation prior to construction activities relating to the development of new watercourse road crossings - upgrading of existing roads, installation of underground cables traversing through watercourses, and upgrading of roads within close proximity (within 32 m) to watercourses. • Increased sedimentation of the watercourses, leading to smothering of vegetation associated in the watercourses; • Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.	**Moderate**
	Creating new watercourse crossings, upgrading existing watercourse crossings and upgrading of existing roads within close proximity (within 32 m) to watercourses: • Excavation within the watercourse for the removal of existing infrastructure (where applicable) and for the casting of proposed concrete base • Placement of culvert structures atop concrete base.	**Moderate**
	Construction of surface infrastructure outside of the watercourses but still within the 100 m/500m GN509 ZoR, which includes the collector overhead powerlines, construction camp, substation and 6 crane pads: • Removal of vegetation and topsoil and associated stockpiling; • Ground-breaking and earthworks relating to foundations and trenches; • Mixing and casting of concrete for construction purposes.	**Low**
Operational Phase	Operation and maintenance of the surface infrastructure outside the watercourses but still within the 100 m GN509 ZoR, which includes the collector overhead powerlines, construction camp, substation and 6 crane pads: • Potential indiscriminate movement of maintenance vehicles within the watercourses or within close proximity to the watercourses; • Increased risk of sedimentation and/or hydrocarbons entering the watercourses via stormwater runoff from the surface infrastructure (with specific mention of the crane pads and construction camp area).	**Low**
	Operation and maintenance of roads traversing watercourses: • Concentrated runoff entering the watercourses; • Disturbance to the watercourse vegetation.	**Low**
Decommissioning Phase	Removal of all surface infrastructure from the project area: • Movement of construction vehicles and personnel; • Disturbance to the buffer zone surrounding the watercourses	**Low**

No surface infrastructure components are located within any of the delineated watercourses, with the exception of road crossings, which entails the construction of new watercourse road crossings and upgrading of existing crossings. Due to the ecological sensitivity and importance of the watercourses, the upgrading of access roads directly adjacent to watercourses and upgrading of watercourse crossings by means of installing formal through flow structure poses a moderate risk significance to the watercourses, with the application of the recommended mitigation measures. The proposed collector overhead powerlines will also traverse several watercourses; however, the powerline support structures will be constructed outside the delineated extent of the watercourses and as far as feasible, at least 32m from the delineated extent of the watercourses.

Despite direct negative impacts expected from the proposed development, with implementation and strict enforcement of cogent, well-developed mitigation measures as outlined in this report, with specific mention of ensuring all instream construction footprints are rehabilitated and the watercourses monitored for any alien and invasive species establishment, no fatal flaws in terms of freshwater ecological aspects were identified and the proposed development can be considered acceptable.

Authorisation by means of a Water Use Licence Application (WULA) in terms of Sections 21 (a), (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) must be obtained from the DWS for the proposed development prior to the commencement of any works.

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environment, Forestry and Fisheries screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as well as for the Environmental Impact Assessment (EIA) Regulations 2014 (as amended) requirements for Specialist Reports (Appendix 6).

No.	Requirements	
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Cover Page and Appendix G.
2.2	Description of the preferred development site, including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution and movement patterns	Section 4.1: Table 1 and Section 4.2
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 4: Table 1
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 4: Table 1
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 5.3
2.3	Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	Section 6 and 7
2.4	Assessment of impacts – a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Yes, with implementation of the proposed mitigation measures
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.) and d. Assessment of the risks associated with water use/s and related activities.	Section 5.3

2.4.4	How will the development impact on the functionality of the aquatic feature including: a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system); b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over abstraction or instream or off-stream impoundment of a wetland or river); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f. Loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soil, etc).	Section 7.1 and 7.2
2.4.5	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 5.3
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 5.3
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	NA – Closest estuary is approximately 180 km south of the study area
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Appendix G
3.2	A signed statement of independence by the specialist.	Appendix G
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Section 3.1
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	Section 3, Appendix C and Appendix D
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	Section 1.3
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	Section 6
3.7	Additional environmental impacts expected from the proposed development.	Section 7
3.8	Any direct, indirect and cumulative impacts of the proposed development on site.	Section 7
3.9	The degree to which impacts, and risks can be mitigated.	Section 7
3.10	The degree to which impacts, and risks can be reversed.	Section 7, Appendix F
3.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	Section 7
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 6
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 7
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a “low” aquatic biodiversity and sensitivity and that were not considered appropriate.	Section 7
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	Section 8
3.16	Any conditions to which this statement is subjected.	Section 8

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flow into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Episodic drainage lines	Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period or may flow only once in several years.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soil).
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soil with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perennial:	Flows all year round.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Vernal pool	Also called vernal ponds or ephemeral pools, are temporary pools of water that provise habitat for distinctive aquatic plants and animals that are adapted to the very short inundation periods of these pools (BlueScience, 2018)
Watercourse:	In terms of the definition contained within the National Water Act, 1998 (Act No. 36 of 1998) a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks.
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soil, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius
AC	Alternating Current
BA	Basic Assessment
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
DC	Direct Current
DEFF	Department of Environment, Forestry and Fisheries
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHI	Index of Habitat Integrity
kV	Kilovolt
m	Meter
MAP	Mean Annual Precipitation
MC	Management Classes
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NBA	National Biodiversity Assessment
NEMA	The National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
NWCS	National Wetland Classification System
O&M	Operation and Maintenance
PEMC	Present Ecological Management Class
PES	Present Ecological State
REC	Recommended Ecological Category
REDZ	Renewable Energy Zones
REIPPPP	Renewable Energy Independent Power Producer Procurement Program (REIPPPP)
PFP	Preferential Flow Path
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SARERD	South African Renewable Energy Resource Database
SAS	Scientific Aquatic Services
SQR	Sub-quaternary catchment reach

subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WUA	Water Use Authorisation
WULA	Water Use Licence Application
WRC	Water Research Commission
ZOR	Zone of Regulation

1 INTRODUCTION

1.1 *Background*

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Water Use Authorisation (WUA) process for the proposed Brandvalley Wind Energy Facility (WEF) and associated infrastructure between Matjiesfontein and Sutherland in the Northern and Western Cape Province (hereafter referred to as the 'proposed development') (Figures 1 and 2). Please refer to Section 2 for the project description.

In order to identify all watercourses that may potentially be impacted by the proposed development, a 500 m "zone of investigation" was implemented around the proposed development, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), in order to assess possible sensitivities of the receiving freshwater environment. This area – i.e., the 500 m zone of investigation around the proposed development - will henceforth be referred to as the 'investigation area'.

The purpose of this report is to provide a description and assessment of the ecology of the watercourses associated with the proposed development including mapping of the natural watercourses, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES). The Department of Water and Sanitation (DWS) Risk Assessment Matrix as promulgated in Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the impacts associated with the proposed development and mitigatory measures were identified which aim to minimise the potential impacts.

This study further aims to provide detailed information to guide the proposed development in the vicinity of the watercourses, to ensure the ongoing functioning of the ecosystems, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development. This report, after consideration of the above, must guide the proponent, by means of a reasoned opinion and recommendations, as to the viability of the proposed development from a watercourse management perspective.

1.2 *Structure of this report*

This report investigates the impact significance of the proposed development, as explained the National Water Act, 1998 (Act No. 36 of 1998) (NWA) by means of the DWS Risk Assessment Matrix. The following structure is applicable to this report:

Section 1: Introduction
Provides an introduction, the structure of this report, the assumptions and limitations.

Section 2: Project Description
Provides the location of the proposed development as well as a brief summary of the proposed activities associated with the proposed development.

Section 3: Assessment Approach
Provides the relevant methodology and definitions applicable to this report, a description of the sensitivity mapping and the impact assessment approach.

Section 4: Desktop Assessment Results
Reports on the findings from the relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA], 2014 database and the Western Cape Biodiversity Spatial Plan (2017), Critical Biodiversity Areas of the Northern Cape (2016) and National Biodiversity Assessment (NBA) 2018 was undertaken to aid in defining the PES and EIS of the watercourses.

Section 5: Site Based Watercourse Assessment Results (Terms of Reference)
This section reports the following:

- A description and delineation of all watercourses associated with the proposed development according to "Department of Water Affairs and Forestry (DWAF)[2] (2008)[3]: A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones";
- Delineation of all watercourses (using desktop methods) within 500 m of the proposed development in accordance with Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to activities as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998);
- The classification of the watercourses according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The Ecological assessment of the watercourses utilised the following methodologies:
    - The EIS of the watercourses according to the method described by DWAF (1999);
    - The services provided by the watercourses associated with the proposed development were assessed according to the method of Kotze et al. (2009);
    - The PES of the watercourses was assessed according to the resource directed measures guideline as advocated by Macfarlane *et al.* (2008) and the River Eco Classification: Index of Habitat Integrity (IHI) as advocated by the Water Research Commission (WRC) and DWAF (2008), as applicable; and
- The allocation of a suitable Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS) to the watercourse based on the results obtained from the PES, Ecoservices and EIS assessments.

Section 6: Legislative Requirements
Provides the applicable legislative requirements based on the findings from Section 5 and indicates any applicable zones of regulation that may trigger various enviro-legal authorisation requirements.

Section 7: Risk Assessment
Provides the outcomes from the DWS Risk assessment which highlights all potential impacts that may affect the surrounding watercourses. Management and mitigation measures are provided which should be implemented during the various proposed development activities (planning, construction and operational phases) to assist in minimising the impact on the receiving environment.

Section 8: Conclusion
Summarises the key findings and recommendations based on the impact assessment outcomes and legislative requirements.

[2] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA). At present, the Department is known as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.
[3] Although an updated manual is available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas). This is still considered a draft document currently under review.

1.3 *Assumptions and Limitations*

- The ground-truthing and verification of the delineated extent of the watercourses are confined to a single site visit undertaken from the 25th to the 28th of May 2021 of the proposed development. All watercourses identified within the investigation area were delineated in fulfilment of Government Notice 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) using various desktop methods with limited field verification including the use of topographic maps, historical and current digital satellite imagery and aerial photographs;
- Due to the landscape in some areas being rugged and very undeveloped, some reaches of the identified watercourses were inaccessible. Therefore, verification points for watercourses were located at points as close to the watercourse to be verified as possible and, where necessary the conditions at the exact point required were inferred or extrapolated;
- Due to the majority of the watercourses being ephemeral within the region, very few areas were encountered that displayed more than one watercourse characteristic as defined by the DWAF (2008) method (such as containing alluvial or inundated soils, or hosts riparian vegetation adapted to saturated conditions). As a result, identification of the outer boundary of the temporary watercourse zones and marginal riparian zones proved difficult in some areas and, in particular, in the areas where watercourse conditions and riparian zones are marginal. Therefore, delineations were augmented with the use of digital satellite imagery. Nevertheless, the watercourse delineations as presented in this report are regarded as a best estimate of the watercourse boundaries based on the site conditions present at the time of assessment and the results obtained are considered sufficiently accurate to allow informed planning and decision making to take place;
- Global Positioning System (GPS) technology is inherently somewhat inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. However, the delineations as provided in this report are deemed accurate enough to fulfil the environmental authorisation requirements as well as the implementation of the mitigation measures provided;
- Watercourses and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the watercourse boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the watercourses have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of riparian and wetland ecology.

2 PROJECT DESCRIPTION

The proposed Brandvalley Wind Energy Facility (WEF) is located in the Western Cape, approximately 15 km north of Matjiesfontein, with Laingsburg a further 30 km east of Matjiesfontein. The Brandvalley WEF will comprise of the following:

- 58 wind turbines;
- Permanent compacted hardstanding areas / crane pads for each wind turbine (70 m x 50 m);
- Internal access roads up to 12 m wide, including structures for stormwater control would be required to access each turbine location and turning circles. Where possible, existing roads will be upgraded;
    - Access to the proposed development will be obtained from the Regional (R) 354 road, east of the development. The following existing Minor Roads (MR) from the R354 will be upgraded: the MR 8041 and MR 8042 (north of proposed development) and MR 6159 (west of proposed development). Typical existing watercourse crossings that will be upgraded include large rectangular culverts and pipe culverts, where required;

- 33kV overhead powerlines linking groups of wind turbines to onsite 33/132kV substation(s) (referred to as the collector systems – three (3) options proposed)';
- Underground 33 kV cabling between turbines buried along access roads, where feasible;
- 33/132kV onsite substation location (approximately 200m x 200m);
- Construction camp (~10ha) and an on-site concrete batching plant (~1ha);
- Additionally, a maximum potential of 80,000 m^3/annum of groundwater will be required for the construction phase to support the construction activities. The construction phase is estimated to last for a maximum of 2 years. Abstraction will be from the most appropriate borehole sited across the project area. At the time of report compilation, a single borehole (BH 264) was considered feasible for pumping with little to no impact on groundwater drawdown expected based on the sustainable yield tests. This volume of water will be significantly reduced to 250 m^3/annum during the operational life of the proposed development.

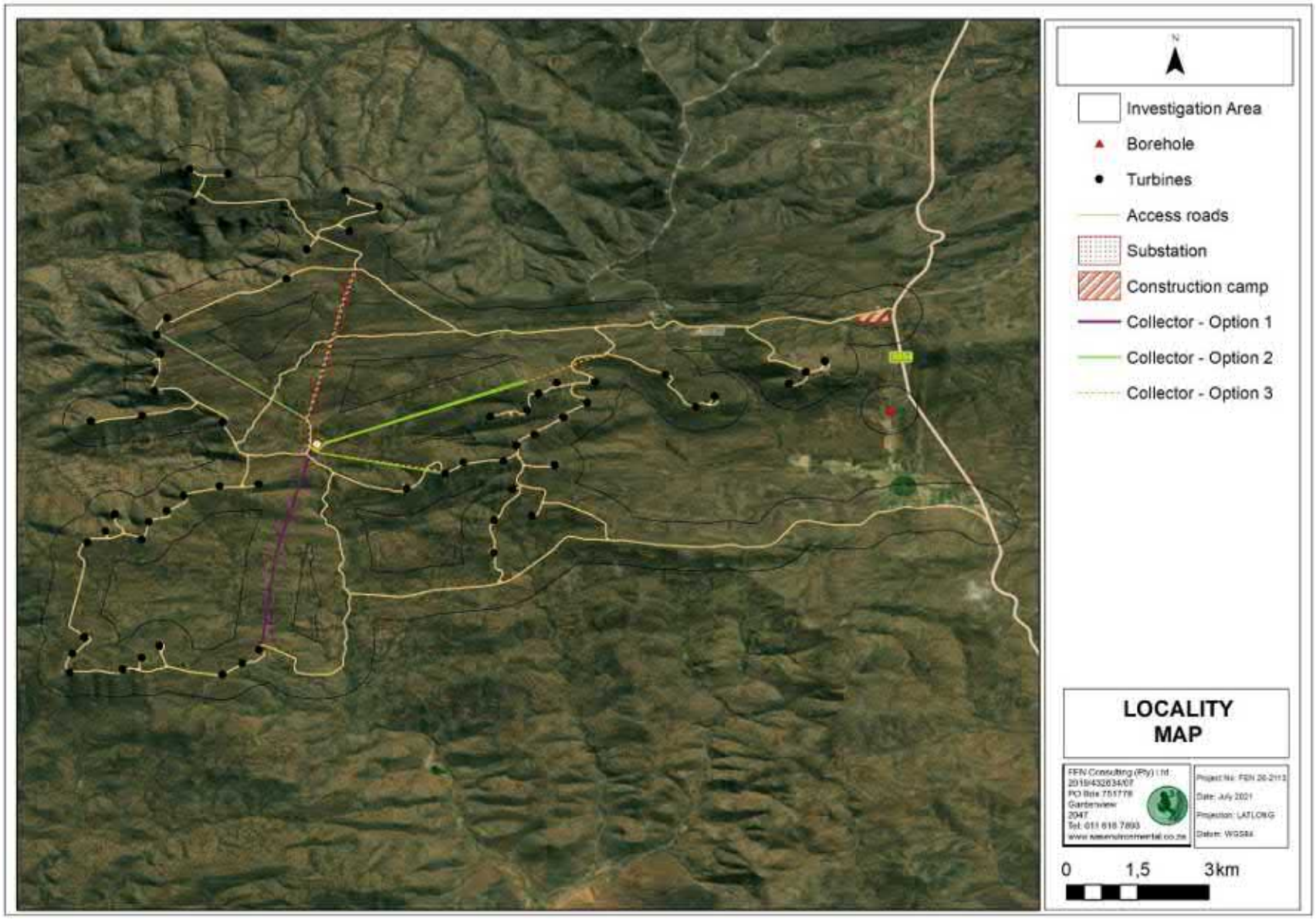


Figure 1: Digital satellite image depicting the proposed development and the associated investigation area in relation to its surroundings.

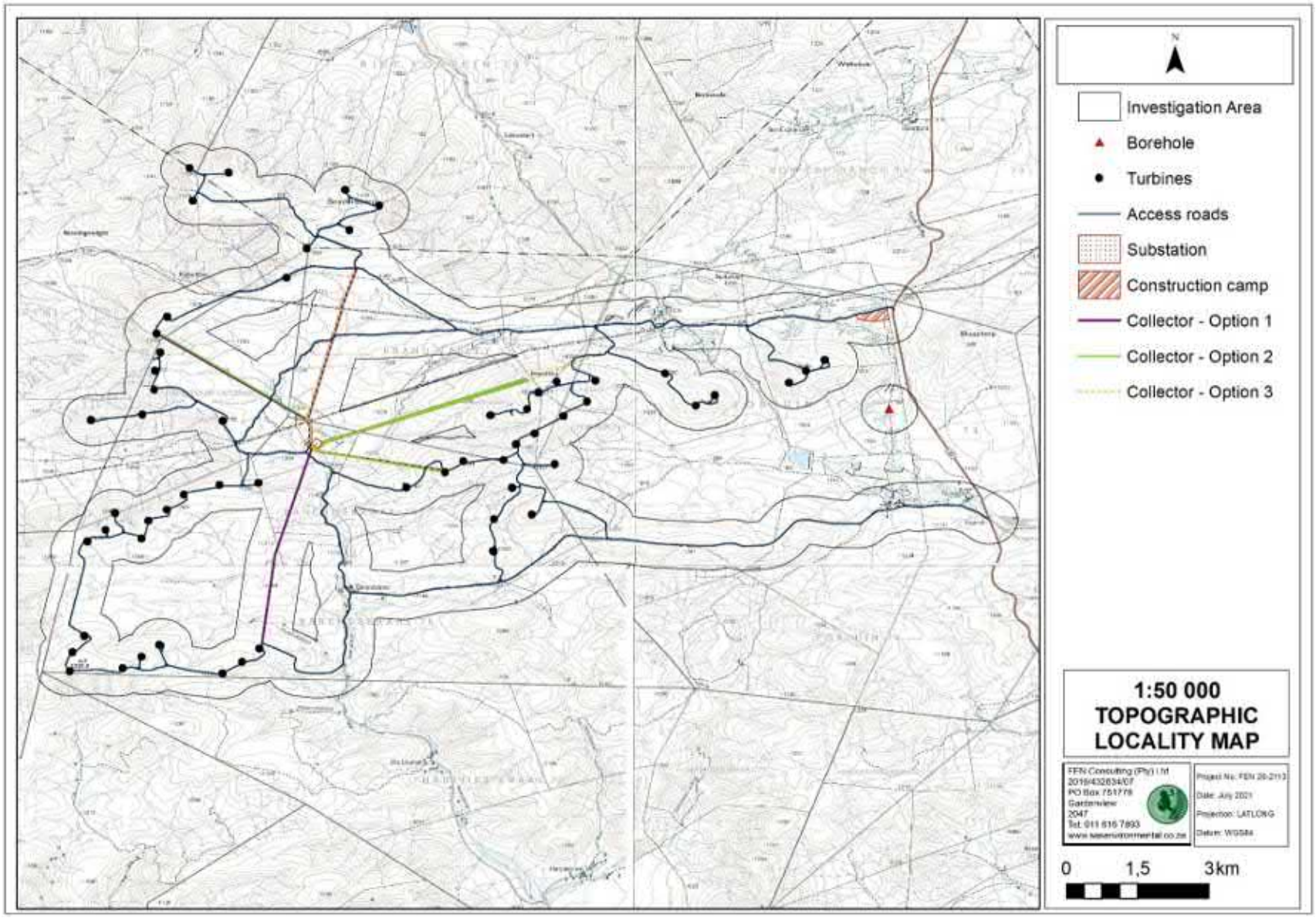


Figure 2: Location of the proposed development and the associated investigation area depicted on a 1:50 000 topographical map in relation to surrounding areas.

3 ASSESSMENT APPROACH

3.1 *Watercourse Field Verification*

As part of this assessment, the following definitions, as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance:

Watercourse means-

(a) A river or spring;
(b) A natural channel in which water flows regularly or intermittently;
(c) A wetland, lake or dam into which, or from which water flows; and
(d) Any collection of water, which the Minister may, by notice of the Gazette, declare a watercourse.

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

Riparian habitat includes the physical structure and associated vegetation of areas associated with a watercourse which are commonly characterised by alluvial soil, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

A field verification was undertaken from the 25th to the 28th of May 2021 (early winter season[4]) during which the presence of any watercourse characteristics as defined by DWAF (2008) or wetlands as defined by the National Water Act, 1998 (Act No. 36 of 1998) were noted (please refer to Sections 5 and 6 of this report). In addition to the delineation process, detailed assessment of the delineated watercourses was undertaken, at which time factors affecting the integrity of the watercourses were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the watercourses. A detailed explanation of the methods of assessment undertaken as listed in Section 1.1 is provided in **Appendix C** of this report.

The watercourse delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that watercourses have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soil;
- Vegetation adapted to saturated soil; and
- The presence of alluvial soil in stream systems.

[4] Site surveys are recommended to take place during a seasonal period where the probability of detecting an identifiable life history stage of vegetation species (such as facultative vegetation species) is highest and in the rainy period to ensure optimised conditions for the identification of seasonal watercourses, which may otherwise be overlooked. Thus, the site conditions at the time of the field assessment are considered optimal as rainfall had occurred in the local area prior to the site assessment undertaken end of May 2021.

3.2 *Sensitivity Mapping*

All watercourses associated with the proposed development were delineated with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity map presented in Section 6 should guide the design, layout and management of the proposed development.

3.3 *Risk and Impact Assessment and Recommendations*

Following the completion of the assessment, a risk assessment (DWS Risk Assessment) was conducted (please refer to **Appendix D** for the method of approach) and recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures, which apply to the proposed construction and operational/maintenance activities. The detailed mitigation measures are outlined in Section 7 of this report, while the general management measures which are considered best practice mitigation applicable to this project, are outlined in **Appendix F**.

4 DESKTOP ASSESSMENT RESULTS

4.1 *National and Provincial Datasets*

The following section contains data accessed as part of the desktop assessment and presented as a "dashboard-style" report below (Table 2). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for integration of results by the reader to take place. Where required, further discussion and interpretation are provided.

It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics associated with the proposed development at the scale required to inform the environmental authorisation and/or water use authorisation processes. Given these limitations, this information is considered useful as background information to the study, is important in legislative contextualisation of the risks and impacts, and was thus used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the field survey. It must, however, be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case the site verified information must carry more weight in the decision-making process.

Table 1: Desktop data (from desktop databases only) relating to the characteristics of the proposed development and its associated investigation area.

Aquatic ecoregion and sub-regions in which the investigation area is located		Detail of the investigation area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
Ecoregion	Great Karoo		
Catchment	Olifants – Cape and Gourits	FEPACODE	The proposed development is located in a sub-quaternary catchment classified as an upstream management catchment which is required to be managed to prevent downstream degradation of Freshwater Ecosystem Priority Areas (FEPAs) and fish support areas (FEPA CODE = UPSTREAM).
Quaternary Catchment (Figure 3)	E22A, E22B, E23A, J11E and J11D		
WMA	Olifants/Doorn and Gouritz		
subWMA	Doring and Groot		
Dominant characteristics of the Great Karoo Ecoregion Level II (21.03) (Kleynhans *et al*., 2007)		NFEPA Wetlands (Figure 4)	According to the NFEPA database (2011), several natural and artificial wetlands are located in the investigation area, of which some of the natural seep wetlands (considered to be in a moderately modified ecological condition (WETCON = C)) are proposed to be traversed by the access roads along existing crossings. Most of the natural and artificial wetland identified by this database was verified to be artificial impoundments or irrigated fields during the site assessment.
Level II Code	21.03		
Dominant primary terrain morphology	Low Mountains, Parallel Hills, Lowlands, Mountains and Lowlands.		
Dominant primary vegetation types	Great Nama Karoo, Escarpment Mountains Renosterveld, Upland Succulent Karoo, Upper Nama Karoo		
Altitude (m a.m.s.l)	500 – 1700	Wetland Vegetation Type	The majority of the investigation area is located in the Karoo Shale Renosterveld Wetland Vegetation type (least threatened), with the south central section of the investigation area located in the Rainshadow Valley Karoo (Skv) Wetland vegetation Type. The threat status of the wetland vegetation type is provided by Mbona *et al.* (2015).
MAP (mm)	100 – 300		
The coefficient of Variation (% of MAP)	30 – 40		
Rainfall concentration index	30 – 55	NFEPA Rivers (Figure 4)	As per the NFEPA database (2011), the Groot River is proposed to be traversed by the internal access road. The Roggeveld River is located in the eastern portion of the investigation area, the Muishond River in the north eastern portion and the Wilgebos River in the northern portion of the investigation area. These rivers are considered to be largely natural with only a few modifications (RIVCON = AB) but is considered to be in a moderately modified (Class C) ecological condition by the PES 1999 dataset.
Rainfall seasonality	Very late summer, Winter		
Mean annual temp. (°C)	14 – 18		
Winter temperature (July)	0 – 18		
Summer temperature (Feb)	10 – 30		
Median annual simulated runoff (mm)	<5 - 20		
Importance of the investigation area according to the Western Cape Biodiversity Spatial Plan (2017) (Figure 5)			
According to the Western Cape Biodiversity Spatial Plan (2017), the western portion of the investigation area is located in an area classified as Critical Biodiversity Areas (CBA) 1, of terrestrial ecological importance. CBAs are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure, in this case specifically for riverine environments. CBA 1 are areas likely to be in a natural condition. The central and southern portions of the investigation area are associated with areas classified as Ecological Support Areas (ESAs) 1 and 2 (of aquatic/watercourse importance). ESAs are important in supporting the functioning of CBAs and are often vital for delivering ecosystem services. ESA 1 are areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of Protected Areas (PAs) or CBAs, and are often vital for delivering ecosystem services. ESA 2s are areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services. The central and southern portions of the investigation area are also associated with areas classified as Other Natural Areas (ONAs). ONAs are areas that have not been identified as a priority in the current systematic biodiversity plan, but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.			
Importance of the investigation area according to the Critical Biodiversity Areas of the Northern Cape (2016) (Figure 5)			
According to the Critical Biodiversity Areas of the Northern Cape (2016), the northern portion of the investigation area is associated with areas classified as Ecological Support Areas (ESAs) and Other Natural Areas (ONAs). ESAs are areas that are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning in CBAs. ONAs are areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.			
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (National Wetland Map 5 is included in the NBA) (Figure 6)			
According to the NBA 2018: SAIIAE seep wetlands and a large channelled valley bottom wetland are proposed to be traversed by the proposed access roads. These wetlands are considered to be in a heavily to severely/critically modified ecological condition (WETCON = D/E/F). The Ecosystem Threat Status (ETS) of the seep wetlands are considered Least Concerned, while the ETS of the channelled valley bottom wetland are considered Critical. The ecosystem protection level (EPL) of the wetlands is Not Protected. The NBA 2018:SAIIE also identified the following rivers: the Groot River is proposed to be traversed by the internal access road. The Roggeveld River is located in the eastern portion of the investigation area, the Muishond River in the north eastern portion and the Wilgebos River in the northern portion of the investigation area; which corresponds with the rivers identified by the NFEPA database. The ETS of the rivers are least threatened, and the EPL thereof is poorly protected.			

CBA = Critical Biodiversity Area; EI = Ecological Importance; EN = Endangered; EPL = Ecosystem Protection Level ES = Ecological Sensitivity; ESA = Ecological Support Area; ETS = Ecosystem Threat Status; m.a.m.s.l = Metres above mean sea level; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Area; OESA = Other Ecological Support Area; PA = Protected Area; PES = Present Ecological State; WMA = Water Management Area.

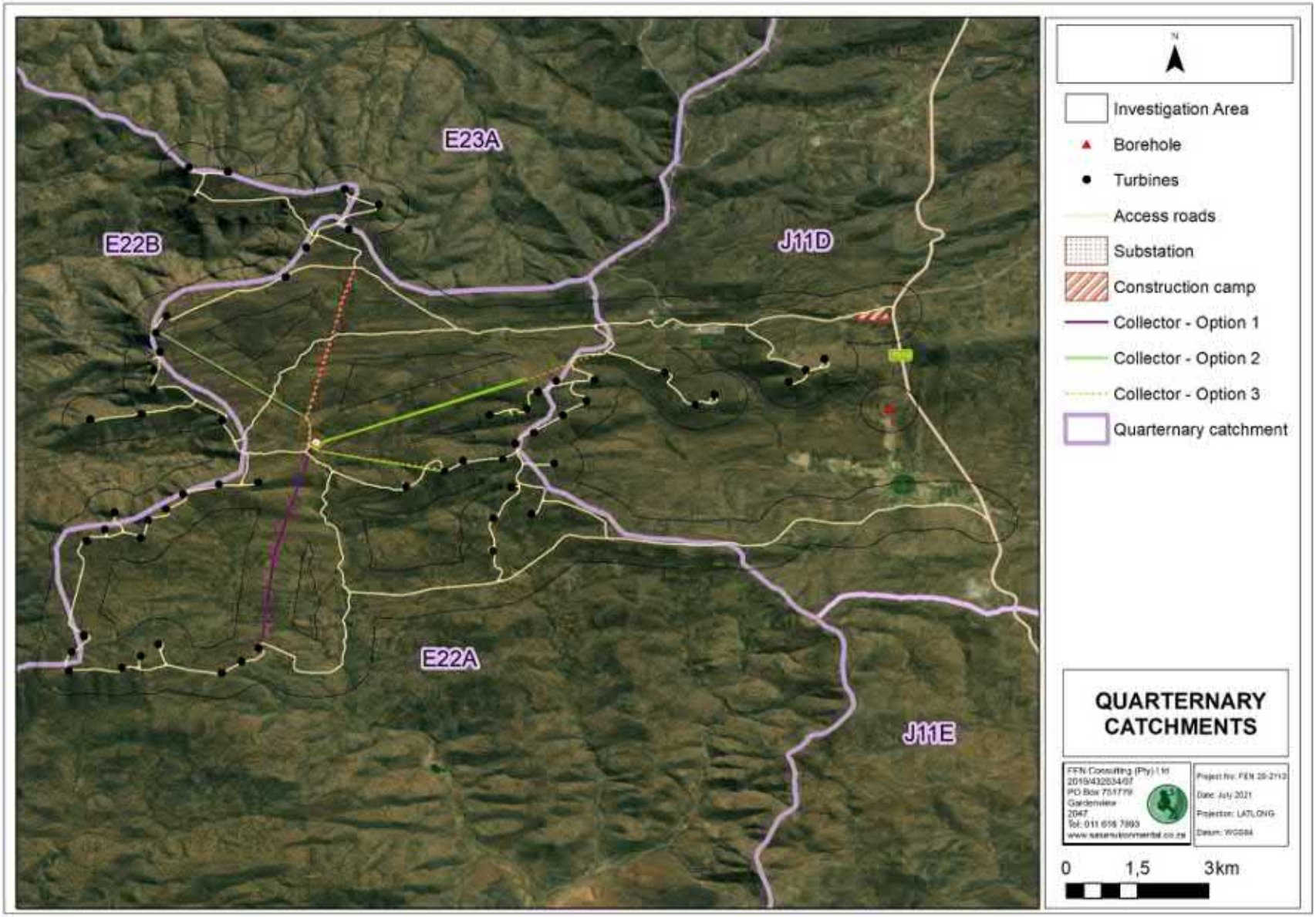


Figure 3: Quaternary catchments associated with the proposed development.

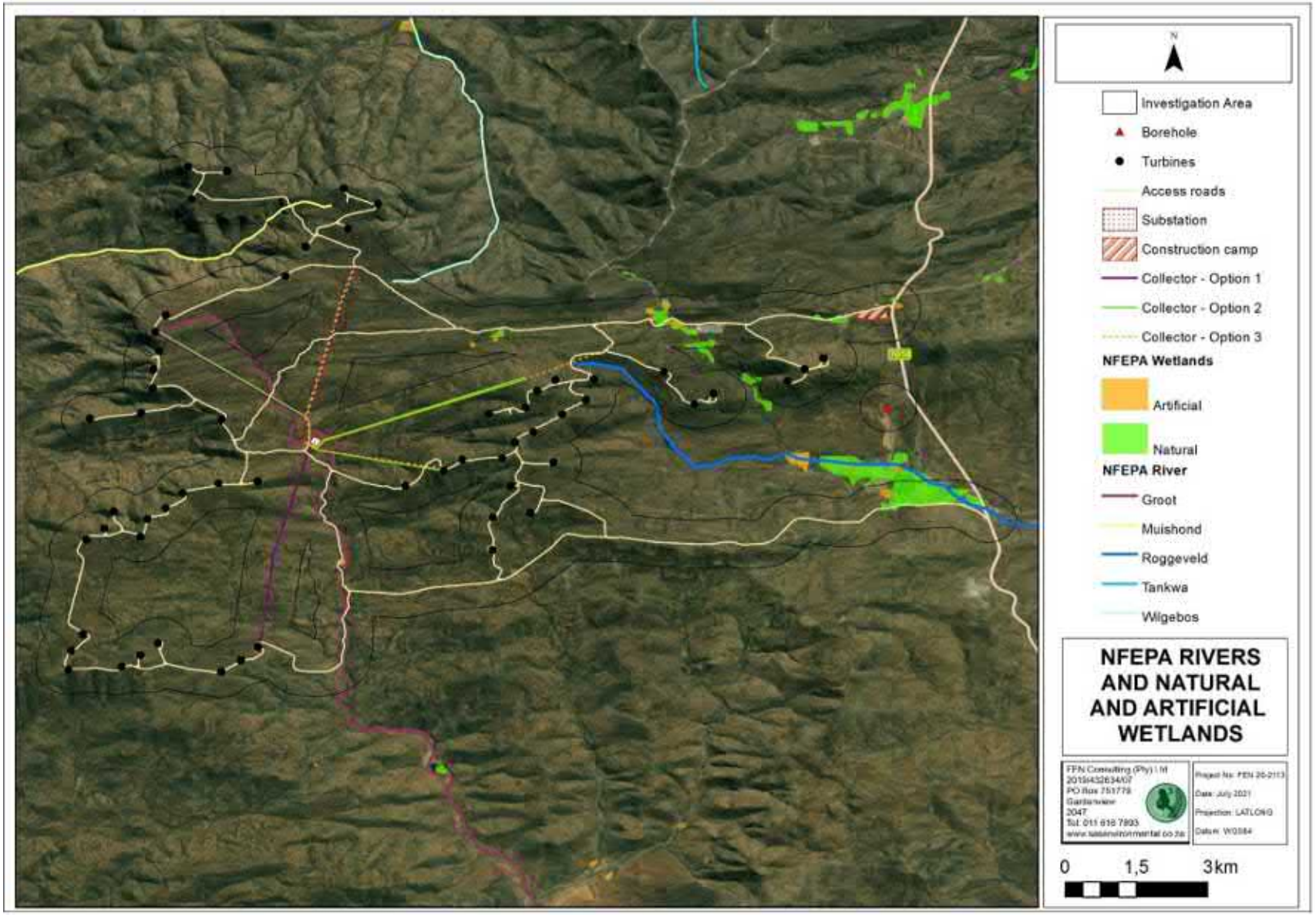


Figure 4: NFEPA listed rivers and natural and artificial wetlands associated with the proposed development and investigation area, according to the NFEPA database (2011).

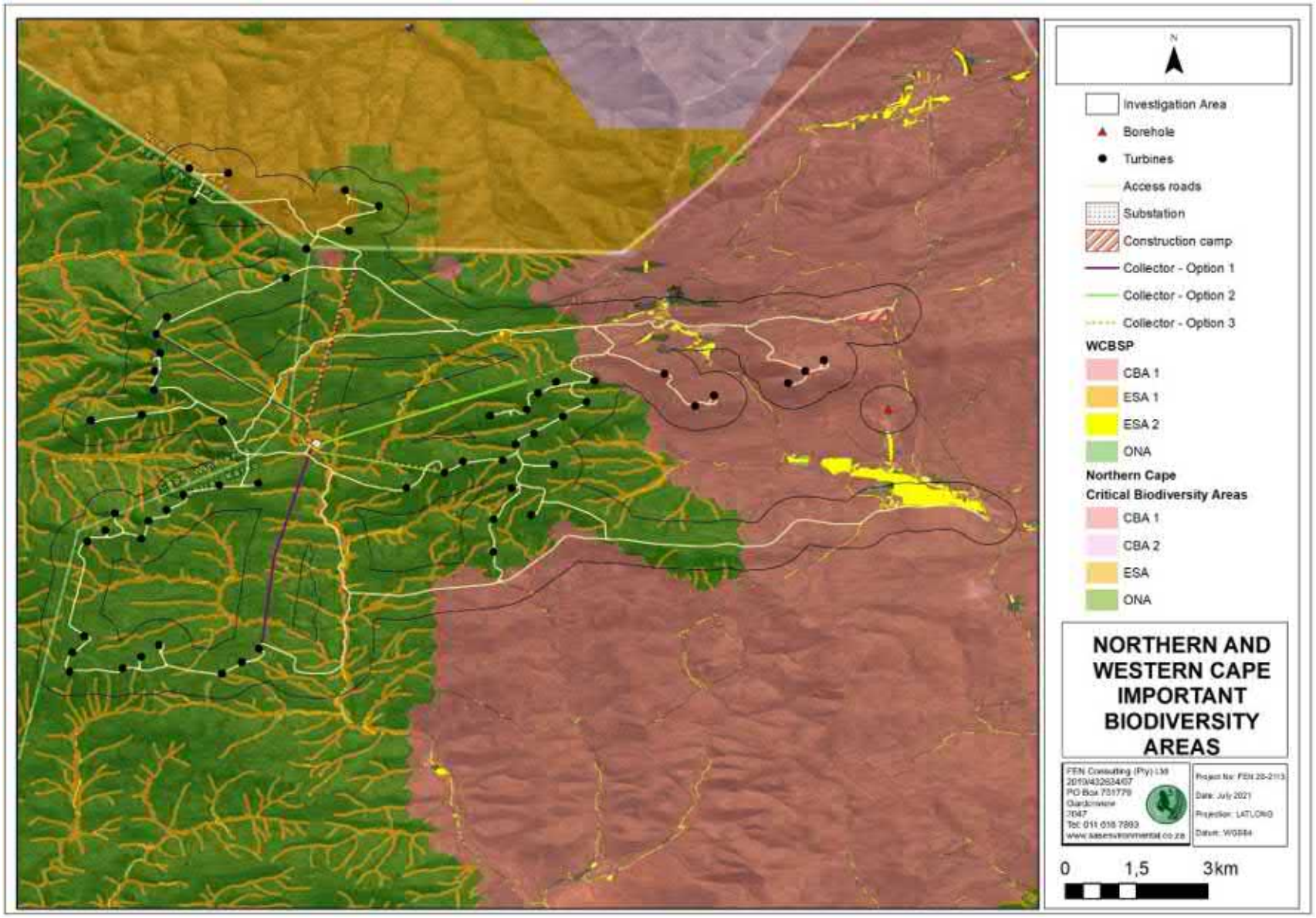


Figure 5: The areas of biodiversity importance associated with the proposed development and investigation area, according to the Western Cape Biodiversity Spatial Plan (2017) and Critical Biodiversity Areas of the Northern Cape (2016) databases.

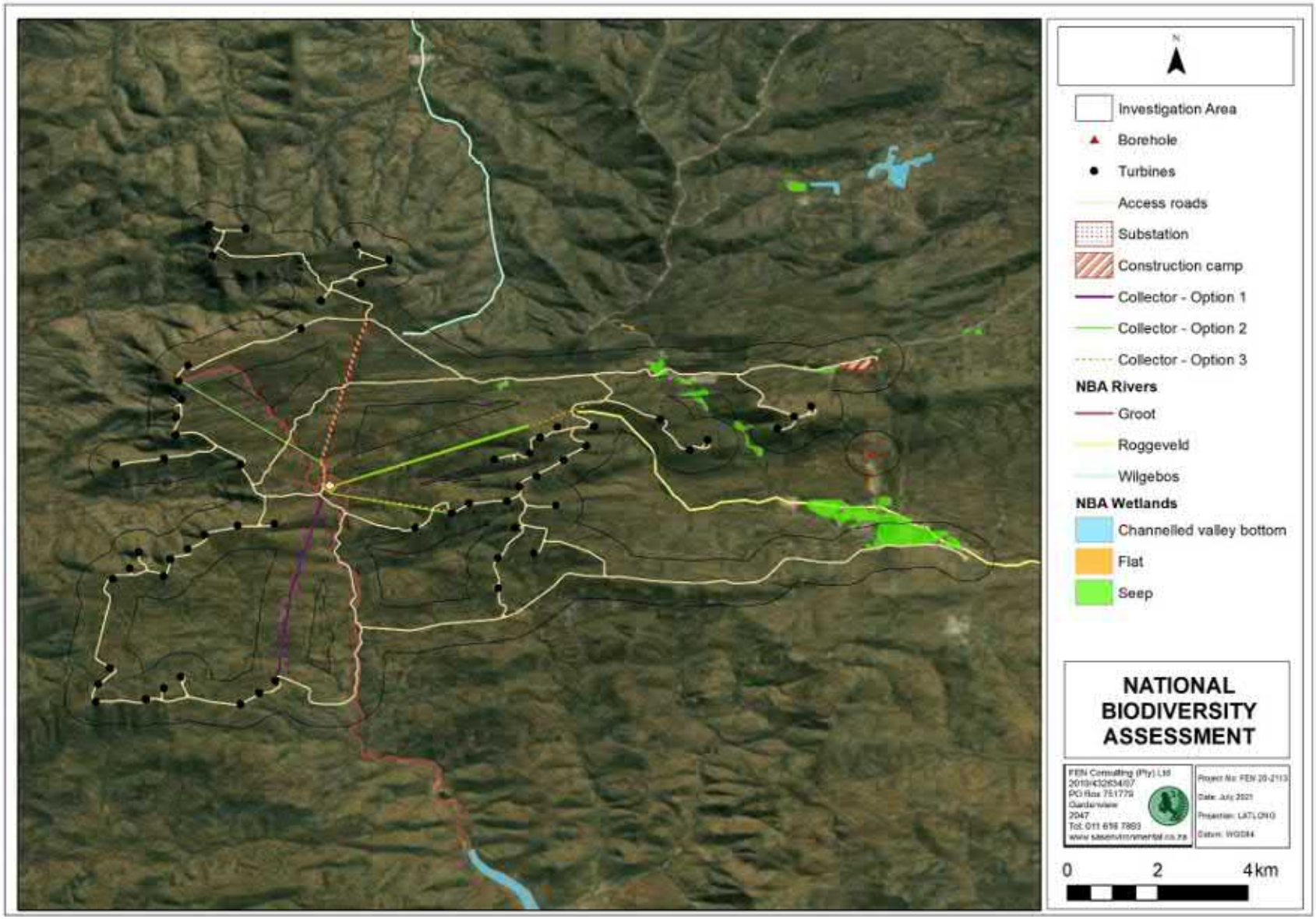


Figure 6: NBA identified wetlands and rivers associated with the proposed WEF development and investigation area, according to the NBA database (2018).

4.2 *Ecological Status of Sub-Quaternary Catchments [Department of Water and Sanitation (DWS) Resource Quality Services (RQS) PES/EIS Database]*

The PES/EIS database, as developed by the DWS RQIS department was utilised to obtain additional background information on the project area. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level. Descriptions of the aquatic ecology is based on information collated by the DWS RQIS department from available sources of reliable information, such as the South Africa River Health Programme (SA RHP) sites, Ecological Water Requirements (EWR) sites and Hydro Water Management System (WMS) sites.

Key information on invertebrates and background conditions associated with the SQRs SQRs E23A-07875 (Wilgebos River), E22A-08171 (Groot River) and J11D-08162 (Roggeveld River) as contained in this database and pertaining to the PES and EIS are tabulated in Tables 2 and 3 and visually represented in Figure 7 that follows.

Table 2: Invertebrates previously collected from or expected at the SQR monitoring points.

Macro-Invertebrates	E23A-07875 (Wilgebos River)	E22A-08171 (Groot River)	J11D-08162 (Roggeveld River)
Aeshnidae	X	X	X
Ancylidae	X		X
Baetidae 1 Sp	X		X
Baetidae 2 Sp		X	X
Belostomatidae	X		
Ceratopogonidae	X	X	X
Caenidae	X		X
Chironomidae	X	X	X
Coenagrionidae	X	X	X
Corduliidae	X	X	
Corixidae	X	X	X
Culicidae	X	X	X
Dytiscidae	X	X	X
Ecnomidae			X
Elmidae/Dryopidae		X	
Gerridae	X	X	X
Gyrinidae	X	X	X
Hirundinea		X	
Hydracarina	X	X	X
Hydropsychidae 1 Sp			X
Hydropsychidae 2 Sp		X	
Leptoceridae		X	
Leptophlebiidae			X
Lestidae	X		
Libellulidae	X	X	X
Lymnaeidae	X	X	
Muscidae	X		
Naucoridae		X	X
Notonectidae	X	X	X
Oligochaeta	X	X	X
Physidae	X		
Pleidae	X	X	X
Potamonautidae			X
Simuliidae	X	X	X
Tabanidae			X
Teloganodidae			X
Tubellaria		X	X
Veliidae/Mesoveliidae	X	X	X

Table 3: Summary of the ecological status of the sub-quaternary catchment (SQ) reaches associated with the proposed development based on the DWS RQS PES/EIS database.

	E23A-07875 (Wilgebos River)	E22A-08171 (Groot River)	J11D-08162 (Roggeveld River)
Synopsis			
PES Category Median	Natural/Close to natural	Natural/Close to natural	C (Moderately modified)
Mean EI class	High	High	High
Mean ES class	High	High	High
Length	31,84	35,2	37.93
Stream order	1	1	1
Default EC[4]	B (High)	A (Very High)	B (High)
PES Details			
Instream habitat continuity MOD	None	None	Moderate
RIP/wetland zone continuity MOD	Small	Small	Moderate
Potential instream habitat MOD activities	None	None	Moderate
Riparian/wetland zone MOD	None	None	Moderate
Potential flow MOD activities	Small	Small	Large
Potential physico-chemical MOD activities	None	None	Large
EI Details			
Fish spp/SQ	-	-	-
Fish average confidence	-	-	-
Fish representivity per secondary class	-	-	-
Fish rarity per secondary class	-	-	-
Invertebrate taxa/SQ	25	28	29
Invertebrate average confidence	3	1	5
Invertebrate representivity per secondary class	Moderate	Moderate	Very High
Invertebrate rarity per secondary class	High	High	Very High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	Very Low	Very Low	Very High
Habitat diversity class	Low	Low	Moderate
Habitat size (length) class	Moderate	High	High
Instream migration link class	Very High	Very High	High
Riparian-wetland zone migration link	Very High	Very High	High
Riparian-wetland zone habitat integrity class	Very High	Very High	High
Instream habitat integrity class	Very High	Very High	High
Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m	Very High	Very High	Very High
Riparian-wetland natural vegetation rating based on expert rating	Very High	Very High	High
ES Details			
Fish physical-chemical sensitivity description	-	-	-
Fish no-flow sensitivity	-	-	-
Invertebrates physical-chemical sensitivity description	Moderate	Moderate	Very High
Invertebrates velocity sensitivity	High	Very High	Very High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description	Very High	Very High	Very High
Stream size sensitivity to modified flow/water level changes description	High	Very High	High
Riparian-wetland vegetation intolerance to water level changes description	Very High	Very High	High

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;

[2] EI = Ecological Importance;

[3] ES = Ecological Sensitivity

[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

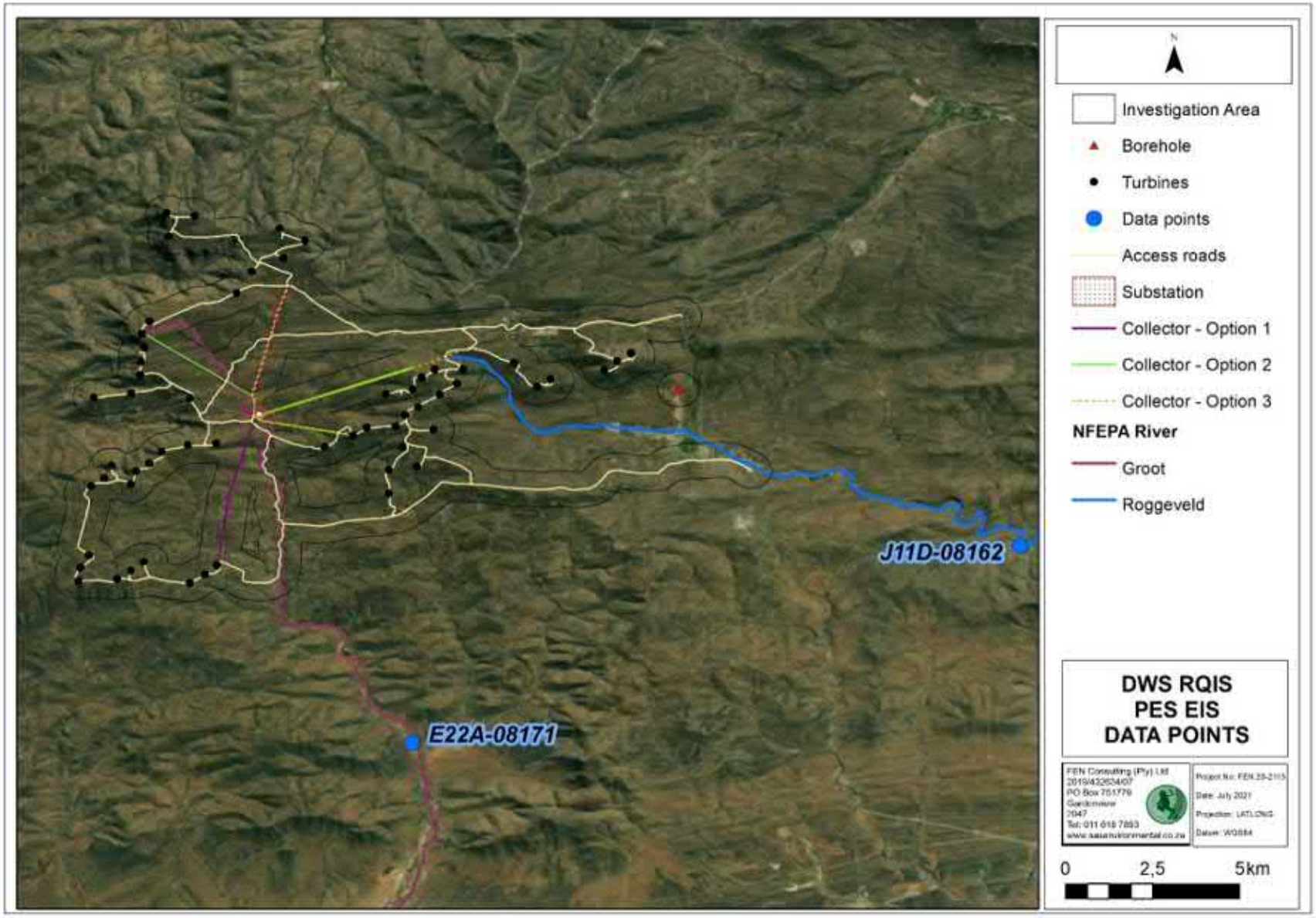


Figure 7: DWS RQIS PES/EIS sub-quaternary catchment reaches (SQRs) indicated relative to the proposed development and investigation area.

5 RESULTS: WATERCOURSE ASSESSMENT

5.1 *Field verification and delineation*

In preparation for the field assessment, aerial photographs, digital satellite imagery and provincial and national watercourse databases (as outlined in Section 4 of this report) were used to identify points of interest associated with the proposed development at a desktop level. In this regard, specific mention is made of the following:

- Linear features: since water flows/moves through the landscape, watercourses often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often showing as white/grey or black and outcrops or bare soil displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with watercourse vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

These points of interest were verified during the site assessment undertaken from the 25th to the 28th of May 2021. Watercourses associated with the Groot, Muishond, Roggeveld and Wilgebos River systems were identified within the investigation area. The proposed development is located at the southern end of the greater Koedoesberg mountains and directly south of the existing Roggeveld WEF. Turbines (turbines 35, 37, 40 to 46) located on the Snydersberg associated with the most northern extent of the proposed development, located upgradient of the Wilgebos River system. Turbines 53 to 61 are located on and around Brandkop, which forms part of the catchment of the headwater systems associated with the Groot and Roggeveld River systems. The sections of existing internal roads proposed to be upgraded (MR 8041 and MR 8042 (north of proposed development) and MR 6159 (west of proposed development)) traverses watercourses associated the Groot and Roggeveld River systems. Current land uses associated with the development site includes predominantly small-scale farming activities, specifically located adjacent to watercourses and existing powerline servitudes. An irrigation furrow was identified immediately west of the R 354 road where the construction camp is proposed (Figure 8). This is a man-made feature created to collect surface water runoff from watercourses and convey it into an artificial impoundment located 3,5 km south of the proposed construction camp. Due to the anthropogenic origin of this furrow, it cannot be defined as a true watercourse and does not enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998).
+

Figure 8: (Left) digital satellite imagery depicting the locality of the furrow, which is a straightened berm and channel feature, relative to the proposed construction camp. (Right) Photograph of the furrow being traversed by the MR 8042 (access road) located along the northern boundary of the proposed construction camp.

Most of the watercourses to be traversed by the proposed development and those identified within the investigation area can best be described as headwater episodic[5] drainage lines (EDLs) without riparian vegetation which flow into larger ephemeral tributaries with riparian vegetation, which ultimately flow into the larger riverine systems. Although these EDLs cannot be classified as riparian resources in the traditional sense, due to the lack of saturated soil and riparian vegetation, they do still function as waterways, through episodic conveyance of water. However, based on the definition of a watercourse (see Section 3.1) water flows regularly or intermittently within these EDLs, conveying water from the upgradient catchment area into the downgradient tributaries and eventually into the larger river systems. As such, they can be considered as watercourses due to their importance for hydrological functioning as they do function as waterways and therefore enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998). Ephemeral tributaries with riparian vegetation and associated channelled valley bottom wetlands were also identified to be traversed by the proposed. The Groot River are proposed to be traversed several times by access roads.

Figures 9 to 12 depicts the delineated extent of the identified watercourses relative to the proposed development.

[5] "Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period or may flow only once in several years." (Uys and O'Keeffe, 1997, in Rossouw *et. al*, 2006).

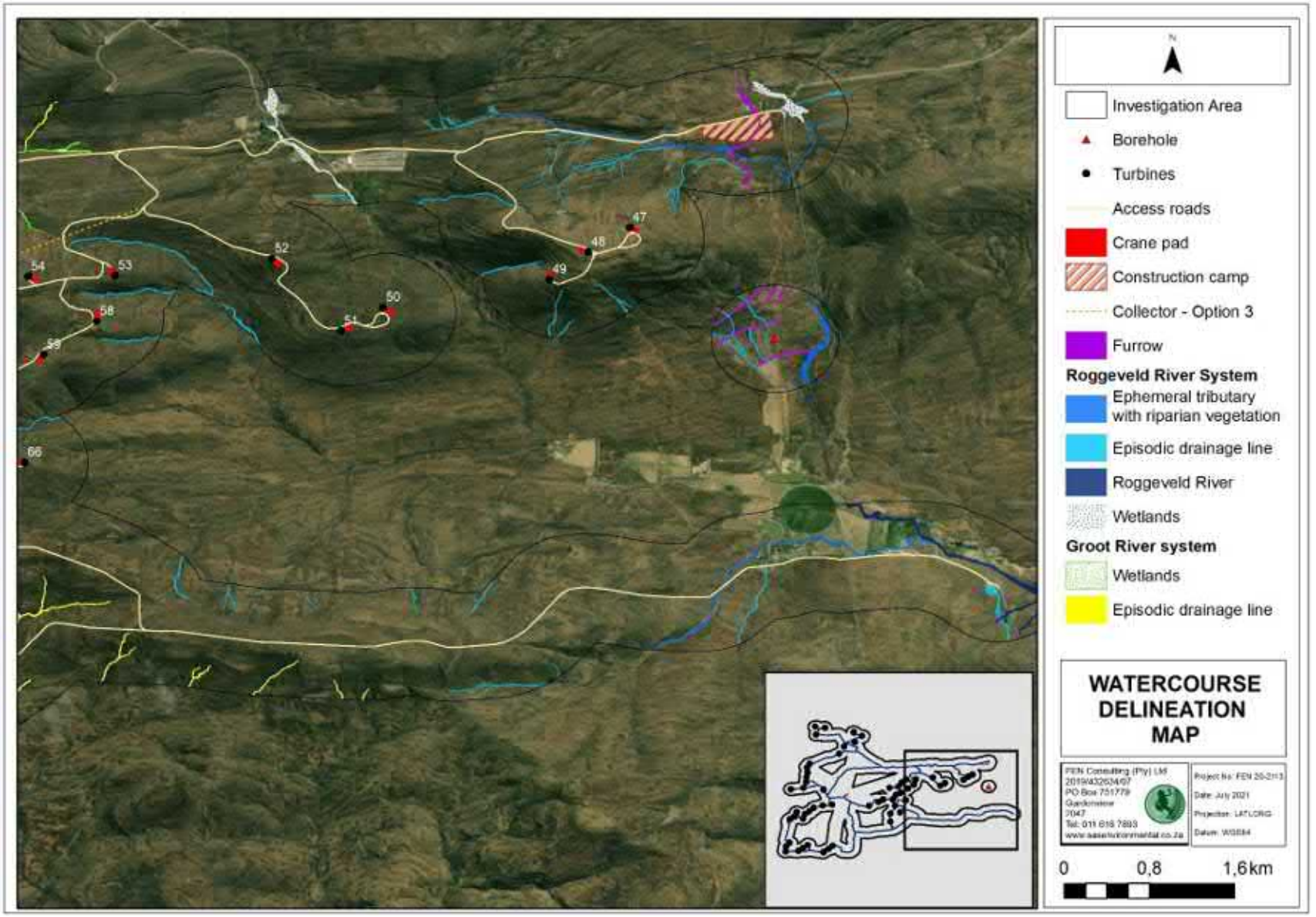


Figure 9: The locality of the delineated watercourses in the eastern portion of the investigation area.

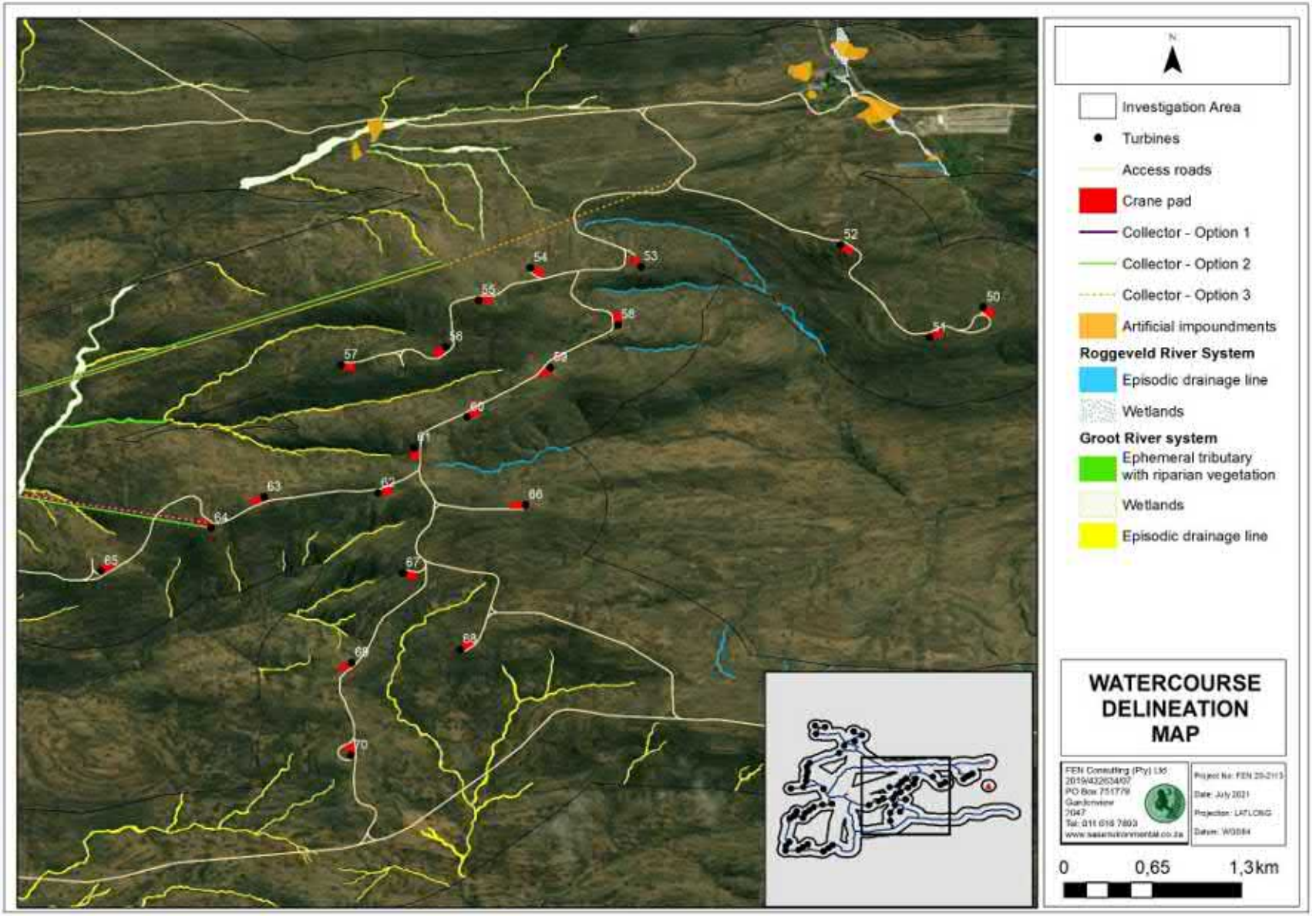


Figure 10: The locality of the delineated watercourses in the central portion of the investigation area.

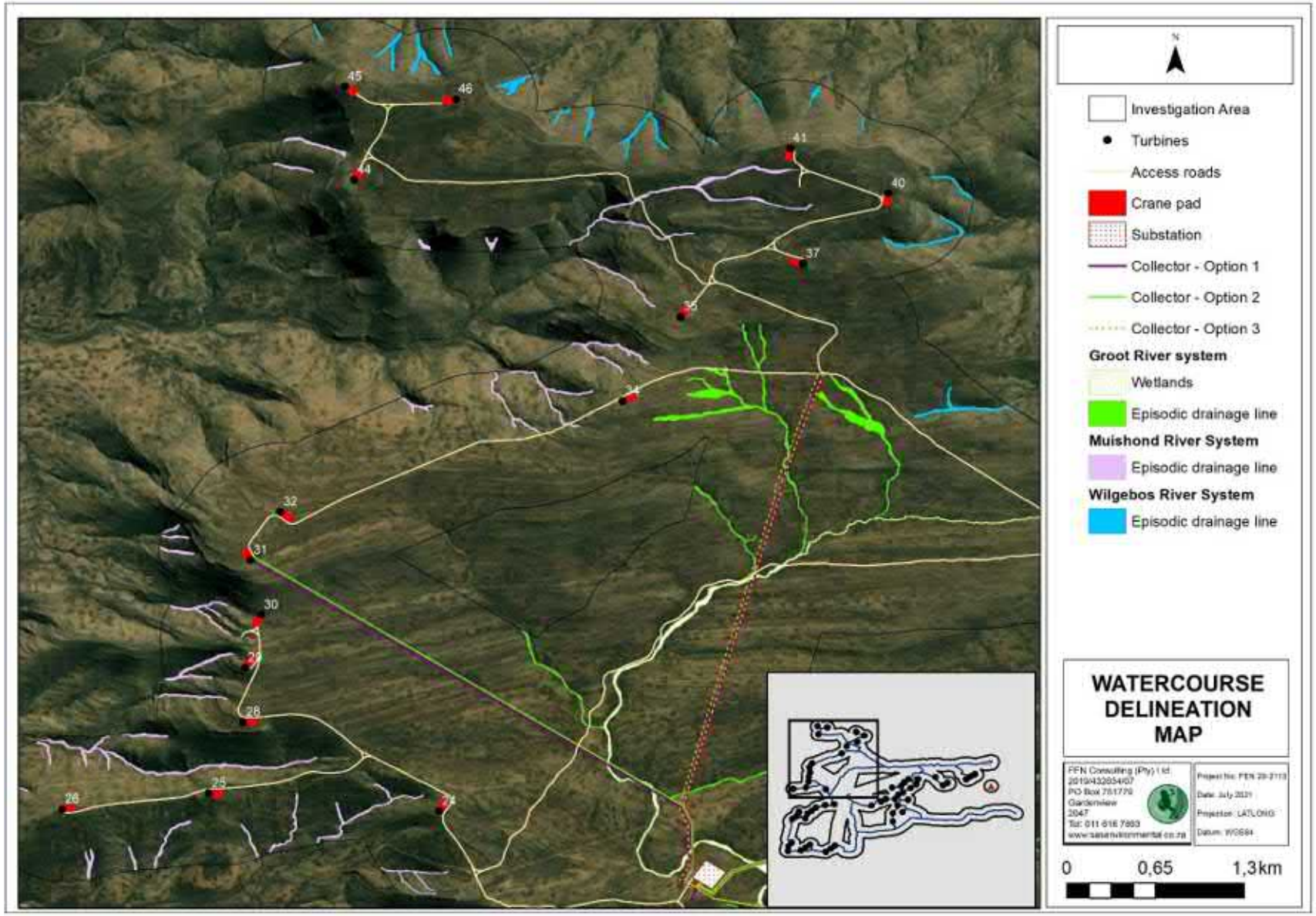


Figure 11: The locality of the delineated watercourses in the northwestern portion of the investigation area.

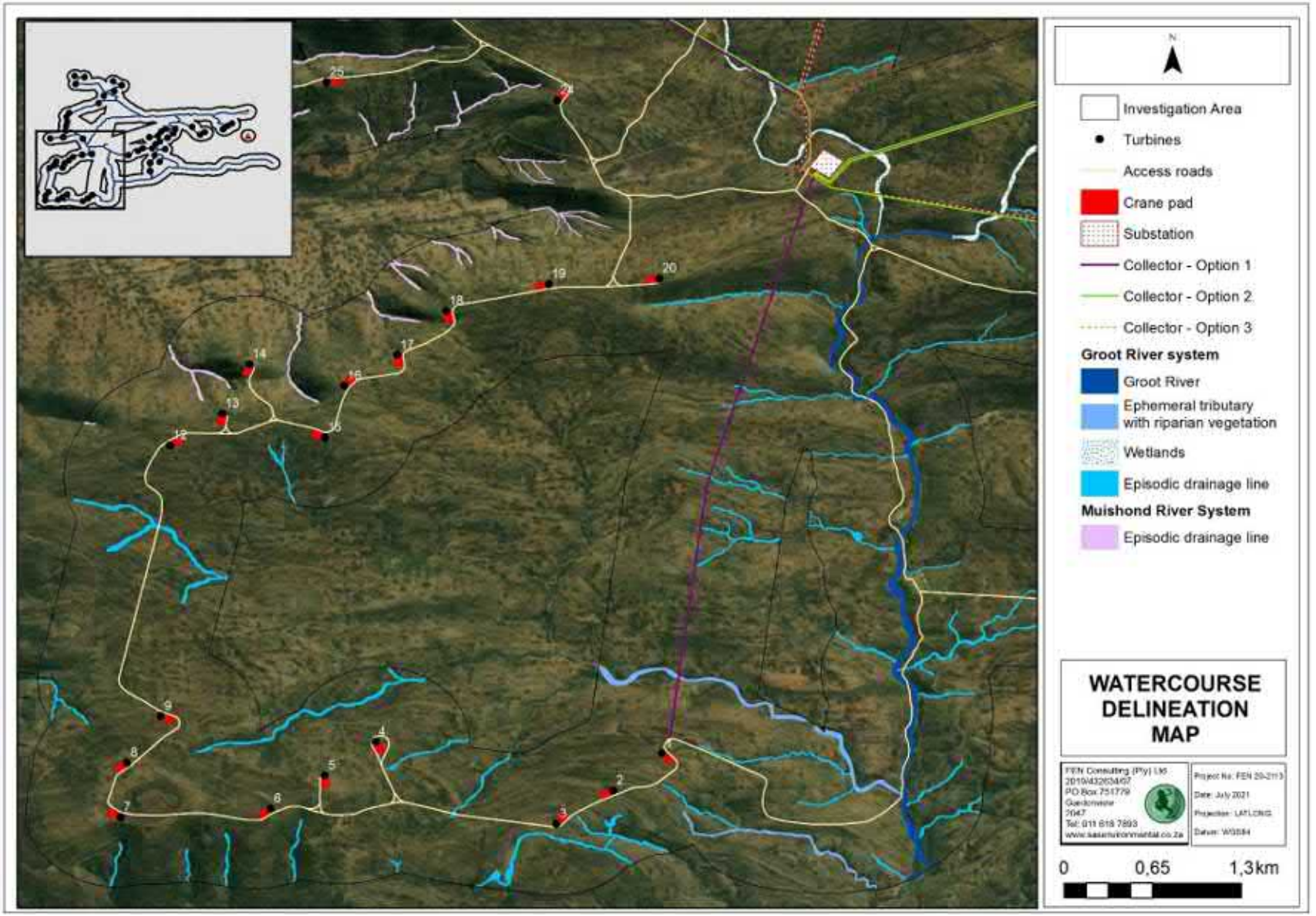


Figure 12: The locality of the delineated watercourses in the southwestern portion of the investigation area.

5.2 *Watercourse delineation*

The outer boundary of the identified watercourses were delineated according to the guidelines advocated by DWAF (2008) taking into consideration soil characteristics as defined by Job (2009). The delineations as presented in this report are regarded as a best estimate based on the site conditions present at the time of the assessment. During the field assessment, the following indicators were used in order to determine the boundary of the riparian watercourses identified to be associated with the proposed development and associated investigation area:

- **Topography/elevation** was used to determine which parts of the landscape watercourses are most likely to occur. Since watercourses occur where there is a prolonged presence of water in the landscape, the most common place one could expect to find watercourses is in the valley bottom position (DWAF, 2008). The main tributaries, the Groot and Roggeveld Rivers are located in the valley bottom position (Figure 13). Most other watercourses (like the smaller episodic drainage lines) are also located in valleys between undulating hills within the upslope that slopes towards the larger downstream system where concentration of flow leads to drainage towards the larger tributaries and river.

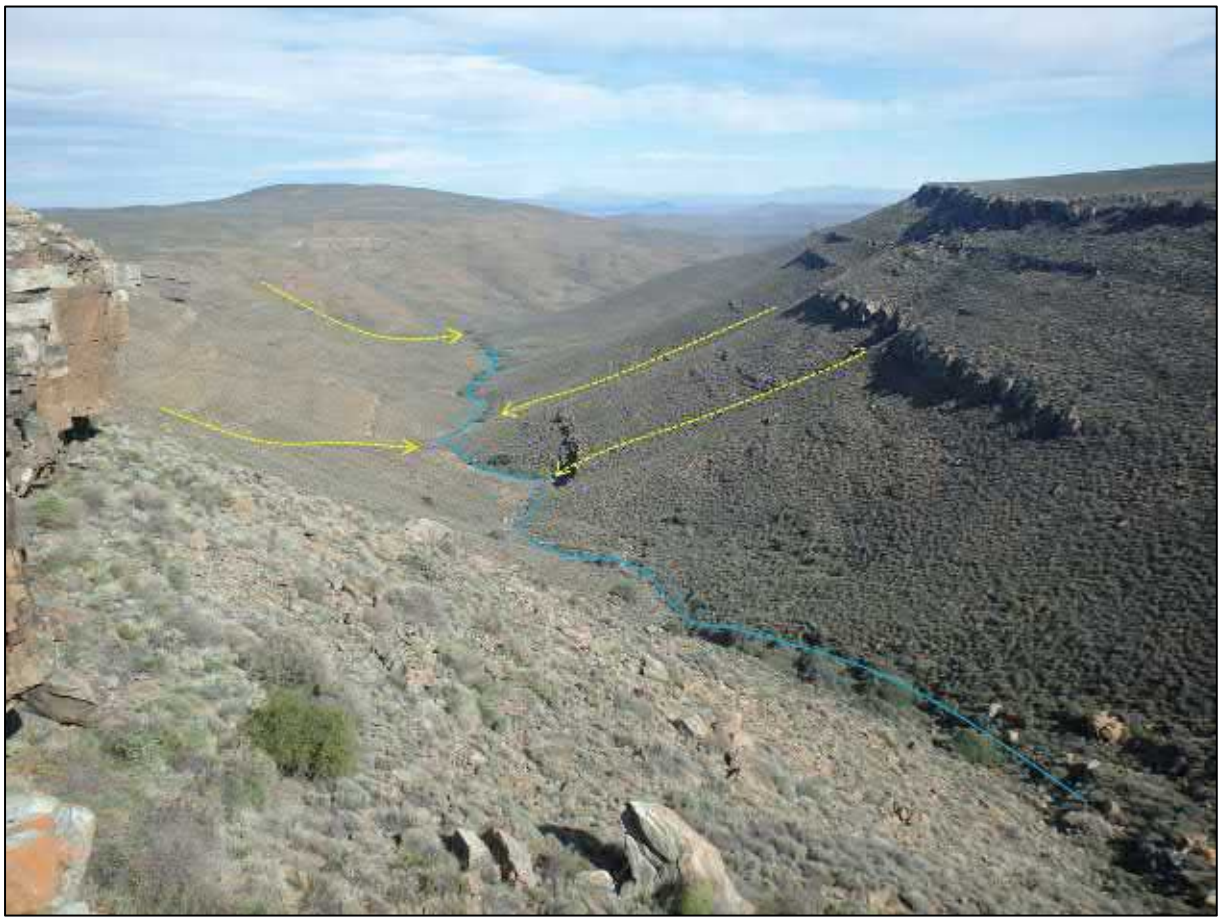


Figure 13: A photograph depicting the topographical setting of the smaller episodic drainage lines in the higher slope position (yellow dashed line) relative to the larger ephemeral tributary of the Muishond River in the valley bottom position (blue arrow).

- **Vegetation associated with riparian areas:** the identification of riparian areas relies heavily on vegetative indicators. Using vegetation, the outer boundary of a riparian area can be defined as the point where a distinctive change occurs:
  - in species composition relative to the adjacent terrestrial area; and
  - in the physical structure, such as vigour or robustness of growth forms of species similar to that of adjacent terrestrial areas. Growth form refers to the health, density, crowding, size, structure and/or numbers of individual plants.

Only in the larger downstream ephemeral tributaries and Groot River was a change in riparian vegetation identified from that of the terrestrial vegetation (Figure 14), where a mix of low tree and shrub species such as *Vahellia karroo, Searsia lancea, Lycium cinereum, Diospyros ausro-africana* and *Buddleja saligna* are prevalent. Trees and shrubs are less prominent along the rocky episodic drainage lines located in the upper reaches of the drainage systems (Figure 15). The channelled valley bottom wetlands identified hosts, predominantly facultative *Pseudoschoenus inanis* and *Scirpoides dioecus* sedges (Figure 15). Patches of *Phragmites australis* reeds, grasses such as *Stipagrostis namaquensis* with *Juncus spp* rushes were also identified in isolated patches within the ephemeral rivers/tributaries located in the valley bottom position, specifically where anthropogenic impacts have occurred, such as the construction of instream artificial impoundments.

Figure 14: Photographs depicting the vegetation component of the watercourses associated with the proposed development. (Left) the lower reaches of the ephemeral tributaries and rivers host tree species (indicated by the yellow arrows) in its marginal zones, which can be easily distinguished from the surrounding terrestrial vegetation. (Right) the vegetation of the smaller episodic drainage line watercourses is similar to that of the surrounding terrestrial areas.

Figure 15: A photograph depicting the typical vegetation of the identified wetlands, predominantly sedges.

- ***The presence of alluvial soil:*** The presence of alluvial soil was used as an indicator of riparian zones, as defined by the National Water Act, 1998 (Act No. 36 of 1998). The occurrence of alluvial deposited material adjacent to the active channel is a good indicator of the riparian zone of a riparian watercourse (such as that of the identified river, tributaries and ephemeral drainage lines). Alluvial soil is soil derived from materials deposited by flowing water, especially in the valley bottom position. Riparian areas often, but not always, have alluvial soil. While the presence of alluvial soil cannot always be used as a primary indicator to delineate riparian watercourses accurately, it can be used in conjunction with the topographical and vegetative indicators. Unlike wetland areas, riparian zones are usually not saturated for a long enough period of time for redoximorphic features to develop. This is because riparian watercourses are mainly driven by flow, originating from its local catchment which flows through the watercourse and does not reside in the riparian watercourse as with wetlands. This is specifically true for ephemeral and episodic systems that experience flash flooding in response to rainfall events.
- **Soil form indicators** were used to determine the presence of soil that are associated with prolonged and frequent saturation with key wetland indicators including gleying, mottling, organic streaking and increased clay content, as well as alluvial soil. A thick layer of clay above impermeable rock retains sufficient moisture for facultative species to have established within the identified wetlands (Figure 16).

Figure 16: (Left) the embankment of the wetland channel consists of a thick clay layer above impermeable rock. (Right) the soil auger samples consisted of high clay content that was noted to be saturated, however no other hydrogeomorphic indicators were present.

5.3 *Watercourse classification and assessment*

The identified watercourses were classified according to the Classification System outlined in **Appendix C** of this report as Inland Systems, located within the Great Karoo Ecoregion. Table 4 below presents the classification from level 3 to 4 of the Wetland Classification System (Ollis *et al.* 2013).

Table 4: Classification of the watercourses associated with the proposed development.

Watercourse	Level 3: Landscape Unit	Level 4: Hydrogeomorphic (HGM) Type
Channelled valley bottom wetland.	Valley Floor: the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.	Channelled valley-bottom wetland: A valley bottom wetland with a river channel running through it.
Ephemeral rivers and tributaries with riparian vegetation.		A linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.
Episodic Drainage lines.	Slope—an inclined stretch of ground typically located on the side of a mountain, hill or valley, not forming part of a valley floor. Includes scarp slopes, mid-slopes and foot-slopes.	

Tables 5, 6 and 7 provides a summary of the field verification findings in terms of relevant aspects (hydrology, geomorphology and vegetation components) associated with the watercourses. Due to the similar watercourse characteristics of the ephemeral tributaries and that of the episodic drainage lines, and each of these watercourse types having been subjected to the same anthropogenic impacts, the ecoservice provision, hydrological regime, geomorphological characteristics, water quality and habitat of these watercourses, all of the ephemeral rivers and tributaries and all of the episodic drainage lines were assessed in a combined fashion. The details pertaining to the methodology used to assess the watercourses is contained in **Appendix C**.

Table 5: Summary of results of the assessment of the episodic drainage lines associated with the Groot, Roggeveld, Muishond and Wilgebos River systems to be traversed by the proposed development.

Watercourse characteristics overview:
EDLs of these different river systems arise from the slopes of the surrounding mountainous areas. The identified EDLs are considered part of the headwaters of these larger river systems, as they are located in the landscape where runoff flows as surface water over impermeable bedrock at the point of outcropping. Road crossings (informal road crossings associated with the existing public minor roads) and small instream impoundments within the EDLs have resulted in small changes to existing flow patterns. However, overall, changes to the hydrological functioning of the EDLs are not pronounced, allowing for uninterrupted hydrological functionality of the downstream systems. The vegetation associated with the EDLs are predominantly short growing shrubs, but no facultative vegetation species were identified within these EDLs. The vegetation cover within the immediate vicinity of the EDLs (along its active channel) remains fairly intact and indicative of the natural species composition expected of the vegetation type, however some invasive species were present in areas where disturbance has occurred (i.e., road crossings). Some erosion of the downstream reaches of the EDLs just below the instream impoundments and at road crossings were noted, however, this is not considered significant. Despite erosion noted within isolated areas of the EDLs, no significant deposition of sediment was observed.

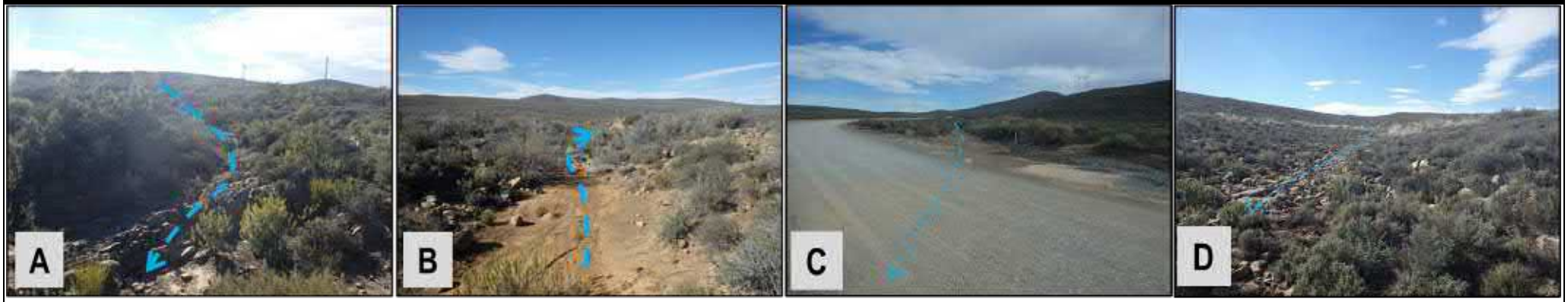



Figure 17: Representative photographs of the episodic drainage lines of the Groot River system (A, B), the Roggeveld River system (C) (existing road crossing without through flow structures) and the Muishond River system (D). These drainage lines are clearly defined by an unvegetated channel of exposed bedrock. No significant change between the vegetation associated with the edge of the drainage line channel to that of the surrounding terrestrial area is evident. Blue dashed lines indicate direction of flow.

Assessment of the EDLs of the Groot River System	**IHI Outcome**	**IHI Riparian PES Category: B (Largely natural with few modifications)** Due to the position of the EDLs in the landscape, they are considered largely intact, with limited change to the cover, abundance and species composition of the EDLs. Informal road crossings were determined to be an anthropogenic impacting factor.	**EIS Discussion**	**High** The EDLs are considered of ecological importance on a landscape scale, primarily due to these EDLs being classified as ESAs as per the WCBSP (2017) and the catchment thereof classified as an upstream catchment management area (according to NFEPA, 2011). Even though modifications to these EDLs have occurred, albeit limited, they still provide habitat to a variety of biota, given the high degree of connectivity of these features with the surrounding landscape.
	Ecoservice provision	**Ecoservice Provisioning: 1,4 (Intermediate)** Important for providing habitat (functions as migratory corridors) and erosion control, with intermediate nutrient and toxicant assimilation.	**REC Category, BAS and RMO**	**REC: Category B (Largely natural with few modifications)** **BAS: Category B RMO: B (Improve)** The RMO is to, at minimum, maintain these EDLs in their current ecological state (although the outcome of the RMO indicated to 'improve', given that the proposed activities will be limited in extent and most likely associated with existing disturbances; to maintain the PES is considered acceptable), as any potential impacts my also impact cumulatively on the downstream larger tributaries and wetland system. Small scale rehabilitation of areas which may potentially be impacted by the proposed development must be undertaken.

Assessment of the EDLs of the Roggeveld River System	**IHI Outcome**	**IHI Riparian PES Category: B/C (Largely natural with few modifications)** Due to the position of the EDLs in the landscape, they are considered largely intact, but due to anthropogenic activities, such as gravel roads and powerline infrastructure crossings (Figure 16C), impacts have resulted in minor modification to the EDLs.	**EIS Discussion**	**High** The EDLs are considered of ecological importance on a landscape scale, primarily due to these EDLs being classified as CBA 1 (of aquatic importance) as per the WCBSP (2017) and the catchment thereof classified as a Freshwater Ecosystem Priority Area (according to NFEPA, 2011). Even though modifications to these EDLs have occurred, they still provide habitat to a variety of biota, given the high degree of connectivity of these features with the surrounding landscape.
	Ecoservice provision	**Ecoservice Provisioning: 1,4 (Intermediate)** Important for providing habitat (functions as migratory corridors) and erosion control, with intermediate nutrient and toxicant assimilation.	**REC Category, BAS and RMO**	**REC: Category B (Largely natural with few modifications)** **BAS: Category B RMO: B/C (Improve)** The RMO is to, at minimum, maintain these EDLs in its current ecological state (although the outcome of the RMO indicated to 'improve', given that the proposed activities will be limited in extent and most likely associated with existing disturbances; to maintain the PES is considered acceptable), as any potential impacts my also impact cumulatively on the downstream wetland and river system. Small scale rehabilitation of areas which may potentially be impacted by the proposed development must be undertaken.
Assessment of the EDLs of the Muishond River System	**IHI Outcome**	**IHI Riparian PES Category: B (Largely natural with few modifications)** Due the remote locality of these EDLs, they have not been subjected to may anthropogenic impacts, with the exception of informal road crossings. This has resulted in erosion and subsequent sedimentation in isolated areas.	**EIS Discussion**	**High** The EDLs are considered of ecological importance on a landscape scale, primarily due to these EDLs being classified as CBA 1 (of aquatic importance) as per the WCBSP (2017) and the catchment thereof classified as a Freshwater Ecosystem Priority Area (according to NFEPA, 2011). Even though modifications to these EDLs have occurred (with specific mention of existing powerline infrastructure crossings), they still provide habitat to a variety of biota, given the high degree of connectivity of these features with the surrounding landscape.
	Ecoservice provision	**Ecoservice Provisioning: 1,4 (Intermediate)** Important for providing habitat (functions as migratory corridors) and erosion control, with intermediate nutrient and toxicant assimilation.	**REC Category, BAS and RMO**	**REC: Category B (Largely natural with few modifications)** **BAS: Category B RMO: A/B (Improve)** The RMO is to, at minimum, maintain these EDLs in its current ecological state (although the outcome of the RMO indicated to 'improve', given that the proposed activities will be limited in extent and most likely associated with existing disturbances; to maintain the PES is considered acceptable), as any potential impacts my also impact cumulatively on the downstream larger Muishond River system. Small scale rehabilitation of areas which may potentially be impacted by the proposed development must be undertaken.
Impact Significance:	**Moderate** (With the implementation of mitigation measures)	No proposed surface infrastructure (i.e., wind turbines, crane pads, substation or construction camp) will be located directly within any watercourses, however, roads traversing some of the EDLs will be upgraded. Underground cables will be installed along these watercourse crossings. Such activities were identified to pose a negative moderate impact on the watercourses. Despite some reaches of these watercourses being considered to be in a degraded state, they are still considered of high ecological importance and sensitivity; as such the upgrading of the watercourse road crossings poses a Moderate risk significance to the watercourses. It is the opinion of the ecologist that formalising watercourse crossings with appropriate through flow structures is considered advantageous as existing informal watercourse crossings have resulted in erosion of the watercourses which have caused interruption of hydrological connectivity between the upstream and downstream reaches. It is highly recommended that the upgrading of the watercourse crossings be undertaken during the driest period of the year. The upgraded watercourse crossings must be appropriately sized to cater for high flood events and suitable erosion and scouring protection must be installed during the construction phase. The construction footprints within these watercourses must be suitably rehabilitated and monitored for the establishment of alien and invasive plant species during the operational phase and to ensure the structures are hydraulically and geotechnically stable. Should the upgrade of roads in close proximity to the watercourses take place during the low flow season, the risk to the receiving environment will be significantly reduced.		

Table 6: Summary of results of the assessment of the Groot River and ephemeral tributaries to be traversed by the proposed development.

Watercourse characteristics overview:				
The Groot River and various ephemeral tributaries associated with the Groot, Roggeveld and Wilgebos River systems have been impacted by surrounding agricultural activities and gravel road crossings. These disturbances have resulted in some bank erosion, an increase in the presence of alien vegetation species and some loss of tree diversity within the riparian zone (albeit not considered extensive). These watercourses function as a migratory corridor due to its connectivity with the smaller upstream EDLs and larger river systems (thus high hydrological connectivity in the landscape). These watercourses also provide habitat for a variety of faunal species, even more so due to the presence of small trees species within the marginal zone.				

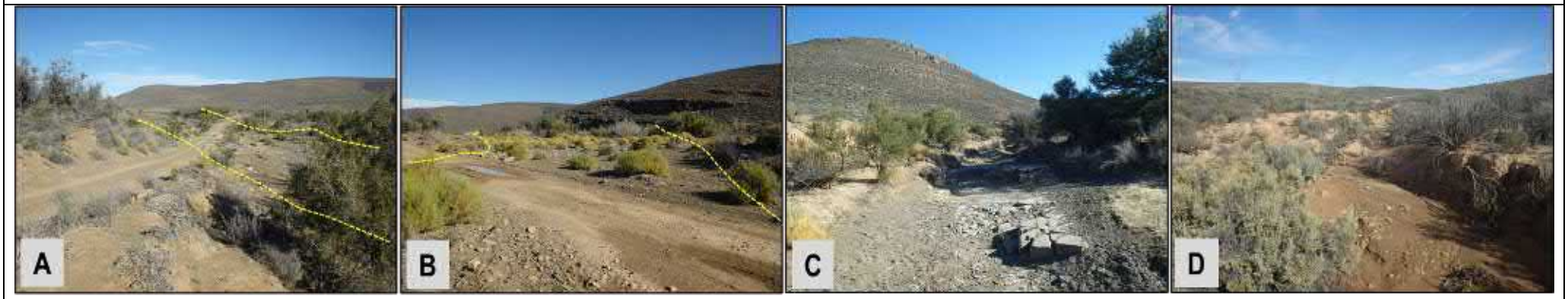



Figure 18: Representative photographs of the Groot River (A and B) with existing road crossings, proposed to be upgraded as part of the proposed development; an ephemeral tributary associated with the Groot River system (C); and an ephemeral tributary associated with the Roggeveld River system (D).				
Assessment of the tributaries located in the investigation area	**IHI Outcome**	**IHI Riparian PES Category: C (Moderately modified)** The assessed reaches of these watercourses have been subjected to impacts associated with existing informal crossings and agricultural activities (including instream impoundments). This has resulted in changes to the riparian vegetation components, which is evident by the reduction of vegetation coverage and the invasion of alien and invasive vegetation species (albeit limited).	**EIS Discussion**	**High** These watercourses are considered of ecological importance on a landscape scale, primarily due to the watercourses being classified as CBA 1 (of aquatic importance) as per the WCBSP (2017) and the catchment thereof classified as a Freshwater Ecosystem Priority Area (according to NFEPA, 2011). Even though modifications to the watercourses have occurred, these systems still provide habitat to a variety of biota, given the high degree of connectivity with the surrounding landscape to the larger rivers outside the investigation area.
	Ecoservice provision	**Ecoservice Provisioning: 1,5 (Intermediate)** These watercourses are considered important for biodiversity maintenance. As these are ephemeral watercourses, they are of seasonal importance for the supply of water for a variety of faunal species. The watercourses are not considered important for harvestable resources or cultivated foods, mainly due to them being located in a natural water scarce region.	**REC Category, BAS and RMO**	**REC: Category C (Moderately modified)** **BAS: Category C RMO: B/C (Improve)** The RMO is to, at minimum, maintain the watercourses in their current ecological state (although the outcome of the RMO indicated to 'improve', given that the proposed activities will be limited in extent and most likely associated with existing disturbances; to maintain the PES is considered acceptable), as any potential impacts my also impact cumulatively on the downstream larger river systems. Small scale rehabilitation of areas which may potentially be impacted must be undertaken.

Assessment of the Groot River	**IHI Outcome**	**IHI Riparian PES Category: C (Moderately modified)** The assessed reach of this river has been impacted by ongoing surrounding agricultural development, instream impoundments and gravel road crossings. These impacts resulted in change to the cover, abundance and species composition of the vegetation component and selective erosion.	**EIS Discussion**	**High** The river is considered of ecological importance on a landscape scale, primarily due to the wetland vegetation type associated with the investigation area (according to NFEPA, 2011) which is considered to be critically endangered and almost the entire extent of the investigation area is located within an ESA as per the CBANC (2016). Even though modifications to these tributaries have occurred, it still provides habitat to a variety of biota, given the high degree of connectivity of these features with the surrounding landscape.
	Ecoservice provision	**Ecoservice Provisioning: 1,5 (Intermediate)** Important for providing habitat (functions as migratory corridors) and erosion control, with intermediate nutrient and toxicant assimilation.	**REC Category, BAS and RMO**	**REC: Category B (Largely natural with few modifications)** **BAS: Category B RMO: A/B (Improve)** The RMO is to, at minimum, maintain the river in its current ecological state, as any potential impacts my also impact cumulatively on the system. Small scale rehabilitation of areas which may potentially be impacted by the proposed development must be undertaken, specifically at direct road crossings.

Impact Significance:	**Moderate** (With the implementation of mitigation measures)	No proposed surface infrastructure (i.e., wind turbines, crane pads, substation or construction camp) will be located directly within any watercourses, however, roads traversing some of the tributaries and the Groot River system will be upgraded. Underground cables will be installed along these watercourse crossings. Such activities were identified to pose a negative moderate impact on the watercourses. Despite some reaches of these watercourses considered to be degraded, they are still considered of high ecological importance and sensitivity; as such the upgrading of the watercourse road crossings poses a Moderate risk significance to the watercourses. It is the opinion of the ecologist that formalising watercourse crossings with appropriate through flow structures is considered advantageous as existing informal watercourse crossings have resulted in erosion of the watercourses which have caused interruption of hydrological connectivity between the upstream and downstream reaches. It is highly recommended that the upgrading of the watercourse crossings be undertaken during the driest period of the year. The upgraded watercourse crossings must be appropriately sized to cater for high flood events and suitable erosion and scouring protection must be installed during the construction phase. The construction footprints within these watercourses must be suitably rehabilitated and monitored for the establishment of alien and invasive plant species during the operational phase and to ensure the structures are hydraulically and geotechnically stable. Should the upgrade of roads in close proximity to the watercourses take place in the low flow season, the risk to the receiving environment will be significantly reduced.

Table 7: Summary of results of the assessment of the channelled valley bottom wetlands to be traversed by the proposed development.

<table>
<tr><td colspan="2">Watercourse characteristics overview:

The channelled valley bottom wetland form part of the headwaters of the Roggeveld and Groot River systems. These wetlands have primarily been impacted by informal road crossings and historical agricultural fields within its immediate catchment. It is also noted that MR 8041 an MR 6159 (proposed to be upgraded) are located directly adjacent to the wetlands associated with the Groot River systems. This has resulted in localised erosion and subsequent sedimentation of the immediate downstream reaches. Due to the thick clay layer associated with the wetlands, high substrate moisture allows for the persistence of facultative wetland species in the wetlands providing habitat and foraging for a variety of faunal species, making the wetlands sensitive to changes in the landscape. The wetlands function as migratory corridors due to its connection to the surrounding terrestrial areas, EDLs, tributaries and larger river systems (thus high hydrological connectivity in the landscape).</td><td colspan="2"> 
Figure 19: (Left) A representative photograph of a channelled valley bottom wetland located in the northern extent of the investigation area. (Right) Existing powerline infrastructure crossing the wetland, with an existing access road within close proximity to the wetland. Yellow dashed arrow indicates direction of flows</td></tr>
<tr><td>PES Discussion</td><td>PES Category: B/C (Largely natural with few modifications)
Despite some reaches of the wetlands not having any anthropogenic impacts, existing gravel roads do traverse the wetlands and the upstream systems connected to the wetlands. Instream dams (immediately south of the MR 8041) and historical agricultural fields have impacted on the overall integrity of the wetlands, with specific mention of its hydrological connectivity. Nevertheless, the wetlands are still considered in a largely natural ecological condition providing important ecological functions.</td><td>EIS Discussion</td><td>High
The wetlands are considered of ecological importance on a landscape scale, primarily due to the wetlands being classified as CBAs 1 (of aquatic importance) and ESAs 1 as per the WCBSP (2017) and the catchment thereof classified as an upstream Freshwater Ecosystem Priority Area (according to NFEPA, 2011). Even though modifications to the wetlands have occurred, they provide habitat to a variety of biota, given the high degree of connectivity with the surrounding landscape to the larger riparian watercourses outside the investigation area.</td></tr>
<tr><td>Ecoservice Provision</td><td>Ecoservice Provisioning: 1,5 (Intermediate)
Important for providing habitat (functions as migratory corridors) within the vast terrestrial landscape. Due to the soil characteristics of the wetlands, it provides intermediate levels of erosion control, and nutrient and toxicant assimilation services.</td><td>REC Category, BAS and RMO</td><td>REC: Category B (Largely natural with few modifications)
BAS: Category B RMO: B/C (Improve)
The RMO is to, at minimum, maintain the wetlands in their current ecological state (although the outcome of the RMO indicated to ‘improve’, given that the proposed activities will be limited in extent and most likely associated with existing disturbances; to maintain the PES is considered acceptable), as any potential impacts my also impact cumulatively on the downstream larger river systems. Small scale rehabilitation of areas which may potentially be impacted by the proposed development must be undertaken.</td></tr>
</table>

Impact Significance:	**Moderate** (With the implementation of mitigation measures)	No proposed surface infrastructure (i.e., wind turbines, crane pads, substation or construction camp) will be located directly within any wetlands, however, roads traversing some of the wetlands will be upgraded and an extensive section of an existing informal road adjacent to a wetland will be upgraded. Underground cables will be installed along these watercourse crossings. Such activities were identified to pose a negative moderate impact on the wetlands. Despite some reaches of these wetlands being considered to be in a degraded condition, they are still considered of high ecological importance and sensitivity; as such the upgrading of the watercourse road crossings poses a Moderate risk significance to the wetlands. It is the opinion of the ecologist that formalising watercourse crossings with appropriate through flow structures is considered advantageous as existing informal watercourse crossings have resulted in erosion of the watercourses which have caused interruption of hydrological connectivity between the upstream and downstream reaches. It is highly recommended that the upgrading of the watercourse crossings be undertaken during the driest period of the year. The upgraded watercourse crossings must be appropriately sized to cater for high flood events and suitable erosion and scouring protection must be installed during the construction phase. The construction footprints within these watercourses must be suitably rehabilitated and monitored for the establishment of alien and invasive plant species during the operational phase and to ensure the structures are hydraulically and geotechnically stable. Should watercourse crossings development and the upgrade of roads within close proximity to the watercourses take place in the low flow season, the risk to the receiving environment will be significantly reduced.

All comprehensive results calculated are available in **Appendix D.**

6 LEGISLATIVE REQUIREMENTS & SENSITIVITY MAPPING

The following legislative requirements were considered during the assessment. A detailed description of these legislative requirements is presented in **Appendix B** of this report:

- The Constitution of the Republic of South Africa, 1996[6];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA); and
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered to be "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on watercourses arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted, however that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

The definition and motivation for a regulated zone of activity for the protection of the assessed watercourses can be summarised in table that follows.

Table 8: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). **Department of Water and Sanitation (DWS)**	**Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)** In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21c and 21i is defined as: • the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • in the **absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse** where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • a **500m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.**

Based on the above applicable legislation, a 100 m Zone of Regulation (ZoR) has been applied to the riparian watercourses (rivers, ephemeral tributaries and episodic drainage lines) and a 500m ZoR to the wetlands in accordance with Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to activities as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) (Figures 20 to 23).

[6] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

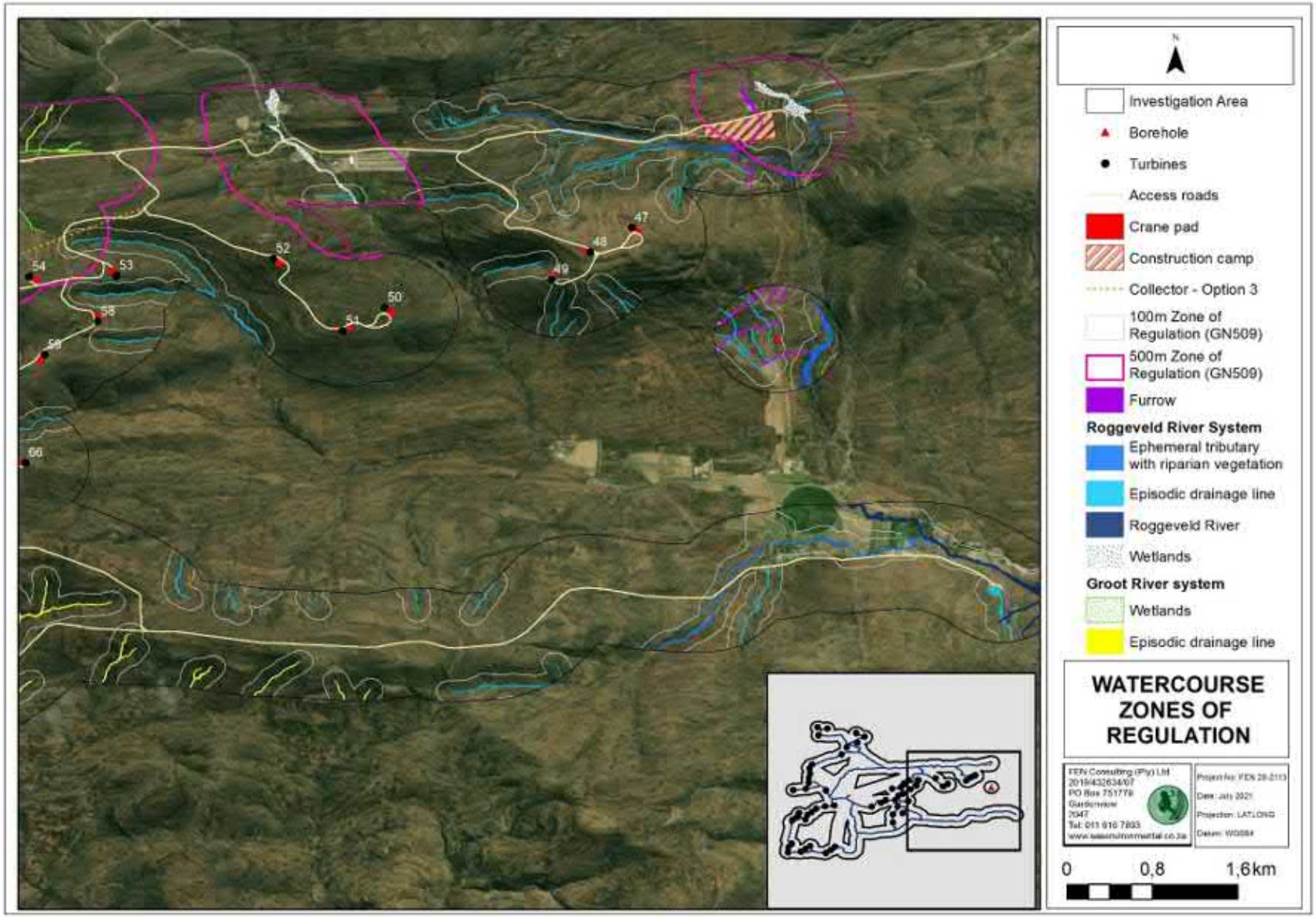


Figure 20: The conceptual presentation of the zones of regulation in terms of GN509 of 2016 as it relates to the NWA for the watercourses associated with the eastern portion of the investigation area.

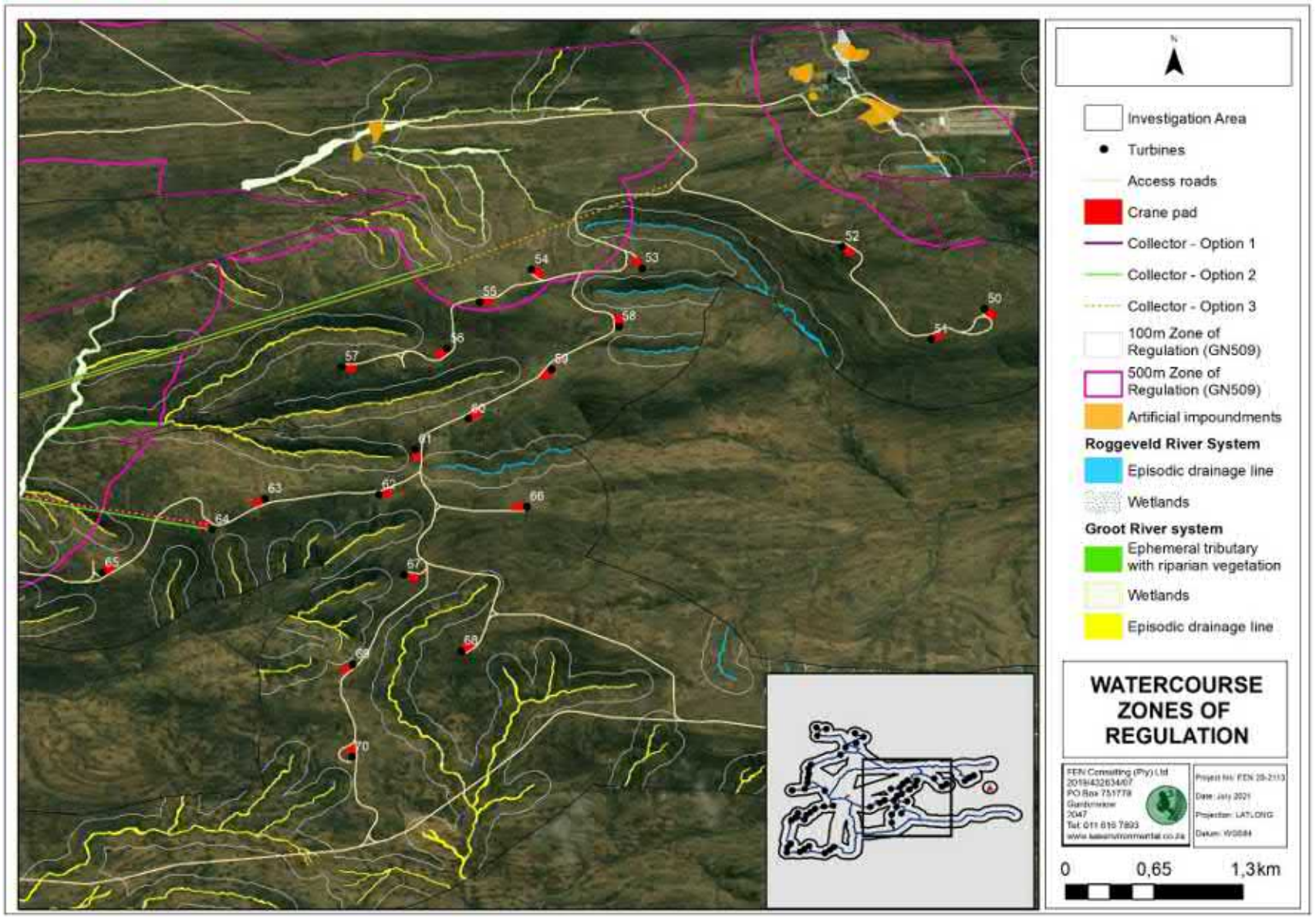


Figure 21: The conceptual presentation of the zones of regulation in terms of GN509 of 2016 as it relates to the NWA for the watercourses associated with the central portion of the investigation area.

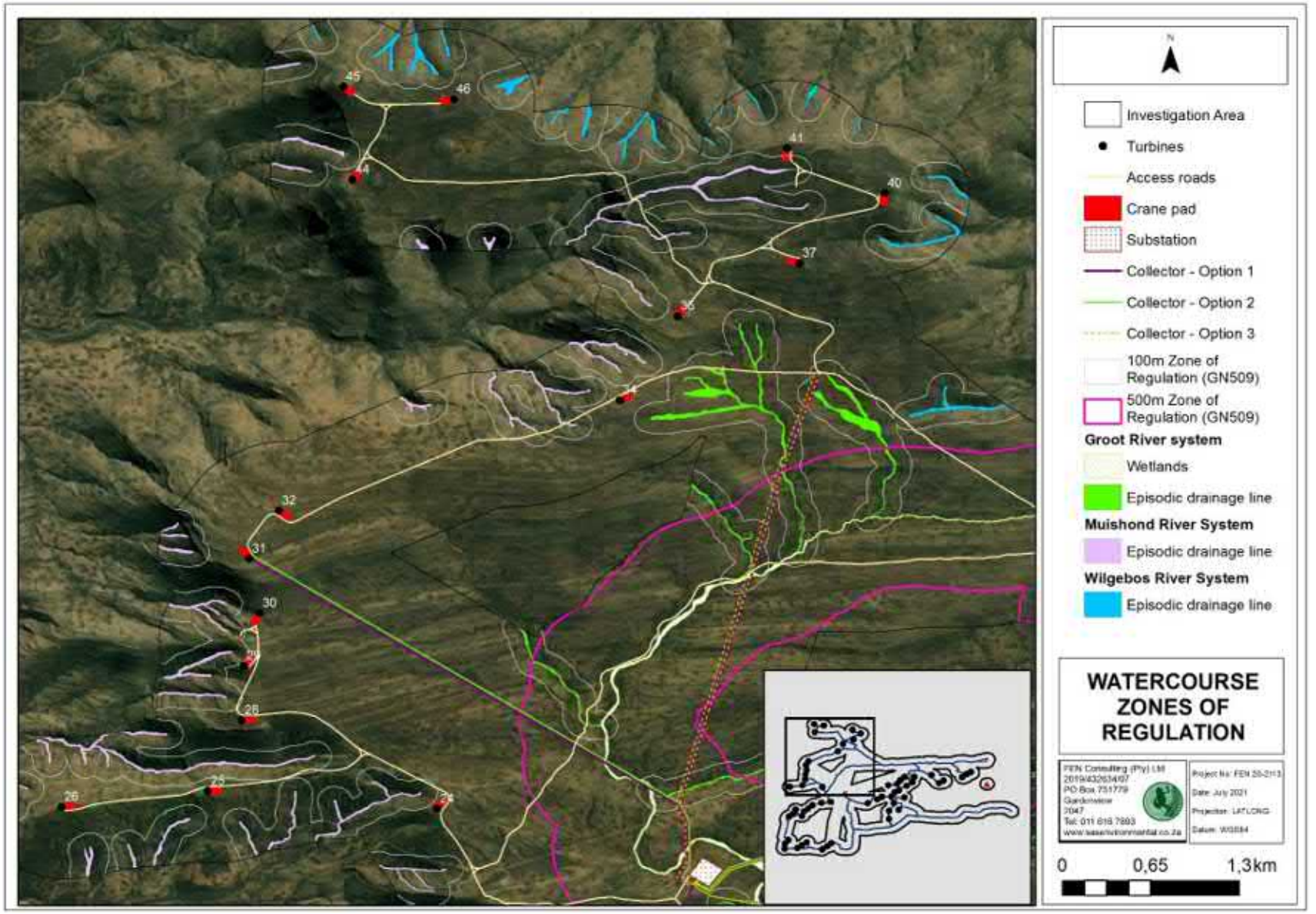


Figure 22: The conceptual presentation of the zones of regulation in terms of GN509 of 2016 as it relates to the NWA for the watercourses associated with the north-western portion of the investigation area.

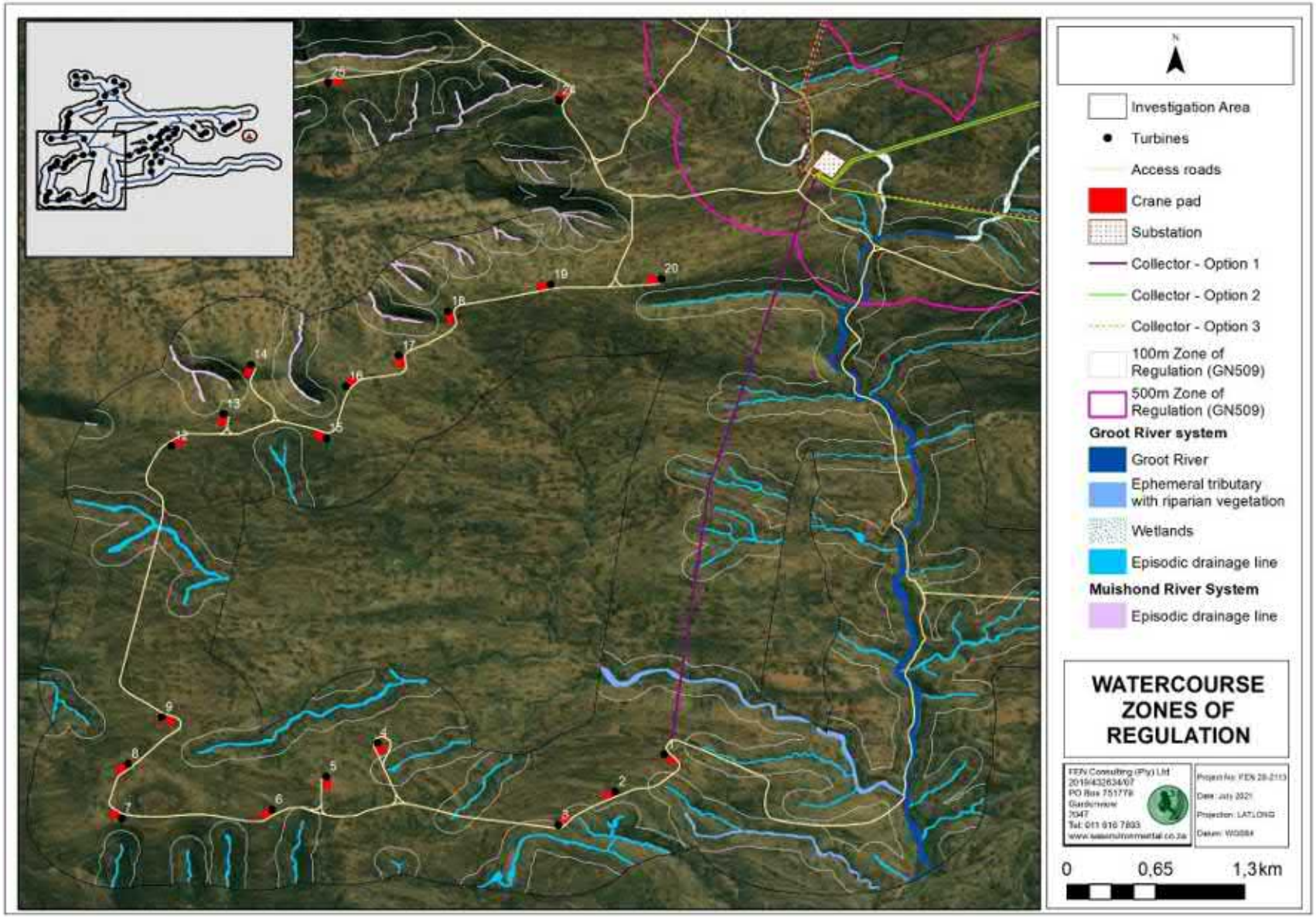


Figure 23: The conceptual presentation of the zones of regulation in terms of GN509 of 2016 as it relates to the NWA for the watercourses associated with the south-western portion of the investigation area.

7 RISK ASSESSMENT

This section presents the significance of potential impacts on the ecology of the identified watercourses associated with the proposed development. In addition, it also indicates the recommended mitigatory measures needed to minimise the perceived impacts of the proposed development and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures.

7.1 *Risk Assessment considerations and outcome*

Following the assessment of the watercourses associated with the proposed development, the impact assessment was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of these watercourses. The impact assessment was undertaken for the proposed layout as provided by the proponent and as described in Section 2 of this report and presented in Figures 1 and 2. The points below summarise the considerations made when applying the impact assessment:

- The risk assessment was applied considering the risk significance of the proposed surface infrastructure components, as described in Section 2 and depicted in Figures 1 and 2;
- Only access road watercourse crossings are located directly within watercourses. The following table provides a summary of the proposed development infrastructures which may potentially impact on the watercourses:

Table 9: Summary of the distance the proposed surface infrastructure components are located relative to a watercourse.

Proposed surface infrastructure component	Approximate distance from the closest watercourse
Borehole	Locate 69m from an EDL. Thus, located within the 100 m GN509 ZoR.
Construction camp	Located 57m from an ephemeral tributary and 102 m from a channelled valley bottom wetland (both watercourses associated with the Roggeveld River System. Thus, located within the 100 m and 500 m GN509 ZoR.
Substation	Located 90 m from a channelled valley bottom wetland associated with the Groot River system. Thus, located within the 500 m GN509 ZoR.
Crane pads	Crane pads located within the 100 m GN509 ZoR: • Crane pad associated with Turbine 49, located approximately 68 m from a riparian watercourse. • Crane pad associated with Turbine 29, located approximately 94 m from a riparian watercourse. • Crane pad associated with Turbine 41, located approximately 65 m from a riparian watercourse. • Crane pad associated with Turbine 3, located approximately 53 m from a riparian watercourse. Crane pads located within the 500 m GN509 ZoR: • Crane pad associated with Turbine 54, located approximately 370 m from a channelled valley bottom wetland. • Crane pad associated with Turbine 55, located approximately 406 m from a channelled valley bottom wetland.
Collector system – Option 1, 2 and 2	Several watercourse crossings: (It must be noted that all powerline support structures will be constructed outside of the delineated extent of the watercourses and as far as feasible, at least 32 m from its delineated extent and therefore are not considered to pose a direct negative risk to the delineated watercourses).

Access roads	• Several watercourse crossings (new and existing). • Upgrading of extensive sections of the proposed access roads which are located adjacent to wetlands and the Groot River system (Figure 24).  **Figure 24: Photographs depicting the locality of existing roads (red line) to be upgraded relative to the relevant watercourses (blue dashed lines). (Right) Groot River; (Left) channeled valley bottom wetland upstream of the Groot River.**

- All other turbines/crane pads not listed in the table above are located outside the 100m/500m GN509 Zone of Regulation. The risk significance of these infrastructure components was not considered as these components are considered to not pose a quantum of risk to the identified watercourses due to their distance;
- As per Figure 10, a man-made irrigation furrow drains through the proposed construction camp location. Since the furrow is an anthropogenic feature, it is not protected under the National Water Act, 1998 (Act No. 36 of 1998). Nevertheless, it is still connected to downgradient natural watercourses and the construction camp may thus pose indirect negative impacts to these watercourses, which was assessed as part of the risk assessment;
- Based on hydro census investigations undertaken by Tsunami Resources (pers. comm Johan Smit, hydrogeologist), abstracting water from borehole 264 has a minimal, if any, impact on the surface watercourses, as the watercourses are hydrologically driven by surface water runoff (please refer to the hydro census analysis report for more detail). As such, the risk significance of the abstraction of water was not considered for Section 21(c) and (i) water uses as this activity is considered to not pose a quantum of risk to the identified watercourses. A Water Use Licence for the required Section 21(a) water use will need to be applied for;
- The risk assessment was applied assuming that a high level of mitigation is implemented, thus the results of the risk assessment provided in this report present the perceived impact significance post-mitigation;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the Department of Forestry, Fisheries and Environment (DFFE) *et a*l (2013) would be followed, i.e., the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required. However, it is acknowledged that new watercourse crossings will be created, and others upgraded and thus direct impacts to the watercourses from this activity are considered inevitable;
- The default score for legal issues (for all watercourses proposed to be traversed) is '5' since some activities, as listed in Table 9, will be located within the 100 m/500 m ZoR in terms of GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- The activities relating to the proposed development are all considered to be highly site specific, not of a significant extent relative to the area of the watercourses assessed, and therefore have a limited spatial extent;
- While the operation of the proposed development will be a permanent activity, the construction thereof is envisioned to take between 12 and 24 months. However, the frequency of the construction impacts may be daily during this time;

- Most impacts are considered to be easily detectable, with the exception of contamination of surface and groundwater (which will require some effort); and
- The considered mitigation measures are easily practicable.

Table 10 below provides a summary of the outcome of the DWS Risk Assessment for the above-listed activities, based on the method presented in **Appendix D.** All general good housekeeping mitigation measures and the full impact assessment scoring is provided in **Appendix F**.

Table 10: Summary of the results of the DWS risk assessment applied to the proposed development activities.

	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
CONSTRUCTION PHASE									
1	Site preparation prior to construction activities of the proposed construction camp, substation, overhead powerline support structures as listed in Table 9 located within the 100m GN509 ZoR but at least 32 m from the delineated extent of the watercourses, and general movement of construction personnel within the 100m/500m GN509 ZoR but outside the delineated extent of watercourses.	Vehicular movement (transportation of construction materials).	• Loss of watercourse vegetation, associated habitat and ecosystem services; • Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and • Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles.	1	3	12	36	L	• All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential; • Retain as much indigenous vegetation as possible; • All vegetation removed as part of the site clearing activities (specifically where large areas need to be cleared) should be transported from the construction site (may not be stockpiled) and disposed of at a registered waste disposal facility; • During construction of the surface infrastructure within the 100 m/500m GN509 Zone of Regulation (but outside the watercourses), regular spraying of non-potable water or the use of chemical dust suppressants, that are approved for use near watercourses must be implemented to reduce dust and to ensure no smothering of vegetation within the watercourses occurs from excessive dust settling. It must be noted that specifics as to what type of dust suppressant (grey water vs. chemical dust suppressant) that will be utilised as part of the proposed development was not available at the time of assessment. Should this detail become available, it is recommended that the freshwater ecologist provide a statement on the suitability of the use of the proposed dust suppressant; • The watercourses outside the construction footprint not having authorised road crossings must be considered as no-go areas. No construction vehicles, nor construction personnel or vehicles may traverse through these watercourses (except on approved road crossings); • As far as possible, existing roads must be utilised to gain access to sites; • Contractor laydown areas, and material storage facilities to remain outside of the 100 m/500 m GN509 ZoR; • All vehicle re-fuelling is to take place outside of the 100 m/500 m GN509 ZoR; and • No vegetation may be removed from the 100 m/500 m GN509 ZoR surrounding the watercourse where no infrastructure is planned, as this provides a natural buffer zone around the watercourses which disperse surface runoff into the watercourses, and thus prevents sedimentation and erosion thereof.
2		Removal of vegetation and associated disturbances to soils.	• Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream watercourse areas; • Exposure of soils, leading to increased runoff, and erosion, and thus increased sedimentation of the watercourses; • Increased sedimentation of the watercourses, leading to smothering of vegetation associated in the watercourses; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.	1,25	3,25	12	39	L	
3	Site preparation prior to construction activities relating to the development of new watercourse road crossings: • Upgrading of existing roads; and • Installation of underground cables	Removal of vegetation and associated disturbances to soils.	• Earthworks and exposure of soils could result in sedimentation of the watercourses, which may be transported as runoff into the downstream watercourse areas and may smother vegetation associated with the watercourses; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.	5	7	14	98	M	• It is imperative that all construction works be undertaken during the driest period of the year when there is no flow within the watercourses, and thus no diversion of flow would be necessary; • The reaches of the watercourses where no activities are planned to occur must be considered no-go areas. These no-go areas can be marked at a maximum distance of 5 m upstream and downstream of the proposed road upgrade crossing. This 5 m buffer area would allow for construction personal, vehicles (if applicable) to enter the watercourse crossing where the road is proposed to be upgraded;

	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
	traversing through watercourses, and • Upgrading of roads within close proximity (within 32 m) to watercourses.								• For trenching of the cables, the topsoil has to be stored separately and may not be contaminated. Furthermore, the soil layers should be replaced in the same order and the topsoil returned last; and • The removed vegetation must be stockpiled outside of the delineated boundary of the watercourse. The footprint areas of these stockpiles should be kept to a minimum, and may not exceed a height of 2 m. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site.
4	Creating new watercourse crossings, upgrading existing watercourse crossings and upgrading of existing roads within close proximity (within 32 m) to watercourses: • Excavation within the watercourse for the removal of existing infrastructure (where applicable) and for the casting of proposed concrete base. • Placement of culvert structures atop concrete base.	• Disturbances to soil of the watercourses; • Movement of construction machinery/ vehicles within the watercourses; and • Possible spills / leaks from construction vehicles.	• Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream reach of the watercourse; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.	5	7	15	105	M	• The construction footprint must be limited to the 5 m construction buffer (upstream and downstream of the watercourse crossing) only. • Upgrading of the most westerly access route (associated with MR 8041 and MR 6159) must take cognisance of the delineated extent of the wetland located within close proximity to the road. Should the road be increased in width, the road must be expanded on the side opposite of the wetland, to ensure that the remaining natural buffer between the access road and the wetland remains intact; • Material to be used (gravel – if applicable) as part of the upgrading of the existing roads must be stockpiled outside the delineated extent of the watercourses (preferably at least 32 m from the watercourse) to prevent sedimentation thereof and to avoid any other vegetation being impacted by the construction activities. These stockpiles may not exceed a height of 2 m and should be protected from wind using tarpaulins; • The area surrounding the road must be revegetated with suitable indigenous vegetation to prevent the establishment of alien vegetation species and to prevent erosion from occurring; • It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction; and • All existing alien and invasive vegetation should be removed. All material must be disposed of at a registered garden refuse site and may not be burned or mulched on site. With regards to excavation and soil compaction activities within the watercourses Although the proposed watercourse crossings are associated with existing road servitudes (existing public roads) or farm roads, and as such the most significant impacts have already occurred, the existing gravel roads are relatively small with no formal through flow structures in most cases. The following are applicable with regards to excavation works and any concrete related activities: • The culvert crossing must be designed to ensure that the structures are geotechnically sound and that they are hydraulically stable, even if a 1:100 year flood event was to occur. The designs should include culverts installed intermittently to ensure a free draining landscape. It is recommended that a suitably qualified hydrologist be consulted to provide guidance on the relevant sizes and width requirements to ensure that hydraulic

	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
									functioning of the system is maintained. In addition, the crossings must be designed such that should they be overtopped, they remain stable and do not lead to excessive downstream erosion and incision. Similarly, a freshwater ecologist must ensure that the final design accounts for appropriate wetting frequencies and patterns are maintained in the pre-development condition; • During the excavation activities, any soil/sediment or silt removed from the watercourse may be temporarily stockpiled in the road reserve but outside the delineated extent of the watercourse. These stockpiles may not exceed 2 m in height, and their footprint should be kept to a minimum. Stockpiling of removed materials may only be temporary (may only be stockpiled during the period of construction at a particular site) and should be disposed of at a registered waste disposal facility; • Excavated materials should not be contaminated, and it should be ensured that the minimum surface area is taken up. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum, for later usage as backfill material or as part of rehabilitation activities; • Care must be taken to ensure that no scouring or erosion occurs as a result of the proposed culvert crossing. Installation of riprap or gabion mattresses adjacent to the abutments may be required (especially within the larger, low lying watercourses such as the Groot River) and/or concrete aprons associated with any culverts; • All construction material (with specific mention of prefabricated culvert structures) must be stockpiled in the construction camp and must only be imported to the construction site when required; • Machinery/vehicles used to install culvert structures must be parked on the existing road surface and may not enter the watercourses; and • Reno-mattresses or riprap must be installed at the outlet side of the culvert/bridge structures to ensure energy dissipation and prevent concentrated runoff into the downstream watercourse. The reno mattress/riprap must be installed flush with the culvert outlet. <u>Control measures specific to concrete works:</u> High alkalinity associated with cement can dramatically affect and contaminate both soil and ground water. The following measures must be adhered to: • Fresh concrete and cement mortar should not be mixed near or in the watercourses. Mixing of cement may be done within a construction camp, however it may not be mixed on bare soil, and must be within a lined, bound or bunded portable mixer. Consideration must be given to the use of ready-mix concrete; • No mixed concrete shall be deposited directly onto the ground or within the watercourses. All concrete must be brought in via a cement mixing truck which must remain within the road reserve, and cement must be piped down to the proposed crossing. Any areas that require manual application of cement require that the mixed

	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
									materials be placed on a batter board or other suitable platform/mixing tray until it is deposited; • A washout area should be designated outside of the delineated extent of the watercourses, and wash water should be treated on-site or discharged to a suitable sanitation system; • At no point may batter boards/mixing trays or cement trucks be rinsed off on site and run-off water may not be allowed into the watercourses; • Cement bags (if any) must be disposed of in the demarcated hazardous waste receptacles and the used bags must be disposed of through the hazardous substance waste stream; and • Spilled or excess concrete must be disposed of at a suitable landfill site. Chain of custody documentation must be provided.
5	Construction of surface infrastructure outside of the watercourses but still within the 100 m/500m GN509 ZoR, which includes: • Collector overhead powerlines; • Construction camp; • Substation; and • 6 crane pads.	• Removal of vegetation and topsoil and associated stockpiling; • Ground-breaking and earthworks relating to foundations and trenches; • Mixing and casting of concrete for construction purposes; • Backfilling of excavated and disturbed areas; and • Miscellaneous activities by construction personnel.	• Disturbances of soils leading to increased alien vegetation proliferation within the terrestrial buffer zone surrounding the watercourses, with the potential to affect the watercourse habitat; • Altered runoff patterns within the local catchment of the watercourses, potentially leading to increased erosion and sedimentation of the watercourses; • Potential impacts on the water quality of surface water runoff (when present) which may potentially enter the watercourses and contamination of soils due to concrete casting; and • Potential of backfill material entering the watercourses, increasing the sediment loads therein.	1,75	3,75	12	45	L	As this activity was assessed based on the recommendation that the proposed powerline support structures (associated with the overhead collector powerlines) be located as far as feasible, at least 32 m from the delineated extent of a watercourse, this in itself is considered a mitigation measure which complies with the mitigation hierarchy as advocated by the DFFE et al. (2013). With regards to ground-breaking activities outside the delineated extent of a watercourse, but within the 100 m/500 m GN509 ZoR: • During excavation activities, the topsoil and vegetation should be stockpiled separately from other material outside the delineated extent of the watercourses; • Excavated materials should not be contaminated, and it should be ensured that the minimum surface area is taken up by any stockpiled materials. The mixture of the lower and upper layers of the excavated soil should be kept to a minimum, so as for later use as backfill material after construction has commenced; • All exposed soils must be protected from wind using tarpaulins for the duration of the construction phase to prevent potential erosion and sedimentation of the watercourses; • Suitable drainage should be insured along the crane pads and specifically the construction camp (associated with an existing furrow connected to natural watercourses), in order to ensure that water does not pond or drain in a concentrated manner into the nearby watercourses. This must be considered as part of the stormwater management plan and be overseen by a freshwater ecologist; • Construction of the proposed surface infrastructure may result in disturbance to the natural buffer zone surrounding the watercourses which may result in the reduction of surface roughness. This can be mitigated by ensuring that no concentrated runoff from the surface infrastructure construction areas enter the watercourses by installing silt traps or placing haybales down gradient of the construction footprint (until suitable basal vegetation cover has been restored) to ensure no sediment laden or concentrated runoff generates from the construction footprint; and

	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
									• It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction. With regards to concrete mixing on site: Refer to Activity 4 above. With regards to backfilling of excavated areas: • Stockpiled material should be used as backfill material; • All excavated areas should be backfilled to the natural ground level with excavated material; and • Soil must be suitably compacted, and all construction material must be removed from the site upon the completion of construction or used in the rehabilitation process. Rehabilitation of the construction footprint areas: • All footprint areas which have been compacted should be ripped and revegetated with indigenous vegetation as soon as the construction activities have been completed. This will prevent soil erosion and the creation of gullies within the operational area; and • The operational area should regularly be inspected for alien and invasive vegetation species which might have established due to the construction activity related disturbances.
OPERATIONAL PHASE									
6	Operation and maintenance of the surface infrastructure outside the watercourses but still within the 100m/500m GN509 ZoR, which includes: • Collector overhead powerlines; • Construction camp; • Substation; and • 6 crane pads.	• Potential indiscriminate movement of maintenance vehicles within the watercourses or within close proximity to the watercourses; and • Increased risk of sedimentation and/or hydrocarbons entering the watercourses via stormwater runoff from the surface infrastructure.	• Disturbance to soils and ongoing erosion as a result of periodic maintenance activities; and • Altered water quality (if surface water is present) as a result of increased availability of pollutants.	1,5	3,5	12	42	L	• No indiscriminate movement of construction equipment through the watercourses may be permitted during standard operational activities or maintenance activities. Use must be made of the existing watercourse crossings only; • Unnecessary disturbances surrounding the perimeter of the surface infrastructure must be avoided; • Vehicles used in the development site must be regularly washed (on a non-permeable surface or off-site) to avoid the dispersal of seeds on any alien or invasive species into the watercourses; • Ensure that routine inspections and monitoring of any instream infrastructure are undertaken to monitor any build-up of debris that will impact on structure integrity or lead to erosion and sedimentation. Furthermore, monitoring to determine the establishment of indigenous vegetation and the presence of any alien or invasive plant species; • Should erosion be noted at the base of the powerline support structures, the construction camp or surrounding the crane pads that may potentially impact on a watercourse in the surrounding area, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation;

	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
									• The surface infrastructure areas must be inspected to ensure that no concentrated runoff from these areas form erosion gullies leading to erosion and sedimentation of receiving watercourses. Should these impacts be noted, these gullies/preferential flow paths must be infilled with *in situ* material and appropriately stabilised and/or revegetated; and • Monitoring for the establishment for alien and invasive vegetation species must be undertaken, specifically at the road crossings and surface infrastructures. Should alien and invasive plant species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation.
7	Operation and maintenance of roads traversing watercourses.	• Concentrated runoff entering the watercourses; and • Disturbance to the vegetation within and surrounding the watercourses.	• Concentrated runoff from the road crossings leading to erosion and subsequent sedimentation of the watercourses (increase in the sediment load) and turbulent flows when surface water is present; • Higher flood peaks into the watercourses due to reduced surface roughness in the watercourses.	2,5	4,5	12	54	L	• Hot spots for the build-up of debris and excess sediment must be identified and when necessary, debris/excess sediment must be removed by hand to prevent future flooding and potential damage to infrastructure. • Routine maintenance of the roads must be undertaken to ensure that no concentration of flow and subsequent erosion occurs due to the road crossings/instream infrastructure. Such maintenance activities must specifically be undertaken after high rainfall events; • Stormwater runoff from the road crossings should be monitored (by the Operation and Maintenance (O&M) Manager), to ensure it does not result in erosion of the watercourses. Stormwater should be allowed to diffusely spread across the landscape, by ensuring adequate surface roughness in the watercourse (through vegetation and rocky areas); • Maintenance vehicles must make use of dedicated access roads and no indiscriminate movement in the watercourses may be permitted; • During periodic maintenance activities of the roads, monitoring for erosion should be undertaken; and • Should erosion be observed, caused by the road crossings/instream infrastructure, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation. Use can also be made of rocks collected from the surrounding area to infill any area prone to erosion, as a natural dispersal mechanism.
DECOMMISSIONING PHASE									
8	Removal of all surface infrastructure from the project area.	• Movement of construction vehicles and personnel; and • Disturbance to the buffer zone surrounding the watercourses.	• Disturbance of soil and vegetation that established within the operational area.	2,25	4,25	13	55,24	L	• No indiscriminate movement of construction equipment in the watercourses and buffer zones surrounding the watercourses may be permitted. Use must be made of the existing roads during the decommissioning phase; • All surface infrastructure must be decommissioned. All materials must be removed from the watercourses (where applicable) and may temporarily be stored/ stockpiled outside of the delineated extent of the watercourses, where after it must be removed from site and disposed of at a registered disposal facility; • High flood peaks from the decommissioning footprint areas can be mitigated by ensuring that no concentrated runoff from the surface infrastructure area and subsequent cleared

	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
									area enters the watercourses. The velocity of surface water flow from these areas must be reduced by ensuring that the vegetation in the buffer area surrounding the watercourses is intact or by the strategic placement of silt traps of haybales as a means to obstruct flow but still allow flow to percolate at a reduced velocity and encourages a diffuse flow pattern. In this regard it is recommended at an alien and invasive plant species management plan be implemented during the construction and operational phases to specifically prevent the spread of any such species into the sensitive ecological areas; • Areas where surface infrastructure have been decommissioned and removed must be suitably compacted/ripped and revegetated to ensure that no erosion occurs which may contribute to the sediment load of the watercourses; • Should erosion gullies be noted, these areas must be rehabilitated by infilling them with suitable soil and ensuring the area is vegetated. The increased surface roughness will discourage concentrated flow paths to develop and ensure diffuse flow patterns; • Should road crossings be decommissioned, road footprint areas within the watercourse must be levelled to the same level and shape as that of the upstream and downstream reaches. This will ensure a continuous bed level and prevent any concentration of surface flow from occurring; • Watercourse embankments must be suitably rehabilitated (shaped end revegetated) to prevent any erosion from occurring; • All bare areas in the investigation area, specifically where vegetation was initially cleared for surface infrastructure components) must be ripped and be revegetated within suitable indigenous vegetation species; • Follow up revegetation should take place where initial revegetation is not successful; and • Post-closure monitoring of the watercourses (for a period of 3 years), with specific mention of the invasion of alien vegetation species) is recommended to be undertaken.

The activities associated with the construction and operational phases of the proposed development poses a moderate to low risk significance to the watercourses, with the application of the recommended mitigation measures. Due to the extent of access roads proposed to be upgraded adjacent to sensitive channelled valley bottom wetlands and the Groot River and the upgrading of wetland road crossings, the direct impacts during the construction phase pose a Moderate risk significance to the watercourses. It is the opinion of the ecologist that formalising watercourse crossings with appropriate through flow structures is considered advantageous over the long-term as existing informal watercourse crossings have resulted in erosion of the watercourses which have caused interruption of hydrological connectivity between the upstream and downstream reaches.

Although the irrigation furrow located within the development footprint of the construction camp is considered an anthropogenic feature and thus not protected under the National Water Act, 1998 (Act No. 36 of 1998), this furrow is connected to downgradient watercourses and therefore suitable mitigation measures, such as potential realignment of the furrow to maintain the connectivity as well as stormwater management measures must be implemented to limit indirect negative impacts to the downgradient watercourses.

Assuming that strict enforcement of cogent, well-developed mitigation measures takes place, as recommended in Table 10, the significance of impacts arising from the construction and operation of other infrastructure components (such as the construction camp and collector overhead powerline support structures) located outside of the watercourses and at least 32 m from the delineated extent of a watercourse, but within the 100 m/500 m GN509 ZoR are likely to be of very low significance. It is recommended that ongoing monitoring of the surface water areas be undertaken to minimise the risk of indirect impacts on the overall watercourse integrity. Additional “good practice” mitigation measures applicable to a project of this nature are provided in **Appendix F** of this report.

Authorisation by means of a Water Use Licence Application (WULA) in terms of Sections 21 (a), (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) must be obtained from the DWS for the proposed development prior to the commencement of any works.

7.2 *Cumulative Impact Statement*

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future, both spatially and temporally, considered together with the impacts identified in Section 7.1 above. Watercourses within the region are under continued threat due to rapid land use transformation in the surrounding landscape, with specific mention of renewable energy facilities (REF) and associated powerline infrastructure.

Direct and indirect impacts identified within the assessed watercourses can predominantley be attributed to the upgrading of extensive sections of access roads direcltey adjacent to a wetland and formalising watercourse road crossings the disturbance to the hydrological connectivity and functioning of the watercourses and alien and invasive species establishment. Although mitigation measures are provided to limit the significance of the direct negative impacts to the watercourses, considering the proposed development and ather proposed REFs in the catchment of the identified watercourses, a cumulative negative impact to the biophysical environment is expected. With management and mitigation measures implemented during the construction phase and monitoring of all proposed development infrastructure for any erosion during the operational phase, the direct and indirect negative impacts can be reduced and managed.

8 CONCLUSION

FEN Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the WUA processes for the proposed Brandvalley WEF and associated infrastructure.

During the site visit undertaken in May 2021, several headwater episodic drainage lines (EDLs) without riparian vegetation which flow into larger ephemeral tributaries and rivers in the valley bottom position were identified. These watercourses form part of the Groot, Roggeveld, Huishond and Wilgebos River systems.

Although these EDLs cannot be classified as riparian resources in the traditional sense, due to the lack of saturated soils and riparian vegetation, they do still function as waterways, due to the episodic conveyance of water. However, based on the definition of a watercourse (see Section 3.1) water flows regularly or intermittently within these drainage lines, conveying water from the upgradient catchment area into the downgradient tributaries and eventually into the larger river systems. As such, they can be considered as watercourses and therefore enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998).

The results of the ecological assessment of the watercourses are discussed in Section 5 of this report is summarised in the table below:

Table 11: Summary of results of the ecological assessment as discussed in Section 5.

Watercourse	PES	Ecoservices	EIS	REC /BAS/RMO
Channelled valley bottom wetlands	B/C (Largely natural with few modifications)	Intermediate (1,5)	High	REC: Category B (Largely natural with few modifications) BAS: Category B RMO: B/C (Improve)
Ephemeral river (Groot River) and tributaries with riparian vegetation	C (Moderately modified)	Intermediate (1,5)	High	REC: Category C (Moderately modified) BAS: Category B RMO: B/C (Improve)
Episodic drainage line (EDL)	B (Largely natural with few modifications)	Intermediate (1,4)	High	REC: B (Largely natural with few modifications) BAS: Category B RMO: B (Improve)

No surface infrastructure components are located within any of the delineated watercourses, with the exception of road crossings, which entails the construction of new watercourse road crossings and upgrading of existing crossings. Due to the ecological sensitivity and importance of the watercourses, the upgrading of access roads directly adjacent to watercourses and upgrading of watercourse crossings by means of installing formal through flow structure poses a moderate risk significance to the watercourses, with the application of the recommended mitigation measures. The proposed collector overhead powerlines will also traverse several watercourses; however the powerline support structures will be constructed outside the delineated extent of the watercourses and as far as feasible, at least 32m from the delineated extent of the watercourses. Should the recommended mitigation measures be implemented with specific mention of ensuring proper stormwater management practices during the construction and operational phases, the crane pads pose a Low risk significance.

Despite direct negative impacts expected from the proposed development, with implementation and strict enforcement of cogent, well-developed mitigation measures as outlined in this report, with specific mention of ensuring all instream construction footprints are rehabilitated and the watercourses monitored for any alien and invasive species establishment, no fatal flaws in terms of freshwater ecological aspects were identified and the proposed development can be considered acceptable.

9 REFERENCES

Bromilow, C. 2001. Revised Edition, First Impression. *Problem Plants of South Africa.* Briza Publications, Pretoria, RSA.

Dada R., Kotze D., Ellery W. and Uys M. 2007. WET-RoadMap: *A Guide to the Wetland Management Series*. WRC Report No. TT 321/07. Water Research Commission, Pretoria.

Department of Water Affairs and Forestry 2008 *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas*. Report no. X. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Department of Water Affairs, 1999. South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources [Appendix W3].

De Villiers, C., Driver, A., Clark, B., Euston-Brown, D., Day, L., Job, N., Helme, N., Van Ginkel, CE., Glen, RP., Gordon-Gray, KD., Cilliers, CJ., Muasya, M and van Deventer, PP. 2011. *Easy identification of some South African Wetland Plants*. WRC Report No TT 479/10.

Henderson, L. 2001. *Alien Weeds and Invasive Plants*. Agricultural Research Council, RSA.

Job, N. 2009. Application of the Department of Water Affairs and Forestry (DWAF) wetland delineation method to wetland soil of the Western Cape.

Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N.B. 2009. *WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands*. WRC Report No. TT 339/09. Water Research Commission, Pretoria.

Malan, H.L., and Day, J.A. 2012. Water Quality and Wetlands: Defining Ecological Categories and Links with Land-Use. Water Research Commission. Report No 1921/1/12.

Mucina, L. & Rutherford, M.C. (eds) 2010. (CD set). The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Nel, JL, Driver, A., Strydom W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J, Nienaber, S., Van Deventer, H., Swartz, E. & Smith-Adao, L.B. 2011a. *Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources*. Water Research Commission Report No. TT 500/11, Water Research Commission, Pretoria.

Ollis, DJ; Snaddon, CD; Job, NM & Mbona, N. 2013. *Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems*. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

Snaddon, K and Day, L. 2009. Prioritisation of City Wetlands. City of Cape Town Department of Environmental Resource Management, Cape Town.

The South African National Biodiversity Institute - Biodiversity GIS (BGIS) *[online].* Retrieved 2015/04/10 URL: http://bgis.sanbi.org

Van Oudtshoorn, F. 2004. Second Edition, Third Print. *Guide to Grasses of South Africa.* Briza Publications, Pretoria, RSA.

APPENDIX A: Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and FEN CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field or pertaining to this investigation.

Although FEN CC exercises due care and diligence in rendering services and preparing documents, FEN CC accepts no liability and the client, by receiving this document, indemnifies FEN CC and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by FEN CC and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

APPENDIX B: Legislative Requirements

The Constitution of the Republic of South Africa, 1996[7]	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive normalization of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act, 1998 (Act No. 107 of 1998)	The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The objectives of this act are (within the framework of the National Environmental Management Act) to provide for: ➢ the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➢ the use of indigenous biological resources in a sustainable manner; ➢ the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources; ➢ to give effect to 'ratified international agreements' relating to biodiversity which are binding to the Republic; ➢ to provide for co-operative governance in biodiversity management and conservation; and ➢ to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act. This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources. Furthermore, a person may not carry out a restricted activity involving either: a) a specimen of a listed threatened or protected species; b) specimen of an alien species; or c) a specimen of a listed invasive species without a permit. Permits for the above may only be issued after an assessment of risks and potential impacts on biodiversity is carried out. Before issuing a permit, the issuing authority may in writing require the applicant to furnish it, at the applicant's expense, with such independent risk assessment or expert evidence as the issuing authority may determine. The Minister may also prohibit the carrying out of any activity, which may negatively impact on the survival of a listed threatened or protected species or prohibit the carrying out of such activity without a permit. Provision is made for appeals against the decision to issue/refuse/cancel a permit or conditions thereof. ***National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (Alien and Invasive Species Regulations, 2014)*** NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aim to: ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) as: (a) a species that is not an indigenous species; or

[7] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

	(b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2014): ➢ **Category 1a**: Invasive species that require compulsory control. ➢ **Category 1b**: Invasive species that require control by means of an invasive species management programme. ➢ **Category 2**: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread. ➢ **Category 3**: Ornamentally used plants that may no longer be planted.
National Water Act , 1998 (Act No. 36 of 1998)	The National Water Act, 1998 (Act No. 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i). A watercourse is defined as: a) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) A wetland, lake or dam into which, or from which water flows; and d) Any collection of water which the minister may, by notice in the Gazette, declare a watercourse.
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act , 1998 (Act No. 36 of 1998)	In accordance with Government Notice (GN)509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: ➢ The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; ➢ In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or ➢ A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and storm water management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.

APPENDIX C: Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the watercourses and drainage line features present in close proximity of the proposed wind farm development are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA; 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland feature present in the vicinity of the proposed wind farm development.

1.2 *Department of Water and Sanitation (DWS) Resource Quality Information Services Present Ecological State / Ecological Importance and Sensitivity (PES/EIS) Database (2014)*

The PES/EIS database as developed by the DWS RQIS department was utilised to obtain background information on the project area. The PES/EIS database has been made available to consultants since mid-August 2014. The information from this database is based on information at a sub-quaternary catchment reach (subquat reach) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as SA RHP sites, EWR sites and Hydro WMS sites. The results obtained serve to summarise this information as a background to the conditions of the watercourse traversed by the proposed linear development.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All watercourses encountered within the study area was assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "Classification System" (Ollis et. al., 2013). A summary on Levels 1 to 4 of the classification system are presented in the tables below.

Table C1: Classification System for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	**LEVEL 2: REGIONAL SETTING**	**LEVEL 3:LANDSCAPE UNIT**
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4:HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	B	C
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean**[8] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et. al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

[8] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups' vegetation types across the country, according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the classification system for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et. al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the classification system (Table C2), on the basis of hydrology and geomorphology (Ollis *et. al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates;
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley, but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for "channel", "flat" and "valleyhead seep") is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et. al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et. al*., 2009).

3. Wet-Ecoservices (2009)

"The importance of a water resource, in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class" (DWA, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;

- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

Table C3: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4. Index of Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in the table below.

Table C4: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans et al. 2008]

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60 - 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 – 59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0 - 19

5. WET-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever-changing landscape. The primary purpose of this assessment is to evaluate the eco-physical health of wetlands, and in so doing to promote their conservation and wise management.

Level of Evaluation

Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment

A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

Units of Assessment

Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the Classification System for Wetlands and other Aquatic Ecosystems above.

Quantification of Present State of a wetland

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial extent of the impact of individual activities and then separately assessing the intensity of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The impact scores, and Present State categories are provided in the table below.

Table C5: Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (table below).

Table C6: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Overall health of the wetland

Once all HGM Units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

6. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (see table below) of the wetland system being assessed.

Table C7: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

7. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the watercourse (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.

Table C8: Recommended management objectives (RMO) for watercourses based on PES & EIS scores.

PES			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, a REC class D is allocated by default, as the minimum acceptable PES category.**

A watercourse may receive the same class for the REC as the PES if the watercourse is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the watercourse.

Table C9: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

8. Watercourse Delineation

For the purposes of this investigation, a wetland is defined in the National Water Act, 1998 (Act No. 36 of 1998) as "land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".
The wetland zone delineation took place according to the method presented in the DWAF (2005) document "A practical field procedure for identification and delineation of wetlands and riparian areas.

An updated draft version of this report is also available and was therefore also considered during the wetland delineation (DWAF, 2008). The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The position in the landscape, which will help identify those parts of the landscape where wetlands are more likely to occur;
- The type of soil form (i.e. the type of soil according to a standard soil classification system), since wetlands are associated with certain soil types;
- The presence of wetland vegetation species; and
- The presence of redoximorphic soil feature, which are morphological signatures that appear in soil with prolonged periods of saturation.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF, 2005 and 2008).
Riparian and wetland zones can be divided into three zones (DWAF, 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant period of wetness (at least three months of saturation per annum) and the temporary zone surrounds the seasonal zone and is only saturated for a short period of saturation (typically less than three months of saturation per annum), but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soil and the growth of wetland vegetation. The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

APPENDIX D: Risk Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation;
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[9]. The interaction of an aspect with the environment may result in an impact;
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Frequency of activity** refers to how often the proposed activity will take place;
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor;
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial extent** refers to the geographical scale of the impact; and
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[10].

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

[9] The definition has been aligned with that used in the ISO 14001 Standard.

[10] Some risks/impacts that have low significance will however still require mitigation

"RISK ASSESSMENT KEY" (Based on DWS 2015 publication: Section 21 c and i water use Risk Assessment Protocol)

Table D1: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table D2: Spatial Scale (How big is the area that the aspect is impacting on)

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table D3: Duration (How long does the aspect impact on the resource quality)

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, an E or F	5
PES and EIS (sensitivity) must be considered.	

Table D4: Frequency of the activity (How often do you do the specific activity)

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table D5: The frequency of the incident or impact (How often does the activity impact on the resource quality)

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table D6: Legal issues (How is the activity governed by legislation)

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table D7: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table D8: Rating Classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA (after the application of mitigation measures)

Table D9: Calculations

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develop or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for construction phase and operational phase; and
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts[11] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources in traversed by or in close proximity of the proposed infrastructure.

[11] Mitigation measures should address both positive and negative impacts

APPENDIX E: Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the IHI assessment applied to the ephemeral tributaries & Groot River

	MRU
INSTREAM IHI	
Base Flows	0,0
Zero Flows	0,0
Floods	3,0
HYDROLOGY RATING	**0,9**
pH	1,0
Salts	1,0
Nutrients	1,0
Water Temperature	1,0
Water clarity	1,0
Oxygen	1,0
Toxics	1,0
PC RATING	**0,1**
Sediment	2,0
Benthic Growth	2,0
BED RATING	**2,0**
Marginal	0,5
Non-marginal	0,5
BANK RATING	**0,5**
Longitudinal Connectivity	2,5
Lateral Connectivity	2,0
CONNECTIVITY RATING	**2,3**
INSTREAM IHI %	**76,8**
INSTREAM IHI EC	**C**
INSTREAM CONFIDENCE	**3,0**

	MRU
RIPARIAN IHI	
Base Flows	0,0
Zero Flows	0,0
Moderate Floods	1,0
Large Floods	1,0
HYDROLOGY RATING	**0,6**
Substrate Exposure (marginal)	2,0
Substrate Exposure (non-marginal)	1,5
Invasive Alien Vegetation (marginal)	2,0
Invasive Alien Vegetation (non-marginal)	1,5
Erosion (marginal)	2,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	1,0
Physico-Chemical (non-marginal)	1,0
Marginal	2,0
Non-marginal	1,5
BANK STRUCTURE RATING	**1,8**
Longitudinal Connectivity	0,0
Lateral Connectivity	0,0
CONNECTIVITY RATING	**0,0**
RIPARIAN IHI %	**80,2**
RIPARIAN IHI EC	**B/C**
RIPARIAN CONFIDENCE	**2,9**

Table E2: Presentation of the results of the IHI assessment applied to the EDLs.

RIPARIAN IHI	
Base Flows	0,0
Zero Flows	0,0
Moderate Floods	1,0
Large Floods	1,0
HYDROLOGY RATING	**0,6**
Substrate Exposure (marginal)	1,5
Substrate Exposure (non-marginal)	1,0
Invasive Alien Vegetation (marginal)	1,5
Invasive Alien Vegetation (non-marginal)	1,0
Erosion (marginal)	1,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	1,0
Physico-Chemical (non-marginal)	1,0
Marginal	1,5
Non-marginal	1,0
BANK STRUCTURE RATING	**1,3**
Longitudinal Connectivity	0,0
Lateral Connectivity	0,0
CONNECTIVITY RATING	**0,0**
RIPARIAN IHI %	**84,6**
RIPARIAN IHI EC	**B**
RIPARIAN CONFIDENCE	**2,9**

Table E3: Presentation of the results of the PES assessment applied to the channelled valley bottom wetlands.

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
1	10	100	3,0	-1	1,1	-1	1,6	0
Area weighted impact scores*			3,0	-1,0	1,1	-1,0	1,6	0,0
PES Category (See Table 5.29)			C	↓	B	↓	B	→

Table E4: Presentation of the results of the Socio-cultural and Ecoservice provision provided by the assessed watercourses

Ecosystem service	Episodic drainage lines	Ephemeral tributary	Channelled wetland
Flood attenuation	1,7	1,8	2,4
Streamflow regulation	1,6	2,2	2,4
Sediment trapping	1,6	1,8	2,0
Phosphate assimilation	1,9	1,9	1,9
Nitrate assimilation	1,7	1,7	1,7
Toxicant assimilation	1,8	1,8	1,6
Erosion control	2,1	1,8	1,3
Carbon Storage	0,8	0,8	1,3
Biodiversity maintenance	2,3	2,4	2,4
Water Supply	0,7	0,7	0,7
Harvestable resources	0,6	0,8	0,8
Cultivated foods	0,4	0,4	0,6
Cultural value	0,5	0,5	0,5
Tourism & recreation	2,0	2,5	1,1
Education & research	0,8	1,8	2,0
SUM	**20,3**	**22,6**	**22,6**
Average score	**1,4**	**1,5**	**1,5**

Table E4: Presentation of the EIS assessment applied to the assessed watercourses.

FRESHWATER FEATURE:			Episodic drainage lines	Channelled wetland	Ephemeral tributaries
Ecological Importance and Sensitivity			Score (0-4)		
Biodiversity support			**A (average)**		
			0,67	1,00	1,00
Presence of Red Data species			0	0	0
Populations of unique species			0	1	1
Migration/breeding/feeding sites			2	2	2
Landscape scale			**B (average)**		
			2,00	2,60	2,20
Protection status of the wetland			2	2	2
Protection status of the vegetation type			2	2	2
Regional context of the ecological integrity			2	3	2
Size and rarity of the wetland type/s present			2	4	3
Diversity of habitat types			2	2	2
Sensitivity of the wetland			**C (average)**		
			1,67	1,67	2,00
Sensitivity to changes in floods			2	2	3
Sensitivity to changes in low flows/dry season			1	1	1
Sensitivity to changes in water quality			2	2	2
ECOLOGICAL IMPORTANCE & SENSITIVITY (max of A,B or C)			**B**		**B**
Hydro-Functional Importance			**Score (0-4)**		
Regulating & supporting benefits	**Flood attenuation**		1,7	2,4	1,8
	Streamflow regulation		1,6	2,4	2,2
	Water Quality Enhancement	***Sediment trapping***	1,6	2	1,8
		Phosphate assimilation	1,9	1,9	1,9
		Nitrate assimilation	1,7	1,7	1,7
		Toxicant assimilation	1,8	1,6	1,8
		Erosion control	2,1	1,3	1,8
	Carbon storage		0,8	1,3	0,8
HYDRO-FUNCTIONAL IMPORTANCE (average score)			2	2	2
Direct Human Benefits			**Score (0-4)**		
Subsistence benefits	***Water for human use***		0,7	0,7	0,7
	Harvestable resources		0,6	0,8	0,8
	Cultivated foods		0,4	0,6	0,4
Cultural benefits	***Cultural heritage***		0,5	0,5	0,5
	Tourism and recreation		2	1,1	2,5
	Education and research		0,8	2	1,8
DIRECT HUMAN BENEFITS (average score)			0,83	0,95	1,12

APPENDIX F: Risk Analysis and Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the watercourse ecology and biodiversity, will include any activities which take place in close proximity to the proposed activities that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the watercourse identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should not encroach into watercourses unless absolutely essential and where project activities are located in the watercourses. It must be ensured that the watercourse habitat is off-limits to construction vehicles and non-essential personnel;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Planning of temporary roads and access routes (if applicable) should avoid watercourses and be restricted to existing roads where possible;
- Appropriate sanitary facilities must be provided for the life of the construction phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)) Removal of species should take place throughout the construction, operational, and maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - Footprint areas should be kept as small as possible when removing alien plant species*;* and
  - No vehicles should be allowed to drive through designated sensitive wetland areas during the eradication of alien and weed species.

Soil

- Sheet runoff from access roads should be slowed down by the strategic placement of berms;
- As far as possible, all construction activities should occur in the low flow season, during the drier summer months;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soil;

- No stockpiling of topsoil is to take place within the recommended buffer zone around the watercourses (unless specified otherwise), and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the watercourses;
- All soil compacted as a result of construction activities as well as ongoing operational activities falling outside of project footprint areas should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble/silt removed from the construction area must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area as well as immediate vicinity of the proposed wind farm development should be removed. Alien vegetation control should take place for a minimum period of two growing seasons after rehabilitation is completed.

Risk significance on the watercourse ecology of the project area

The table below serves to summarise the anticipated impacts that might occur during the construction and operational phases as well as the mitigation measures that must be implemented in order to maintain and enhance the ecological integrity of the resource.

Table F1: DWS Risk Assessment outcomes for the proposed development.

	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
1	Construction Phase	Site preparation prior to construction activities of the proposed construction camp, substation, overhead powerline support structures as listed in Table 9 located within the 100m GN509 ZoR but at least 32 m from the delineated extent of the watercourses, and general movement of construction personnel within the 100m/500m GN509 ZoR but outside the delineated extent of watercourses.	Vehicular movement (transportation of construction materials)	• Loss of watercourse vegetation, associated habitat and ecosystem services; • Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and • Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles.	1	1	1	1	1	1	1	3	5	1	5	1	12	36	L
2			Removal of vegetation and associated disturbances to soils.	• Loss of watercourse vegetation, associated habitat and ecosystem services; • Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and • Soil and stormwater contamination from oils and hydrocarbons originating from construction vehicles. • Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream watercourse areas; • Exposure of soils, leading to increased runoff, and erosion, and thus increased sedimentation of the watercourses; • Increased sedimentation of the watercourses, leading to smothering of vegetation associated in the watercourses; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.	1	1	1	2	1,25	1	1	3,25	5	1	5	1	12	39	L

	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
3		Site preparation prior to construction activities relating to the development of new watercourse road crossings: • upgrading of existing roads; and • installation of underground cables traversing through watercourses, and within close proximity (within 32 m) to watercourses.	Removal of vegetation and associated disturbances to soils.	• Earthworks and exposure of soils could result in sedimentation of the watercourses, which may be transported as runoff into the downstream watercourse areas and may smother vegetation associated with the watercourses; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.	5	5	5	5	5	1	1	7	5	3	5	1	14	98	M
4		Creating new watercourse crossings, upgrading existing watercourse crossings and upgrading of existing roads within close proximity (within 32 m) to watercourses: • Excavation within the watercourse for the removal of existing infrastructure (where applicable) and for the casting of proposed concrete base. • Placement of culvert structures atop concrete base.	• Disturbances to soil of the watercourses; • Movement of construction machinery/ vehicles within the watercourses; and • Possible spills / leaks from construction vehicles.	• Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream reach of the watercourse; and • Proliferation of alien and/or invasive vegetation as a result of disturbances.	5	5	5	5	5	1	1	7	5	4	5	1	15	105	M

	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
5		Construction of surface infrastructure outside of the watercourses but still within the 100 m/500m GN509 ZoR, which includes: • Collector overhead powerlines; • Construction camp; • Substation; and • 6 crane pads	• Removal of vegetation and topsoil and associated stockpiling; • Ground-breaking and earthworks relating to foundations and trenches; • Mixing and casting of concrete for construction purposes; • Backfilling of excavated and disturbed areas; and • Miscellaneous activities by construction personnel.	• Disturbances of soils leading to increased alien vegetation proliferation within the terrestrial buffer zone surrounding the watercourses, with the potential to affect the watercourse habitat; • Altered runoff patterns within the local catchment of the watercourses, potentially leading to increased erosion and sedimentation of the watercourses; • Potential impacts on the water quality of surface water runoff (when present) which may potentially enter the watercourses and contamination of soils due to concrete casting; and • Potential of backfill material entering the watercourses, increasing the sediment loads therein.	1	1	3	2	1,75	1	1	3,75	5	1	5	1	12	45	L
6	**OPERATIONAL PHASE**	Operation and maintenance of the surface infrastructure outside the watercourses but still within the 100m/500m GN509 ZoR, which includes: • Collector overhead powerlines; • Construction camp; • Substation; and • 6 crane pads	• Potential indiscriminate movement of maintenance vehicles within the watercourses or within close proximity to the watercourses; and • Increased risk of sedimentation and/or hydrocarbons entering the watercourses via stormwater runoff from the surface infrastructure	• Disturbance to soils and ongoing erosion as a result of periodic maintenance activities; and • Altered water quality (if surface water is present) as a result of increased availability of pollutants.	1	1	2	2	1,5	1	1	3,5	5	1	5	1	12	42	L

	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
7		Operation and maintenance of roads traversing watercourses.	• Concentrated runoff entering the watercourses; and • Disturbance to the vegetation within and surrounding the watercourses.	• Concentrated runoff from the road crossings leading to erosion and subsequent sedimentation of the watercourses (increase in the sediment load) and turbulent flows when surface water is present; • Higher flood peaks into the watercourses due to reduced surface roughness in the watercourses.	3	1	3	3	2,5	1	1	4,5	5	1	5	1	12	54	L
8	**DECOMMISSIONING PHASE**	Removal of all surface infrastructure from the project area.	• Movement of construction vehicles and personnel; and • Disturbance to the buffer zone surrounding the watercourses.	• Disturbance of soil and vegetation that established within the operational area.	2	1	3	3	2,25	1	1	4,25	5	2	5	1	13	55,25	L

APPENDIX G: Details, Expertise and Curriculum Vitae of Specialists

1. (a) (i) Details of the specialist who prepared the report

Christel du Preez	MSc Environmental Sciences (North West University)
Kim Marais	BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)
Stephen van Staden	MSc Environmental Management (University of Johannesburg)

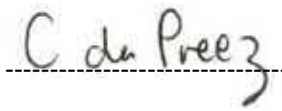
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	SAS Environmental Gorup of Companies		
Name / Contact person:	Christel du Preez		
Postal address:	221 Riverside Lofts, Tygerfalls Boulevard, Bellville,		
Postal code:	7539	Cell:	
Telephone:		Fax:	086 724 3132
E-mail:	christel@sasenvgroup.co.za		
Qualifications	MSc Environmental Sciences (North West University)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Christel du Preez, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

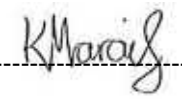


---

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Kim Marais, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



---

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTEL DU PREEZ

PERSONAL DETAILS

Position in Company	Senior Scientist (Watercourse ecology)
Joined SAS Environmental Group of Companies	2016

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP)
(SACNASP – Reg No. 120240/19)
Member of the Western Cape Wetland Forum (WCF)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

MSc Environmental Sciences (North West University)	2017
BSc Hons Environmental Sciences (North West University)	2012
BSc Environmental and Biological Sciences (North West University)	2011

Short Courses

Wetland and Aquatic plant Identification presented by Carin van Ginkel (Crispis Environmental)	2019
Wetland Management: Introduction and Delineation presented by the Centre of Environmental Management University of the Free State	2018
Tools for Wetland Assessment presented by Prof. F. Ellery and Rhodes University	2017
Basic Principles of ecological rehabilitation and mine closure presented by the Centre for Environmental Management North West University	2015

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Limpopo, Western Cape, Northern Cape, Eastern Cape

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant species and Landscape Plan
- Freshwater Offset Plan

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

Position in Company	Senior Scientist (Water Resource Manager)
Joined SAS Environmental Group of Companies	2015

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 117137/17)
Member of the Western Cape Wetland Forum (WCWF)

EDUCATION

Qualifications

BSc (Hons) Zoology (University of the Witwatersrand)	2012
BSc (Zoology and Conservation) (University of the Witwatersrand)	2011

Short Courses

Aquatic and Wetland Plant Identification (Cripsis Environment)	2019
Tools for Wetland Assessment (Rhodes University)	2018
Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Biodiversity Action Plans (BAP)
- Alien and Invasive Control Plans (AICP)
- Faunal Eco Scans
- Faunal Impact Assessments

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Freshwater Offset Plan

Aquatic Ecological Assessment and Water Quality Studies

- Riparian Vegetation Integrity (VEGRAI)
- Water quality Monitoring
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Public Participation processes

SAS ENVIRONMENTAL GROUP OF COMPANIES
SPECIALIST CONSULTANT INFORMATION –

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing Member, Group CEO, Water Resource Discipline Lead, Ecologist, Aquatic Ecologist
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SEGC	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum;
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

CORE FIELDS OF EXPERTISE

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments

APPENDIX

M BAT WALKDOWN REPORT

www.animalia-consult.co.za • werner@animalia-consult.co.za • Somerset West, Cape Town • 2015/364493/07

13 November 2021

Verification of the authorised Brandvalley wind energy facility (WEF) turbine layout, in relation to the bat sensitivity map and impacts on bats.

Animalia Consultants (Pty) Ltd) completed the 12 months pre-construction bat monitoring for the Brandvalley Wind Energy Facility (WEF). The final preconstruction bat impact report also served as the EIA phase bat report and was submitted in July 2016. It included the assessments of impacts as required for the EIA phase.

The applicant is proposing a hub height of 125m and a rotor diameter of 180m. The assessment of the turbine layout, bat sensitivity map and on-site verification, in relation to impacts on bats, considers this proposed dimension and layout amendment.

A site visit was conducted on 13 September 2021 by Animalia Consultants (Pty) Ltd to verify the turbine layout in relation to the approved bat sensitivity map. The proposed turbine layout respects the bat sensitivity map as was applicable during the preconstruction guidelines that was in use during the EIA assessment and subsequent amendments (**Figure 1**). It also respects the current guideline criteria which requires turbine blade length to be outside the high sensitivity buffers, except for Turbines B20, B32, B49, B53, B58.

According to the passive bat activity data collected on site during the preconstruction study, bat activity at 50m height was significantly less than activity at a lower altitude of 10m. Except in the case of the Barendskraal NW meteorological mast where the *Tadarida aegyptiaca* species (Egyptian Free-tailed bat) had higher abundances at 50m. The *Tadarida aegyptiaca* (Egyptian Free-tailed) bat which dominated the occurrence on site, also have the highest likelihood of being impacted on by wind turbines. However, the decrease in the lowest rotor swept height is not significant enough to influence the assessments of the impacts as identified in the EIA phase bat assessment report. But it should be noted that the larger rotor diameter effectively brings the impact zone of each turbine closer to all bat sensitivity buffers, and no part of the turbine (including the turbine blades) is allowed to intrude into high bat sensitivity buffers.

The sensitivity map for the Brandvalley Wind Farm site was updated in October 2018. This update predominantly consisted of the delineation of watercourses within of the Brandvalley project area, using the open source SAGA GIS tool. This tool uses the topography of the area based on a 5m digital elevation model to calculate the channel flow. The tool first fills the sinks. A sink is a cell or set of spatially connected cells whose flow direction cannot be assigned one of the eight valid values in a flow direction raster. This can occur when all neighbouring cells are higher than the processing cell or when two cells flow into each other, creating a two-cell loop. To create an accurate representation of flow direction and, therefore, accumulated flow, it is best to use a dataset that is free of sinks. A digital elevation model (DEM) that has been processed to remove all sinks

is called a depressionless DEM. Next, the flow accumulation is calculated meaning how much water can accumulate in one cell (in m3). Thresholds of 50k, 75k and 100k were considered and 75k was determined to be the most accurate threshold with the least amount of data 'noise' (**Figure 1**).

On a flat surface the distance from a high sensitivity must be 200m, which constitutes the high sensitivity buffer. This includes all parts of a turbine such as the turbine blades, and is in line with the MacEwan, et al. (2020) Preconstruction Guidelines. Therefore, based on a rotor diameter of 180m (blade length of 90m), the turbine base position must be 290m or more from any high bat sensitivities and 90m from high sensitivity buffers. However, in this case the actual bat sensitivities are at a lower elevation in valleys and the turbines are proposed on the ridges. In cases where the turbine base was closer than 90m to the high sensitivity buffer, a formula was applied to consider the hub height of 125m, 90m blade length and difference in elevation of turbine base and sensitivity. In order to calculate the distance of the base to the buffer required for maintaining a minimum of 200m from a blade tip to an actual sensitivity. This formula was only required for Turbines B20, B32, B49, B53 and B58 since their blades are intruding into the high bat sensitivity buffers.

Formula used: b=√((200+bl)2 -(hh+ed)2), derived from Mitchell-Jones & Carlin (2009).

Where:

b= horizontal distance required from turbine base to high sensitivity buffer

bl = blade length

hh= hub height

ed= elevation difference between turbine base and actual sensitivity

When considering a 90m blade length, based on above calculation considering the difference in elevation between the bat sensitivity and the turbine base position, Turbines B20, B32, B49, B53 and B58 base centre points should be moved to be outside of the high bat sensitivity buffer. All other turbines proposed can remain in the currently authorised positions. The significance ratings of the original impacts identified will not change as a result of the amendments.

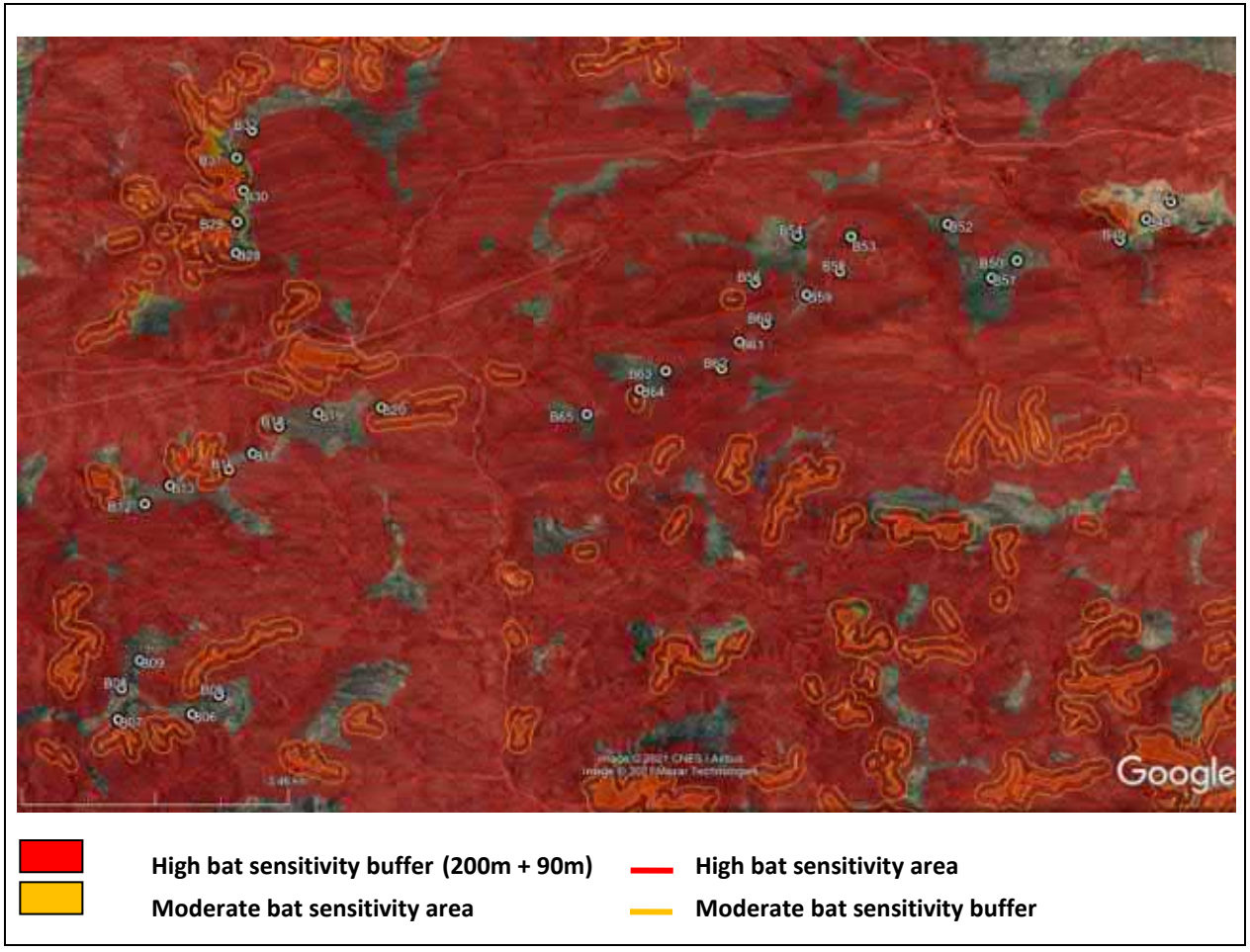


Figure 1: Bat sensitivity map of the Rietkloof site with proposed turbine layout.

In summary, the proposed layout is acceptable from a bat sensitivity perspective if all conditions of the EA are adhered to, an operational bat impact monitoring study is conducted for a minimum of 2 years, and Turbines B20, B32, B49, B53 and B58 are moved outside of the high bat sensitivity buffer.

If there are any queries, please do not hesitate to contact me.

Werner Marais
Managing Director
werner@animalia-consult.co.za
Pr.Sci.Nat. (Zoological Science) 400169/10

APPENDIX

N SOCIAL REPORT

Tony Barbour

ENVIRONMENTAL CONSULTING AND RESEARCH

10 Firs Avenue, 7708, South Africa
(Cell) 082 600 8266
(E-Mail) tbarbour@telkomsa.net
www.tonybarbour.co.za

ENVIRONMENTAL MANAGEMENT PLAN

SUMMARY OF KEY SOCIAL ISSUES

BRANDVALLEY, KAREEBSOCH AND RIETKLOOF WIND ENERGY FACILITIES
AND
ASSOCIATED GRID INFRASTRUCTURE

WESTERN AND NORTHERN CAPE PROVINCE

OCTOBER 2021

1. INTRODUCTION

The comments are based on observations during the site visit to the study area in September 20201 undertaken as part of Social Impact Assessments (SIA) for powerline associated with the Kareebosch WEF. Interviews and discussions were held with a number of land owners and community members affected by the proposed powerline. In addition, the affected landowners provided insight into their experience with the construction phase for the Roggeveld, Karusa and Soetwater WEFs. Additional information was obtained from attending a public participation meeting associated with the proposed Kolkies and Sadawa SEF. Most of the attendees at this meeting were land owners in the vicinity of the existing Paardekraal East WEF and the discussion was largely focused on visual impacts associated with WEFs. The issues raised are also likely to be relevant to the Kareebosch, Brandvalley and Rietkloof WEFs given the location of these facilities within the Komsberg REDZ. The key issues raised are summarised below.

2. POSITIVE IMPACTS

- A number of interviewees indicated that the ongoing construction of WEFs in the Komsberg REDZ has had a significant positive impact on the local economy in the area, specifically the town of Sutherland. The benefits associated with providing accommodation for contractors in Sutherland and on surrounding farms has enabled the local hospitality sector and farmers to survive the impact of COVID-19 and the recent major drought. The construction activities have benefited the local hospitality, retail, and services sector.
- The benefit to the Sutherland and Laingsburg economies is expected to continue for some time given the number of projects planned in the Komsberg REDZ.
- For a number of farmers, the WEFs have been a life saver, effectively ensuring the continuation of farming operations which may have folded due to the drought.

3. COMMUNICATION

Communication and the need for early, effective and on-going communication and engagement was identified as a key issue.

- Many directly affected land owners indicated that good, clear, and on-going communication was a key requirement for addressing and managing impacts.
- Experiences differed between projects. However, it would appear that the initial communication and interaction with individual landowners has been poor and that this has impacted on communication and interaction going forward.
- There is a need for developers / contractors to identify a dedicated project go-to person who can be reached at short notice to report incidents or address problems.
- There is need to keep landowners, authorities, and the public updated and informed about activities with regular updates throughout construction phase.
- The failure of contractors and contract workers to inform farmers and report incidents regarding damage to farm gates, boundary fences and other farm infrastructure was raised as a key concern on all of the projects being established in the area. The onus is then placed on the landowner to check up on contractors. This is time consuming and can also lead to conflicts and arguments.
- Some land owners reported the following negative experiences when they reported issues or problems:
    - The issues were treated as inconvenience by the contractors (i.e., were not taken seriously).
    - Issues were down played. Issues such gates being left open, damage to fences, littering, unnecessary damage to veld, etc., were regarded as petty complaints as opposed to serious concerns. In this regard there was a lack of understanding of severity of impacts on farming activities and the livelihoods of the affected landowners.
    - Adversarial attitude: One landowner felt that whenever he raised issues the response was formal and adversarial, instead of being open, understanding and trying to find a solution to the problem.
    - Deferral of responsibility. One landowner was told to monitor damage to gates and fences himself.

4. IMPACTS ON FARMING AND NATURAL AREAS

- All the affected landowners indicated that they did not expect the disturbances to be as extensive as they turned out to be and felt that excessive areas of land were cleared / disturbed during the construction phase. The disturbances were linked to access roads, turbine laydown areas, soil dumping, off-road driving, etc. The landowners affected by the Karusa and Soetwater WEFs and neighbours were all struck by excessive impacts compared to agreed-upon/ anticipated impacts, especially in more remote portions of properties where oversight was more difficult. Some farmers indicted that that entire hilltops levelled and cleared 'like landing strips'.
- Farm gates damaged or left open and damage to fences. This was a common experience on all projects. The impacts associated with leaving farm gates open include time spent recovering livestock, increased risk of stock theft and predation etc. These impacts were often exacerbated by failure to and or delays by the contractor in reporting incidents, resulting in valuable time lost in rectifying the problem.
- Failure to report damage to boundary fences. A number of land owners indicated that incidents on their properties were left unreported – at least one land owner was advised to do regular boundary line checks himself, a time-consuming activity
- Crime and security. No major incidents were reported directly linked to WEF construction workers. One owner did however have trouble at the outset with taxis being used to supply alcohol and narcotics from town to local farm labourers. Some owners also indicated distrust in the security services employed. Concern was that they provided information onto people involved in stock theft etc.

- Stock theft: No incidents involving construction staff were reported. Some properties experienced incidents linked to local farm workers exploiting the cover of construction activities. Many owners have however pointed to the difficulty of establishing stock theft incidents on extensive properties due to gates being left open or fences damaged, and especially if incidents are left unreported. Pressure from the Tankwa Karoo Farmers Association resulted in the operators of the Perdekraal East to install cameras with night-vision and number-plate recognition capabilities at key points (e.g. site or farm entrances). This may need to be considered for the construction of the Kareebosch, Brandvalley and Rietkloof WEFs.
- Compensation for losses associated with need to reduce and or relocated livestock during construction was identified as an option. However, the option of leasing grazing in the region may become scarcer due to competition from various WEFs in the REDZ and the impact of the drought and climate change. One affected landowner indicated that farmers had to travel further afield to find alternative grazing. This resulted in increased transport costs.
- Impact on the Komsberg Road (Karusa, Soetwater): The road was reasonably maintained, but only the portion up to the northern entrance to the Soetwater WEF. The developers maintained that the balance of road was a public road and was not impacted by construction traffic. However, they did not consider the large number of minibus taxis and bakkies that transported workers in and out from Sutherland every day. Need to consider cumulative impacts from other projects in the area, such as Kareebosch, Brandvalley and Rietkloof WEFs.
- Littering: The key issue of concern is potentially fatal ingestion by livestock. Appears to have been managed reasonably well, although some owners discovered isolated incidents. Timing of reporting and addressing issue a key factor as in case of damage to farm gates etc. Again, the issue is making contractors aware of implications. Littering is not simply a neatness issue, but one that can have significant economic implications on farmers livelihoods due to stock losses.
- Interaction with farmworker staff: Owners indicated that they experienced no issues in this regard. This is largely linked to limited contact between the relevant parties on the large properties and Covid-19. Limiting interaction with taxi crews seems to be a factor in limiting the potential flow of contraband onto farms.

5. IMPACTS ON LOCAL COMMUNITIES

- Representatives as the Sadawa meeting indicated that Sexually Transmitted Disease (STD) infection rates in Sutherland had increased significantly and this had placed pressure on local medical services.
- Also reported that teenage and unplanned pregnancies in Sutherland have increased.
- Rental accommodation in and around Sutherland has become scarce and expensive for locals.
- Tourist accommodation in and around Sutherland has been largely booked out to consultants, contractors, etc, thus reducing the availability for visitors. This may impact on the tourism potential of the town. The impact is expected to last for a number of years given the number of projects proposed in the Komsberg REDZ. However, as indicated above, the economy of Sutherland has benefitted significantly from the construction phase and is expected to continue benefitting.
- Perception with Paardekraal East is that the benefits to the local farming community in the area, as opposed to Witzenberg Municipality, has been limited. It is felt that a start could be made by the WEF at least joining the Tankwa Farmers Association and behaving like a part of the community. Similar concerns may develop with projects located in the vicinity of Sutherland and Laingsburg, such as the Kareebosch, Brandvalley and Rietkloof WEFs.

6. VISUAL AND SENSE OF PLACE IMPACTS

- The sense of place in the Klein Roggeveld portion along the Komsberg Road has significantly altered.
- Civil aviation lights: This was the key issue discussed at Sadawa meeting. Local landowners indicated that the impact on the night sky was a major concern. There is a proposal to see if the CAA and Paardekraal East will agree to retrofit the lights with an aircraft activated system. This approach should also be considered for other WEFs in the Komsberg REDZ, such as the Kareebosch, Brandvalley and Rietkloof WEFs.
- Directly affected owners appear to have resigned themselves to visual impacts as long at the major viewsheds from their farm houses are not affected.
- The disturbances are not only linked to the wind turbines but also to access roads and disturbances to the natural veld.

7. KEY RECOMMENDATIONS

7.1 Communication

- Early, clear, and effective communication with affected and adjacent landowners prior to and throughout the construction phase is critical. A detailed ***Stakeholder Engagement Plan*** should be developed prior to the implementation of the construction phase and should be developed in conjunction with the affected landowners and key stakeholders, such as local landowners, the local farming association and municipality.
- A ***Grievance Mechanism*** should be developed and implemented as part of the Stakeholder Engagement Plan.
- A ***Monitoring Committee*** **(MC)** should be established as part of the Stakeholder Engagement Plan. The MC should be made up of representatives from the affected landowners and key stakeholders, such as the local farmers, the local farming association, municipality and proponent.
- Communication should include regular updates and information sharing throughout the construction phase and be carried over to the operation and maintenance phase. The programme for meetings should be outlined in the ***Stakeholder Engagement Plan***.
- A ***Community Liaison Person (CLP)*** should be appointed by the proponent at the outset of the construction phase. Ideally this person should be from the local community and his or her role should be to ensure that the ***Stakeholder Engagement Plan*** is implemented on the ground. The CLP should be involved in the development of the ***Stakeholder Engagement Plan*** and not merely appointed to implement the Plan. In this way he or she will have met with and engaged with the affected landowners and key stakeholders prior to the start of the construction phase and will have a good understanding of farming activities in the area and how these may be impacted by the construction related activities.
- Procedures and timeframes should be identified for reporting and addressing incidents, such as damage to gates and fences etc. Based on the comments from the affected land owners, it would appear that the role played by the ***Environmental Control Officers (ECOs)*** involved in the existing projects can be improved. The ECO and CLP should liaise closely with each other throughout the construction phase.
- The approach to responding to and addressing complaints or concerns should be sympathetic, open, transparent, and constructive. This would go a long way in maintaining good relations. In this regard the ***Stakeholder Engagement Plan*** should be informed by a set of engagement principles that support this approach.
- Contractor training. Contractor training must include making workers aware of the consequences of their actions and the impact that they may have on farming activities. A Contractor Training programme should be developed and implemented prior to the commencement of the construction phase. The programme should inform contract workers of the requirements of the ***Stakeholder Engagement Plan*** and

Environmental Management Plan and their roles and responsibilities in terms of these plans***.***

7.2 Impacts on local communities and the local economy

Based on comments the construction of existing renewable energy projects has benefited the towns of Sutherland and Laingsburg. However, the presence of construction workers has also impacted negatively on local communities. The recommendations contained in the SIA and the EMPr do cover the potential measures to enhance the potential socio-economic benefits. These are outlined below:

Positive impacts

Employment

- Stakeholder engagement processes should be put in place to make sure that all interested and affected party have buy in in the process which will be designed and followed for employment and local procurement opportunities
- Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
- Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria.
- Before the construction phase commences the proponent should meet with representatives from the Laingsburg and Karoo Hoogland LM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.
- The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project.
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

- The proponent should liaise with the LM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction service providers. These companies should be notified of the tender process and invited to bid for project-related work.

The need to implement training and skills development programmes for locals and local service providers prior to the initiation of the construction phase is a key intervention. The benefits are three-fold:

- Firstly, it will maximise the potential employment opportunities for local community members and businesses.
- Secondly, it will assist the renewable energy companies to meet local employment and procurement targets.
- Thirdly, it will raise skills levels in the area and increase the economic mobility of the local community members and companies that benefit from the programme.

Negative impacts

Based on comments the presence of construction workers has had a negative impact on local communities, specifically in the small town of Sutherland. The local community in Laingsburg has also been impacted. The recommendations contained in the SIA and the EMPr do cover the potential measures to address the potential negative impacts. These are outlined below:

- Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories.
- The proponent and the contractor(s) should develop a ***Code of Conduct*** for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be subject to appropriate disciplinary action and/or dismissed. All dismissals must comply with the South African labour legislation.
- The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase.
- The contractor should provide transport for workers to and from the site on a daily basis. This will enable the contactor to effectively manage and monitor the movement of construction workers on and off the site.
- The contractor must ensure that all construction workers from outside the area are transported back to their place of residence within 2 days for their contract coming to an end.
- No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

Given the issues raised it is recommended that a ***Development Forum*** consisting of representatives from the Laingsburg and Karoo Hoogland Municipality and renewable energy companies involved in the implementation of projects in the Komsberg REDZ be established. The aim of the ***Development Forum*** would be to implement the measures required to address the potential negative impacts during both the construction and operational phase and enhance the potential opportunities.

Negative impacts

The impact of construction workers on local communities in Sutherland and Laingsburg is a key issue of concern and has been borne out by the experience with the construction of the Karusa and Soetwater WEFs. The impacts include increase in STDs and unplanned pregnancies. This has placed pressure on the local medical services in the town. There is currently no resident doctor in Sutherland and the existing medical and social services are limited. Most residents that require a doctor or treatment travel to the hospital in Worcester and have to rent a private vehicle in the case of emergencies.

Recommended that the renewable energy companies engage with the Western Cape Department of Health and local municipalities of to identify how they can contribute towards increasing the capacity of the local health services in the area, specifically in Sutherland. This may include covering the costs of appointing additional medical staff at the clinic and appointing more social workers.

Food security is also an issue, specifically with regards to young children and the elderly. The ***Development Forum*** should also look at the establishment and or support for community feed schemes.

Positive impacts.

The ***Development Forum*** should co-ordinate the planning and implementation of Social and Economic Development (SED) initiatives in the area, including the design and implementation of a co-ordinated, training and skills development programme that

involves and is supported by each of the different renewable energy companies as opposed to a series of separate, fragmented efforts.

In this regard the ***Development Forum*** would play a role during both the construction and operation phase of the renewable energy projects in the Komsberg REDZ. The option of establishing a Renewable Energy Training and Skills Centre facility in Laingsburg that would provide training and skills development to local community members and SMME's so that they can undertake construction related and maintenance and repair work associated with the renewable energy facilities located in the Komsberg REDZ should be investigated. This would represent a legacy project opportunity for the renewable energy sector that have projects in the Komsberg REDZ. The centre should be linked to a technical training college/ university to provided training and skills development. The focus should be on creating opportunities for members from the local community, with a focus on women and the youth.

7.3 Accommodation for construction workers

Meeting the accommodation needs for construction workers is likely to pose a challenge given the limited accommodation facilities available in the area, specifically in Sutherland. In addition, providing accommodation for construction workers will reduce the availability of accommodation for local residents, tourists and other visitors and business people to towns such as Sutherland, Laingsburg and Matjiefontein. Therefore, while the construction phase will benefit local hospitality industry, it also has the potential to impact negatively on local communities and other visitors who require accommodation.

Based on information for SIAs undertaken for WEFs the total number of workers associated with the construction phase for a single WEF project (depending on size) ranges from 300-600 depending on the stage of the construction phase. Of this total approximately 70 would be classified as skilled workers and 400-500 as semi-skilled and low-skilled workers. The construction phase for a single WEF project typically extends over a period of 12-18 months (depending on size).

Based on the assumption that 20% of the semi-skilled and low skilled workers can be sourced locally, the maximum number of semi and low skilled workers that will need to be provided with accommodation will be in the region of 300. However, due to the low education levels in the area it may not be possible to meet the 20% local employment target. The figure is therefore likely to be in the region of 400.

Therefore, for a single WEF project the total number of workers that would need to be accommodated would be in the region of 500. If more than one WEF is constructed, then this increases the cumulative impacts both in terms of benefits to the local economy and the hospitality sector, but also in terms of potential negative impacts.

The Laingsburg Municipality has indicated that they will not support the establishment of construction camps on private farms, such as was undertaken for the Karusa WEF. This reduces the economic benefits for the local towns in the area. However, in order to meet the demand for accommodation associated with the construction of WEFs in the Komsberg REDZ it may be necessary to establish a dedicated accommodation facility/s in Laingsburg for semi and low skilled workers. Based on initial meetings with the Laingsburg Municipality this proposal is supported.

Such a facility will enable proponents to provide quality accommodation that meets IFC worker accommodation requirements and standards. The establishment of a new accommodation facility will also create an opportunity to employ local contractors and meet local procurement and employment targets. The facility can also be handed over the local municipality and used for the establishment of Renewable Energy Centre (see above) or Community Centre.

In terms of recommendations, recommended that a meeting be set up with the with the Laingsburg and Karoo Hoogland Municipality to discuss accommodation requirements and the option of establishing an accommodation facility, including planning and rezoning requirements, bulk services, role of local contractors etc.

7.4 Impacts on natural and farming areas

The EMPr and SIA identify measures aimed at reducing the impact on farming and natural areas. These include:

Natural areas

- Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.
- Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development.
- All roads built for construction should have water diversion and erosion control structures present, especially in steep areas.
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- Demarcate all areas to be cleared with construction tape or similar material. However, caution should be exercised to avoid using material that might entangle fauna.

Farming areas

- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences.
- All farm gates must be closed after passing through.
- Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site.
- The proponent should consider the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site.

As indicated above, all of the affected landowners interviewed as part of the SIA indicated that they did not expect the disturbances to be as extensive as they turned out to be and felt that excessive areas of land were cleared / disturbed during the construction phase. In addition, farm gates damaged or left open, and fences were damaged. These impacts were often exacerbated by failure to and or delays by the contractor in reporting incidents, resulting in valuable time lost in rectifying the problem.

Based on the above it is recommended that more attention be provided to the planning and implementation of construction related activities to ensure that the impact footprint is minimised, and unnecessary disturbances are avoided. These measures should be clearly outlined in the EMPr.

Steps must also be taken to ensure that they are implemented on the ground. In this regard it would appear that the concerns related to extent of the disturbance and damage to farm infrastructure can be directly attributed to the actions of the contractors on the site. It is unclear if this is due to insufficient detail and or training provided to the

contractors prior to and during construction phase and or lack of effective oversight by the ECOs on the site.

As indicated above, a **Monitoring Committee (MC)** should be established. The MC should meet on a monthly basis to review construction related activities and ensure that the requirements of the EMPr are effectively implemented on the ground.

APPENDIX

O GEOTECHNICAL REPORT

PROPOSED DEVELOPMENT OF THE 140MW BRANDVALLEY WIND ENERGY FACILITY, WESTERN AND NORTHERN CAPE PROVINCE

DESKTOP GEOTECHNICAL REPORT

NOVEMBER 2021

REVISION 01

Prepared by:

JG AFRIKA (PTY) LTD

Pietermaritzburg
6 Pin Oak Avenue, Hilton
3201
Phone: 033 343 6700
Email: norrisj@jgafrika.com
Project Director: Jan Norris

VERIFICATION PAGE	Qual-frm-026
	Rev 14

TITLE:
PROPOSED DEVELOPMENT OF THE 140 MW BRANDVALLEY WIND ENERGY FACILITY, WESTERN AND NORTHERN CAPE PROVINCE

JGA REF. NO.	DATE:	REPORT STATUS
5613	23/11/2021	Final

CARRIED OUT BY:

JG AFRIKA (PTY) LTD
Pietermaritzburg
6 Pin Oak Avenue
Hilton
3201

Tel.: +27 33 3434 6700
Email: pmb@jgafrika.com

COMMISSIONED BY:

WSP ENVIRONMENTAL AND ENERGY
Johannesburg
33 Sloane Street
Johannesburg
2191

Tel.: +27 21 300 0610
Email: Ashlea.strong@wsp.com

AUTHOR

K Bulala

CLIENT CONTACT PERSON

A Strong

SYNOPSIS

Desktop geotechnical investigation for the proposed Brandvalley wind energy Facility.

KEY WORDS:

Sandstone, Shale, Mudstone, Foundations, Shallow, Bedrock, Resistivity.

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO 9001: 2015 which has been independently certified by DEKRA Certification.

Verification	Capacity	Name	Signature	Date
By Author	Engineering Geologist	K Bulala Cand.Sci.Nat.	p.p.	23/11/2021
Checked by:	Senior Associate	T Speirs Pr.Sci.Nat	p.p.	23/11/2021
Authorised by:	Director Geotechnical	J Norris Pr.Eng		23/11/2021

Filename:	W:\Geotech\5613 - WSP Desktops (KB)\2. Technical Data\Reporting\Brandvalley\WEF\5613 Brandvalley WEF - Desktop Geotechnical Report.docx

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6)

Section in EIA Regulations 2014 (as amended)		Clause	Section in Report
Appendix 6	(1)	A specialist report prepared in terms of these Regulations must contain —	
	(a)	details of –	
		(i) the specialist who prepared the report; and	Verification Page
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae.	Appendix C
	(b)	A declaration that the person is independent in a form as may be specified by the competent authority;	Appendix C
	(c)	An indication of the scope of, and the purpose for which, the report was prepared;	1
	(cA)	An indication of the quality and age of base data used for the specialist report;	4, 5, 6, 11
	(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Table 8-1, 9-1, 9-2
	(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A
	(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process; inclusive of equipment and modelling used;	1
	(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Appendix A Map 1,2,3,4, 5
	(g)	An indication of any areas to be avoided, including buffers;	Appendix A Map 1,2,3,4
	(h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Appendix A Map 1,2,3,4,5
	(i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	2
	(j)	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	3, 4, 5, 6, 7
	(k)	Any mitigation measures for inclusion in the EMPr;	Table 8-1
	(l)	Any conditions for inclusion in the environmental authorization;	Table 8-1
	(m)	Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Table 8-1,
	(n)	A reasoned opinion –	
		(i) as to whether the proposed activity, activities or portions thereof should be authorized;	10
		(iA) regarding the acceptability of the proposed activity or activities; and	10
		(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures	Table 8-1

		that should be included in the EMPr, and where applicable, the closure plan;	
	(o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
	(p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None
	(q)	Any other information requested by the authority.	N/A
	(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

PROPOSED DEVELOPMENT OF THE 140 MW BRANDVALLEY WIND ENERGY FACILITY, WESTERN AND NORTHERN CAPE PROVINCE

DESKTOP GEOTECHNICAL REPORT

TABLE OF CONTENTS

TABLES

APPENDICES

EXECUTIVE SUMMARY

This report presents the findings concluded from a desktop level study for the proposed 140 MW Brandvalley Wind Energy Facility situated across two provinces, Western Cape and Northern Cape. The study area receives a relatively low mean annual precipitation of 264mm, with the warmest months being January and February. Various tributaries of the Muishond River, Groot River and Roggeveld River drain the study area. The study area is underlain by rock units of the Abrahamskraal Formation (Pa) which forms part of the Beaufort Group. The Abrahamskraal Formation is underlain by the Waterford Formation (Pw) which form part of the Ecca Group. The Ecca and Beaufort Groups form part of the greater Karoo Supergroup.

Competent founding conditions are anticipated in relatively shallow, slightly weathered bedrock, which will have to be assessed during the detailed investigation stage prior to construction. Colluvial deposits can be anticipated along hillslopes with alluvial deposits anticipated near drainage features. Six-fold features were identified in the study area. Regional borehole data indicates relatively low aquifer yields in the range of 0.1-0.5l/s. Based upon preliminary geological and geotechnical assessments the desktop study indicates no fatal flaws. Based upon this desktop study, the site is considered suitable for the proposed construction of the Wind Energy Facility. "**Negative moderate impact - The anticipated impact will have negative effects and will require mitigation**." Based on the impact assessment matrix undertaken for this project, from a geotechnical perspective the impact of the Brandvalley WEF was found to be

PROPOSED DEVELOPMENT OF THE 140 MW BRANDVALLEY ENERGY FACILITY, WESTERN AND NORTHERN CAPE PROVINCE

DESKTOP GEOTECHNICAL REPORT

1 INTRODUCTION

This report presents the findings of a geotechnical desktop level study undertaken by JG Afrika (Pty) Ltd, for the proposed 140 MW Brandvalley Wind Energy Facility (WEF). The proposed WEF is situated in two Provinces, Western Cape Province and Northern Cape Province. It is understood that a desktop level geotechnical report is required to supplement an environmental submission for a Basic Assessment (BA) report being undertaken by WSP. The proposed WEF is situated between the towns of Matjiesfontein and Sutherland in the Western Cape Province.

The Wind Energy facility will consist of the following:

- Thirty-four (34No.) wind turbines with a maximum generating capacity of 140 MW in total, each with a foundation of 25m in diameter and 4m in depth.
- The hub height of each turbine will be up to 125m with a rotor diameter of up to 180m and blade length of 90m. The maximum upper tip height will be 215m
- Permanent compacted hard-standing laydown areas for each wind turbine (4500m^2 per hardstand, total 153 000m^2) will be required during construction and for on-going maintenance purposes.
- Electrical turbine transformers (690V/33kV) adjacent to each turbine (typical footprint of 2m x 2m up to 10m x 10m at certain locations) would be required to increase the voltage to 33kV.
- Internal access roads up to 9m wide, including structures for storm-water control would be required to access each turbine location and turning circles. Where possible, existing roads will be upgraded.
- 33kV overhead power lines linking groups of wind turbines to onsite 33/132kV substation(s). A number of potential electrical 33kV powerlines will be required in order to connect wind turbines or strings of turbines to the preferred onsite substation. The layout of the 33kV powerlines will be informed by sensitive features identified. The facility will consist of both above and below ground 33kV electrical infrastructure depending on what will require the shortest distance and result in the least amount of impacts to the environment.
- Underground 33kV cabling between turbines buried along access roads, where feasible.
- Two 33/132kV onsite substation location(s) were assessed. The footprint of these 33/132kV substation(s) were assessed in both this EIA and the Basic Assessment process for electrical infrastructure as the applicant will remain in control of the low voltage components of the 33/132kV onsite substation (including isolators, control room, cabling, transformers etc.) (assessed in this EIA), whereas the high voltage components of this substation (assessed in BA) will likely be ceded to Eskom. The total footprint of this onsite substation will be

approximately 200m x 200m. The exact coordinates of the low voltage components footprint (assessed in this EIA) and high voltage components footprint (to be assessed in the basic assessment process) will be informed by detailed designs.

- Up to 4 x 120m tall wind measuring lattice masts strategically placed within the wind farm development footprint to collect data on wind conditions during the operational phase.
- Temporary infrastructure including a construction camp (~10ha) and an on-site concrete batching plant (~1ha) for use during the construction phase.
- Borrow pits and quarries for locally sourcing aggregates required for construction (~4.5ha), in addition to onsite turbine excavations where required. All materials excavated will eventually be used on the compacting of the roads and hard-standing areas and no material will be sold to any third parties. The number and size of the borrow pits depends on suitability of the subsurface soils and the requirement for granular material for access road construction and other earthworks. Alternative borrow pit locations will be assessed in a separate BA process. Application for approval will also be submitted in terms of the Mineral and Petroleum Resources Development Act (Act 107 of 2002) (MPRDA) once the suitability of the material has been determined.
- Fencing will be limited around the construction camp and the entire facility would not necessarily need to be fenced off. The height of fences around the construction camp are anticipated to be up to 4m.

1.1 Scope of works

The investigation seeks to give a desktop evaluation of the proposed study site. The objective of the study was to assess the geological and geotechnical conditions across the study area.

The desktop study involved a literature review and a review of topographic and geological maps. Consideration was given to, but not limited to the following from a desktop level:

- The influence of topography on site suitability.
- The envisaged geological and geotechnical influences on the competency of foundations for the construction of structures.
- Tectonic influences on overall stability, namely the presence of faulting, lineaments and preferred discontinuity orientations.
- Comments regarding likely founding conditions, geotechnical constraints, problem areas and overall site stability from a desktop level.
- Recommendations regarding requirements for subsequent detailed geotechnical investigations.

1.2 Terms of Reference

The appointment to proceed with the investigation is based upon JG Afrika's cost estimate entitled, "*Quotation for Geotechnical Desktop Studies for Proposed Wind Energy Facilities and Associated Electrical Infrastructure in the Western Cape*." dated the 26th May 2021. JG Afrika received the

appointment via a sub-consultancy agreement letter referenced, *41103473-D05*, via email on the 20th of July 2021.

1.3 Specialist Credentials

Ms. Bulala is a qualified engineering geologist, having attained a Bachelor of Science Degree in Geology, from the University of Limpopo. She is registered as a Candidate Natural Scientist (Registration No. 116482). Ms. Bulala holds the position of Engineering Geologist at JG Afrika's Pietermaritzburg branch. She has experience in various fields of earth science and ground engineering, namely: engineering geology, geotechnical engineering, environmental geology and soil surveys. At present Ms. Bulala specializes in conducting foundation investigations and material investigations for dams, roads and renewable energy.

The report was reviewed by Mr. Tom Speirs. Mr Speirs is a qualified senior engineering geologist with over 30 years' experience. He is a registered Professional Natural Scientist (Registration No. 400104/94) in the geological sciences fields. He has undertaken geotechnical, geological and materials work throughout Southern Africa, East, West and Central Africa, Madagascar and eastern Australia. He has accumulated extensive experience, including in renewable energy projects in South Africa.

1.4 Assessment Methodology

The methodology entailed a literature review and a review of topographic and geological maps. Consideration was given to the terrain, geological, hydrogeology as well as expected geotechnical constraints.

2 ASSUMPTIONS, LIMITATIONS, UNCERTAINTIES - DISCLAIMER

The interpretation of the overall geotechnical conditions across the site is based upon a review of available information on the project area. Subsurface and geotechnical conditions have been inferred at a desktop level from available information, past experience in the project area and professional judgement. The information and interpretations are given as a guideline only and there is no guarantee that the information given is totally representative of the entire area in every respect. No responsibility will be accepted for consequences arising out of the fact that actual conditions vary from those inferred. The information must be verified by the undertaking of a detailed geotechnical site investigation.

3 SITE DESCRIPTION

3.1 Locality

The proposed Brandvalley WEF is situated approximately 27 km north of the town of Matjiesfontein. The site lies within the Komsberg Renewable Energy Development Zone (REDZ) located within the Cape Winelands District Municipality. Five (5No.) turbines situated on the northern section of the site are located in the Namakwa District Municipality of the Northern Cape Province.

A Locality Plan indicating the site location is presented as **Map 1** which is included in **Appendix A**.

JG Afrika has previous experience in the study area having conducted detailed geotechnical investigations for the Oya energy facility in 2020 and the Roggeveld Windfarm development in 2015. The Roggeveld Windfarm development site location overlaps the proposed Brandvalley WEF site. The Roggeveld project comprised fifty-six proposed wind turbines located near District Road 2243. The Oya project is located 18km west of the site and comprised a solar photovoltaic facility and twelve wind turbines.

JG Afrika also conducted a previous detailed geotechnical investigation for the stabilisation of the Verlatekloof Pass (2008) 48km from the study area.

3.2 Land Use and Vegetation

The project application site for the proposed WEF is approximately 25 521 ha. The project application site incorporates the following Farm portions:

- The farm Rietfontein No.197
- The Remainder of Farm Kabeltouw 160
- Remainder of Farm Muishond Rivier 161
- The Remainder Farm Fortuin 74
- The Remainder of Farm Brandvalley 75
- The Remainder of Farm Barendskraal 76
- Portion 1 of Farm Fortuin 74
- Portion 3 of Farm Fortuin 74
- Portion 1 of Farm Brandvalley 75
- Portion 1 of Farm Barendskraal 76
- Portion 1 of Farm Muishond Rivier 161

From the environmental assessment it is understood that the study area was used for low intensity grazing but is no longer actively used for agricultural activities.

The regional biome within which the study site is located is classed as a Succulent Karoo Biome, with the presence of lowland succulent Karoo vegetation species.

A Site Plan indicating the layout of the proposed WEF development is presented as **Map 2** which is included in **Appendix A**.

3.3 Climate

The study area is characterized by a dry climate with a “BWk” classification according to the Köppen-Geiger climate classification. Matjiesfontein receives a relatively low mean annual precipitation of 264 mm. The average lowest rainfall is received in September (14 mm) and the highest in March (27 mm), which is a seasonal variation of 14 mm.

The maximum midday temperatures for Matjiesfontein ranges from 30°C in January and February to 15.2°C in July. The minimum temperatures for Matjiesfontein ranges from 14.4°C in February to 3.8°C in July. The average temperatures vary during the year by 12.3°C. Table 3-1, summarizes the climatic conditions.

Table 3-1: Summary of Climatic Conditions, Matjiesfontein (information extracted from "Climate-Data.org")

Months	Average Rainfall (mm)	Temperature (°C)		
		Maximum	Minimum	Average
January	16	30.1	14	21.3
February	16	30.0	14.4	21.4
March	27	27.3	12.9	19.5
April	24	23.1	10.1	16.3
May	22	19.2	7.3	12.9
June	25	15.3	4.3	9.4
July	23	15.2	3.8	9.1
August	23	16.5	4.3	10.1
September	14	19.9	6.1	12.7
October	23	23.7	8.7	15.8
November	28	25.9	10.4	17.7
December	23	28.6	12.7	20

3.4 Drainage and Topography

The study area is drained by non-perennial tributaries of Muishond River, Groot River and Roggeveld River. The tributaries form dendritic drainage patterns.

Slope aspect and drainage features are presented in **Map 3.1** and **Map 3.2** which is included in **Appendix A**.

The slope gradient map indicates that the turbines, the substation and the construction camp site are located on flat terrain (0˚ – 2.2˚). The majority of the internal access roads are characterised by flat to gentle slope along the lower lying valley areas and steep terrain characterises the slope sides. The turbines are located gentle terrane ranging between 2.2º to 9.7º slopes.

Spot heights indicate elevation values in the range of 1437m to 1504m above mean sea level in the central portion of the site. The majority of the site indicates elevation values in the 1100m to 1504 above mean sea level.

4 GEOLOGY

According to the 1: 250 000 Geological Maps of Sutherland (3220) and Ladismith (3320) published by the Council for Geoscience, the study area is underlain by rock units of the Abrahamskraal (Pa) Formation. The Abrahamskraal Formation is underlain by the Waterford (Pw) Formation. The two formations form part of the Adelaide Subgroup, forming part of the Beaufort Group. The Beaufort Groups forms part of the greater Karoo Supergroup.

The Abrahamskraal Formation (Pa) is represented by grey and green mudstone, siltstone and subordinate sandstone. Thin chert beds are common on the lowermost red mudstones of the Abrahamskraal Formation. The Waterford Formation (Pw) is represented by sandstone, siltstone, mudstone and shale.

Regional measurements indicate that the rock units dip 20° and 30° in a westerly direction, 47° in a north easterly direction, 25° in south westerly direction and 225° in a south westerly direction.

The sedimentary rocks in the area have been acted upon by numerous tectonic forces resulting in fold structures. Based upon the geology map, six fold features are located within the WEF study area. The fold axes trend in an E-W direction and represent localized synclines and anticlines which form part of the Cape Fold Belts.

A Geological Map is presented as **Map 4** which is included in **Appendix A**.

5 HYDROGEOLOGY

The study area lies within the E22A, E22B, E23A and J11D catchment area. the catchments receive mean annual precipitation of 254mm, 249mm, 251mm and 240mm respectively.

According to the 1: 3 000 000 scaled Groundwater Harvest Potential Map of South Africa, Regional yields of sustainable groundwater abstraction rates, indicate values of 6000 - 10 000 m^3/km^2/annually.

Regional hydrogeological data indicate the aquifer type is classed as ‘b2’ which is a, fractured aquifer type. Regional borehole data indicate relatively low yields, estimated to be in the range of 0.1-0.5 l/s.

An extract of the regional Hydrogeological Map is presented as **Map 5** which is included in **Appendix A**.

The structural geology in the study area is conducive to the formation of high-yielding aquifer formations. As such a detailed hydrogeological investigation for the proposed borehole water abstraction works, is recommended during the detailed design phase.

6 ENGINEERING GEOLOGY

The engineering geology refers to the engineering characteristics of natural earth material for founding structures and suitability for construction material purposes.

The study area is characterized by a Weinert N value of more than 10, meaning that the type of weathering is primarily by mechanical disintegration. Shallow residual soils are commonly granular and gravelly (Brink, 1983).

The study area is dominated by the Abrahamskraal Formation. Colluvial deposits can be anticipated along hillslopes with alluvial deposits anticipated near drainage features.

Based on previous investigations in the greater Roggeveld area, blocky, greyish-red mudstone with interbedded grey very fine to medium-grained quartzofeldspathic sandstone can be anticipated. Weathered, limestone layers of up to 1.5m in thickness may be present. Greenish-grey cherty layers, of a few centimetres to two metres thickness, may also be present in the Abrahamskraal formation. The chert and limestone layers possess potentially soluble properties.

Where material is required for the construction of roads and laydown areas, natural gravely or crushed sandstone bedrock can potentially be a suitable source. Consideration must be given to the presence of excessive pyrite and muscovite which can cause distress where sandstone is used as basecourse (Brink, 1983). In addition, where chemical stabilization is required the clay matrix of sandstones make them suitable for stabilization with lime (Brink, 1983). The occurrence, nature, material quality and quantity of sandstone and other potential construction material will have to be assessed during the detailed geotechnical investigation.

Mudrocks such as siltstone, mudstone and “mud-shales” are not considered suitable for use as construction material, due to their swelling characteristics, excessive absorption of water, poor engineering performance and lack of durability. Slope stability issues can arise in areas where closely intercalated sandstones and mudrock exist. When mudrocks slake or disintegrate the exposed sandstone layers are undercut, this can result in rockfalls (Brink, 1983). Based on previous investigations in the Roggeveld area, concave cave structures can be anticipated through erosion of the less-competent shale and mudstone bedrock beneath the hard sandstone beds when exposed to the elements.
Based on previous investigations in the Sutherland area (Verlatekloof Pass), the Abrahamskraal Formation is represented by maroon mudstone, greenish grey siltstone and olive grey sandstone. These sedimentary units are intercalated and display variable weathering, as described for the Formation.

7 GEOTECHNICAL APPRAISAL

Competent, founding conditions can be anticipated in shallow, slightly weathered bedrock conditions, which will have to be assessed during the detailed investigation prior to construction.

Consideration can be given to the following foundation types for turbines:

- Ballasted Foundations (concrete raft) – these foundations are suitable in areas where shallow bedrock conditions are encountered or in poor, non-cohesive soils, where helical or screw-in piles are not suitable. The limitation is that; ballasted foundations require additional design considerations on steep slopes, they are not suited to areas susceptible to settlement and areas underlain by expansiveness soil conditions.

- Driven Piles - these piles are suited to clay, gravel and dense sand where shallow groundwater conditions can be anticipated. The advantage is that they can be accurately positioned, no curing is required, and the cost of installation is relatively low (e.g Duktus pile).

The proposed substation site and the construction camp site are underlain by the Abrahamskraal Formation. The two sites lie on a flat slope with slope of 0-2.2˚ likely to be shallow transported soils. The substation site does not traverse any drainage features. The construction camp site traverses a drainage feature. Consideration can be given to the following foundation types for the substation:

- Normal strip footings

- Spread footings

It is important to select the correct foundation type and optimize the design, as such a detailed and comprehensive geotechnical investigation is required this will be undertaken prior to construction and upon finalisation of the layout plan.

The presence of uplift and downward forces in the form of wind loads must be taken into consideration during foundation design.

8 GEOTECHNICAL IMPACT ASSESSMENT

From a preliminary geological and geotechnical assessment, no fatal flaws have been identified.

8.1 Impact of the Project on the Geological Environment

The Karoo Supergroup is known for its fossil bearing sedimentary units which will have to be more accurately assessed by a palaeontologist. The removal of rock which contain these fossils will result in the destruction of these fossils.

The impact of the development from a geotechnical perspective will be restricted to the removal and displacement of soil, boulders and bedrock referred to in this report as “subsoils”. The levelling

of areas to create building platforms will also result in the displacement and exposure of subsoils. The potential impact of the development on the terrain and geological environment, will be the increased potential for soil erosion, caused by construction activities and the removal of vegetation.

These impacts will have a negative visual impact on the environment, which in some cases can be remediated. The project requires extensive earthworks to meet the required horizontal and vertical alignments and curvatures for roads, so the aesthetic impact is significant.

The potential impact of the development on the terrain and geological environment, will be the increased potential for soil erosion, caused by construction activities and the removal of vegetation. Areas of concentrated surface flow can be anticipated at energy facilities, resulting in gradual erosion of unconsolidated soil, during the operational life of the facility. This can result in the creation of preferential drainage features, unless remediated through proper engineering design (i.e stormwater drainage).

Based on the impact assessment matrix undertaken for this project, from a geotechnical perspective the impact of the Karreebosch WEF was found to be "**Negative moderate impact - The anticipated impact will have negative effects and will require mitigation**." The assessment impact assessment matrix is presented as Table 8-2. Table 8-1 summaries the impacts and the mitigation of the proposed development.

Areas with steep slope inclinations are not favoured for the energy developments due to the earthworks requirements and the potential need for advanced foundations. The WEF application site is considered suitable for the proposed development provided that the recommendations presented in this report are adhered too and which need to be verified by more detailed geotechnical investigations during detailed design.

The impact assessment criteria developed by WSP is included in **Appendix B.**

Table 8-1: Impact and Mitigation Summary

PHASE	ASPECT	IMPACT	RECOMMENDED MITIGATION
Construction Phase	The displacement of natural earth material and overlying vegetation.	• Increase stormwater velocity. • Increase in soil and wind erosion due to clearing of vegetation. • Construction and earthmoving vehicles may displace soil. • Creation of drainage paths along access tracks. • Sedimentation of non-perennial features and excessive dust.	• Identify protected areas prior to construction. • Construction of temporary berms and drainage channels to divert surface water. • Minimize earthworks and fills. • Use existing road network and access tracks. • Rehabilitation of affected areas (such as revegetation, mechanical stabilization). • Correct engineering design and construction of gravel roads and water crossings. • Control stormwater flow
	Potential oil spillages from heavy plant.	• Potential groundwater and drainage feature contamination.	• Vehicle repairs to be undertaken in designated areas.
Operational Phase	Displacement of natural earth material during maintenance	• Increase in soil erosion. • Sedimentation of non-perennial features caused by soil erosion.	• Use of existing roads and tracks where possible. • Rehabilitation of affected areas (such as erosion control mats). • Correct engineering design and construction of roads and water crossings during maintenance. • Maintenance of stormwater system.
	Potential oil spillages from heavy plant.	• Potential groundwater and drainage feature contamination.	• Vehicle repairs to be undertaken in designated areas.

Decommissioning Phase	Disturb the geological environment	• Increase in soil and wind erosion due to clearance of structures. • Construction and earthmoving vehicles will displace the soil. • Creation of drainage paths. • Excessive sediments in non-perennial features.	• Use of temporary berms and drainage channels to divert surface water. • Minimize earthworks and demolish footprints. • Use of existing roads and tracks were feasible. • Rehabilitation of affected areas (such as revegetation). • Develop a chemical spill response plan. • Develop dust and demolition fly suppression plan. • Reinstate channelized drainage features.
	Potential oil spillages from heavy plant.	• Potential groundwater and drainage feature contamination.	• Vehicle repairs to be undertaken in designated areas.
Cumulative	None	None	None

Table 8-2: Geotechnical Impact Assessment Matrix

Project Name	Proposed Development of the Brandvalley WEF and Associated Infrastructure in the Western and Northern Cape Province																		
Impact Assessment	Geotechnical																		
CONSTRUCTION																			
Impact number	**Aspect**	**Description**	**Stage**	**Character**	**Ease of Mitigation**	**Pre-Mitigation**							**Post-Mitigation**						
						(M+)	**E+**	**R+**	**D)x**	**P=**	**S**	**Rating**	**(M+)**	**E+**	**R+**	**D)x**	**P=**	**S**	**Rating**
Impact 1:	Subsoil Removal	Increase Soil Erosion	Construction	Negative	Moderate	4	2	3	3	5	**60**	**N3**	2	1	1	2	2	**12**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
Impact 2:	Potential Oil Spillage	Ground and Surface Water Contamination	Construction	Negative	Moderate	4	3	5	5	4	**68**	**N4**	3	1	3	1	2	**16**	**N2**
					Significance	**N4 - High**							**N2 - Low**						
OPERATIONAL																			
Impact number	**Receptor**	**Description**	**Stage**	**Character**	**Ease of Mitigation**	**Pre-Mitigation**							**Post-Mitigation**						
						(M+)	**E+**	**R+**	**D)x**	**P=**	**S**		**(M+)**	**E+**	**R+**	**D)x**	**P=**	**S**	
Impact 1:	Displacement of natural material	Increase Soil Erosion	Operational	Negative	Moderate	3	2	3	4	4	**48**	**N3**	2	1	1	4	2	**16**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Potential Oil Spillage	Ground and Surface Water Contamination	Operational	Negative	Moderate	3	2	5	5	3	**45**	**N3**	2	1	3	1	2	**14**	**N1**
						N3 - Moderate							**N1 - Very Low**						
DECOMISSIONING																			

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M +)	E +	R +	D) x	P =	S		(M +)	E +	R +	D) x	P =	S	
Impact 1:	Subsoil Removal	Increase Soil Erosion	Decommissioning	Negative	Moderate	4	2	3	3	5	**60**	**N3**	2	1	1	2	2	**12**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
Impact 2:	Potential Oil Spillage	Ground and Surface Water Contamination	Decommissioning	Negative	Moderate	4	3	5	5	4	**68**	**N4**	3	1	3	1	2	**16**	**N2**
					Significance	**N4 - High**							**N2 - Low**						
CUMULATIVE																			
Impact number	**Receptor**	**Description**	**Stage**	**Character**	**Ease of Mitigation**	**Pre-Mitigation**							**Post-Mitigation**						
						(M +)	E +	R +	D) x	P =	S		(M +)	E +	R +	D) x	P =	S	
Impact 1:	Overall Cumulative Impact	The Construction of the Proposed WEF	Cumulative	Negative	Moderate	4	2	3	3	5	**60**	**N3**	2	1	3	3	2	**18**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

9 CONCLUSIONS AND RECOMMENDATIONS

The foregoing report presents the findings concluded from a desktop study undertaken for the proposed Brandvalley WEF. The site is anticipated to be underlain by shallow bedrock conditions. It is recommended that the turbines be constructed on relatively flat slopes.

No fatal flaws from a geotechnical perspective were identified during this desktop study. The impact of the WEF was found to be "**Negative moderate impact - The anticipated impact will have negative effects and will require mitigation.**"

Conclusions presented in this report will have to be more accurately confirmed during the detailed geotechnical investigation phase. The site from a desktop level geotechnical study is considered suitable for the proposed wind energy facility.

It recommended that a detailed geotechnical investigation be undertaken during the detailed design phase of the project. The detailed geotechnical investigation must entail the following:

- Profiling and sampling exploratory of trial pits to determine founding conditions for the turbine modules, substation and pylons.
- An investigation to determine the subgrade conditions for internal roads and a materials investigation (if required).
- Thermal resistivity and electrical resistivity geophysical testing for electrical design and ground earthing requirements.
- Groundwater sampling of existing boreholes to establish a baseline of the groundwater quality for construction purposes.
- Dynamic Probe Super Heavy (DPSH) tests and rotary core drilling may be required depending on the soil profiles and imposed loads of the structures.

10 REFERENCES

- Brink. A.B.A (1983). Engineering Geology of Southern Africa: The Karoo Sequence. Volume 3. Building Publications: Cape Town.
- Climatic Data, Matjiesfontein. Accessed August 2021 from: https://en.climate-data.org/
- Singh. K. (2020). Solar photovoltaic (PV) and wind turbine infrastructure, Matjiesfontein, western cape province geotechnical investigation. JG Afrika (Pty) Ltd.
- Hayes. T. (2015). Geotechnical Investigation for the proposed Roggeveld Windfarm site. Jeffares & Green, Port Elizabeth.
- Speirs. T. (2008). Geotechnical Assessment of Instability of Verlatekloof Pass. Jeffares & Green, Pietermaritzburg.

- 1: 250 000 Geological Map Series (3220 Sutherland). Published by the Council of Geoscience.
- 1: 3 000 000 Groundwater Harvest Potential of the Republic of South Africa. Published by the Department of Water Affairs and Forestry.

-oOo-

Appendix A: Figures

BRANDVALLEY WEF GEOTECHNICAL DESKTOP STUDY: LOCALITY MAP (MAP 1)

JG AFRIKA

PO Box 794
Hilton 3245

Tel: (033) 343 6789
Fax: (033) 343 6788

Legend

- Met masts
- Turbine positions
- 33kV Medium voltage cables
- 33kV OHL Route
- Hardstands
- Laydown area
- Roads
- Substation and O&M Building
- Temporary Earth Works

Kilometers

0 3.75 7.5 15

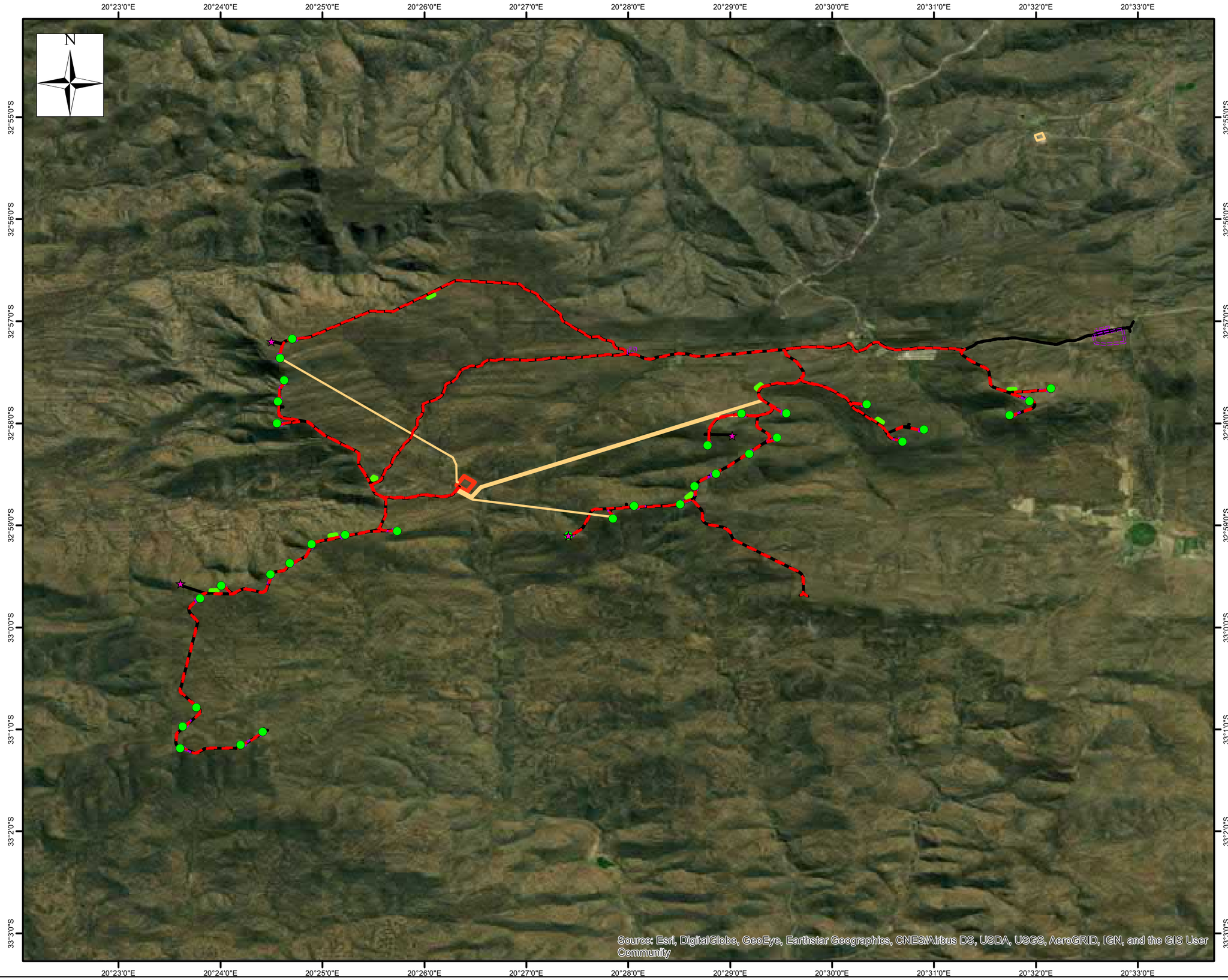
Map No.: 01

Scale (A3): 1:250 000

Designed and detailed under the controls established by our quality management system that meet the requirements of ISO 9001:2000 which has been independently certified by DEKRA Certification under certificate number 90906882.

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

BRANDVALLEY WEF GEOTECHNICAL DESKTOP STUDY:
SITE MAP (MAP 2)



JG AFRIKA

PO Box 794
Hilton 3245

Tel: (033) 343 6789
Fax: (033) 343 6788

Legend

- Met masts
- Turbine positions
- 33kV Medium voltage cables
- 33kV OHL Route
- Hardstands
- Laydown area
- Roads
- Substation and O&M Building
- Temporary Earth Works

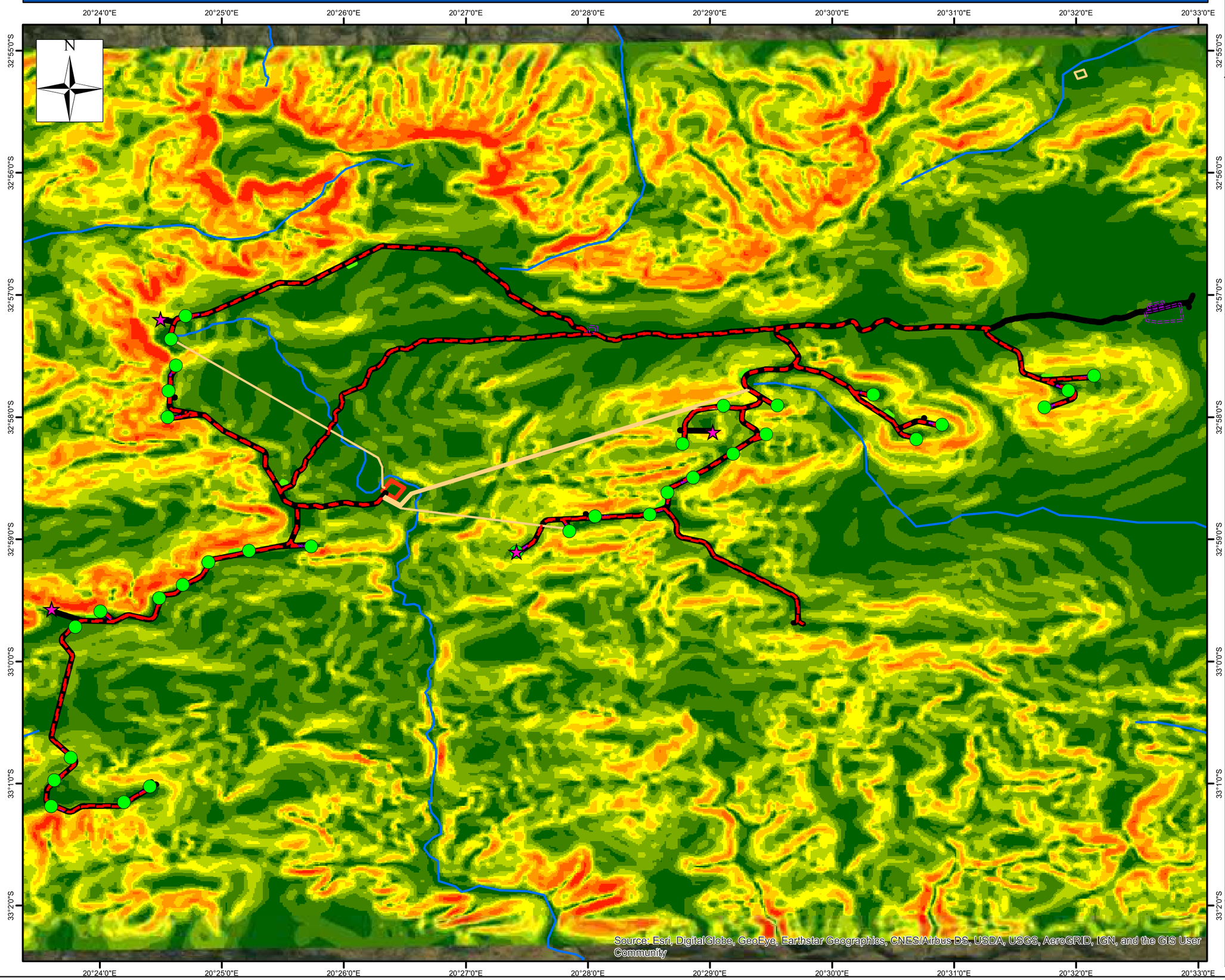
Kilometers
0 1 2 4

Map No.: 02

Scale (A3): 1:66 862

Designed and detailed under the controls established by our quality management system that meet the requirements of ISO 9001:2000 which has been independently certified by DEKRA Certification under certificate number 90906882.

BRANDVALLEY WEF GEOTECHNICAL DESKTOP STUDY: SLOPE MAP (MAP 3)



JG AFRIKA

PO Box 794
Hilton 3245

Tel: (033) 343 6789
Fax: (033) 343 6788

Legend:

- Met masts
- Turbine positions
- 33kV Medium voltage cables
- 33kV OHL Route
- Hardstands
- Laydown area
- Roads
- Substation and O&M Building
- Temporary Earth Works
- Perennial_Watercourses

brand_slope.tif

<VALUE>

- 0.0 - 2.2
- 2.2 - 4.1
- 4.1 - 5.9
- 5.9 - 7.8
- 7.8 - 9.7
- 9.7 - 11.7
- 11.7 - 13.9
- 13.9 - 16.9
- 16.9 - 23.4

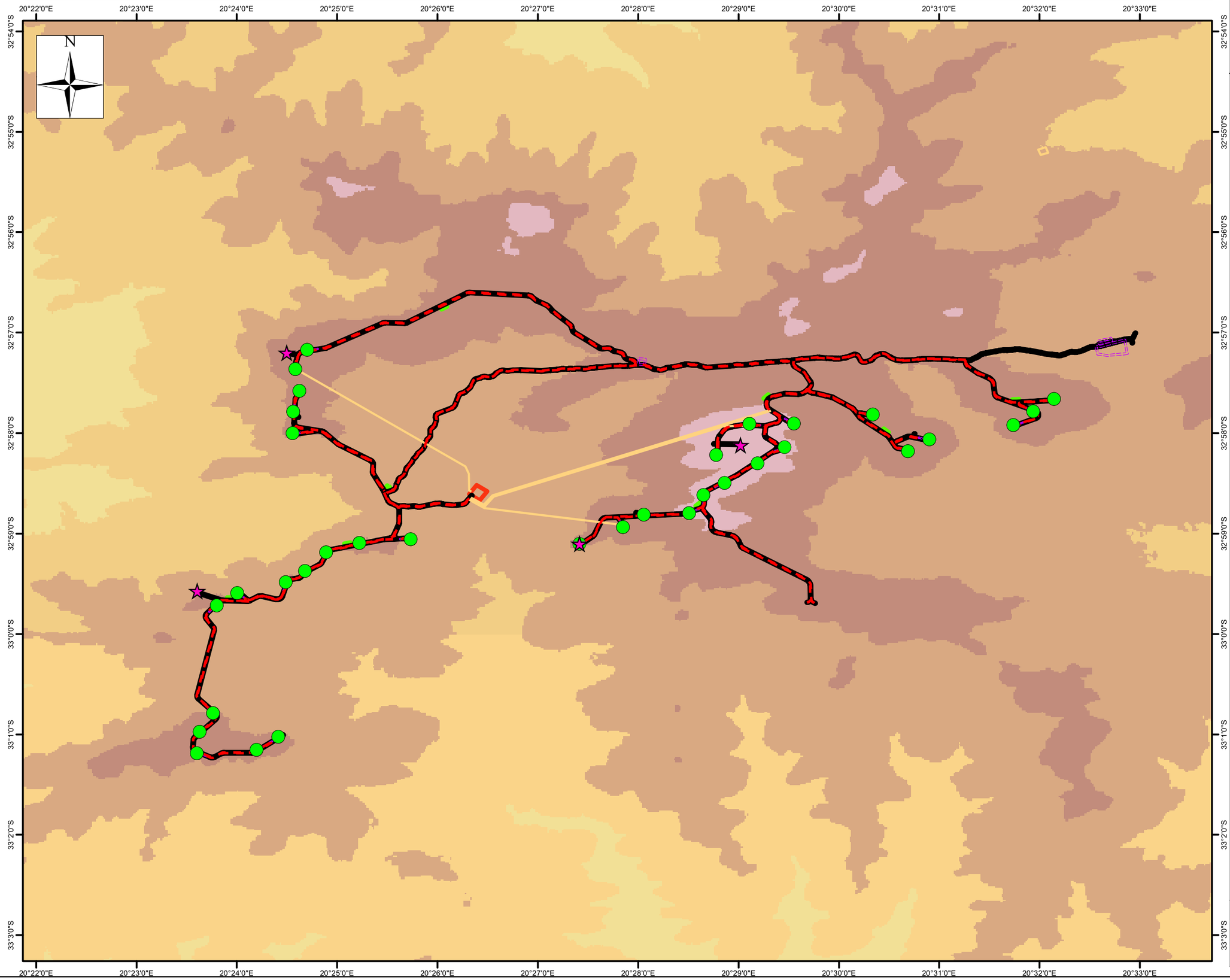
Kilometers

0 0.75 1.5 3

Map No.:	Scale (A3):
03	1:55 510

Designed and detailed under the controls established by our quality management system that meet the requirements of ISO 9001:2000 which has been independently certified by DEKRA Certification under certificate number 90906882.

BRANDVALLEY WEF GEOTECHNICAL DESKTOP STUDY: ELEVATION MAP (MAP 4)



JG AFRIKA

PO Box 794
Hilton 3245

Tel: (033) 343 6789
Fax: (033) 343 6788

Legend

- Met masts
- Turbine positions
- 33kV Medium voltage cables
- 33kV OHL Route
- Hardstands
- Laydown area
- Roads
- Substation and O&M Building
- Temporary Earth Works

Elevation

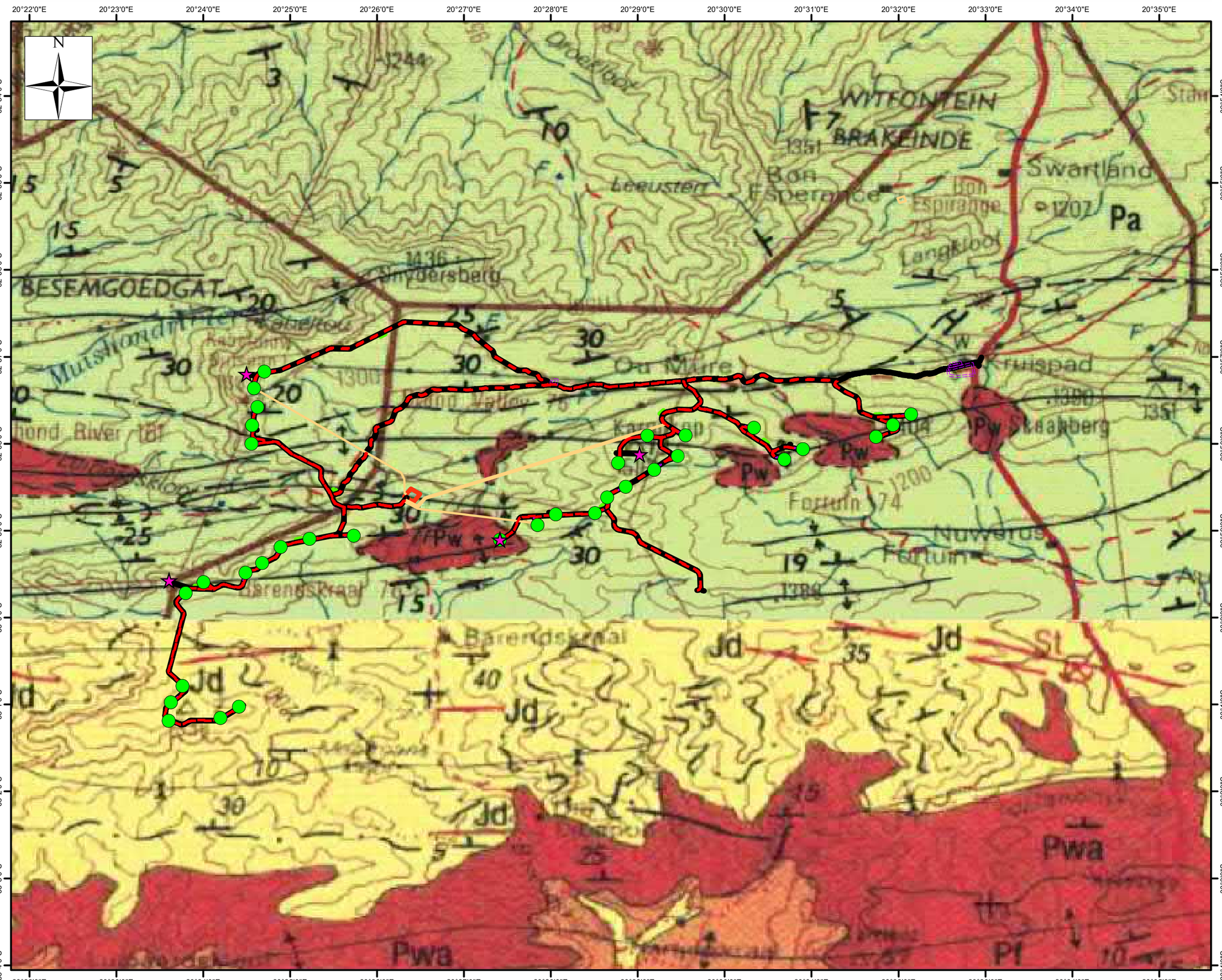
- 368 - 566
- 566 - 722
- 722 - 864
- 864 - 1 004
- 1 004 - 1 148
- 1 148 - 1 284
- 1 284 - 1 405
- 1 405 - 1 523
- 1 523 - 1 846

Kilometers
0 1 2 4

Map No.:	Scale (A3):
04	1:67 800

Designed and detailed under the controls established by our quality management system that meet the requirements of ISO 9001:2000 which has been independently certified by DEKRA Certification under certificate number 90906882.

BRANDVALLEY WEF GEOTECHNICAL DESKTOP STUDY: GEOLOGY MAP (MAP 5)



JG AFRIKA

PO Box 794
Hilton 3245

Tel: (033) 343 6789
Fax: (033) 343 6788

Legend

- Met masts
- Turbine positions
- 33kV Medium voltage cables
- 33kV OHL Route
- Hardstands
- Laydown area
- Roads
- Substation and O&M Building
- Temporary Earth Works

Geology:

Pa - Mudstone, siltstone, sandstone, thin cherty beds (lowermost red mudstone)

Pw - dark grey shale, light grey weathering with cherty siltstone beds

Jd - Dolerite

Pwa - grey mottled feldspathic sandstone, subordinate dark coloured shale and sandstone

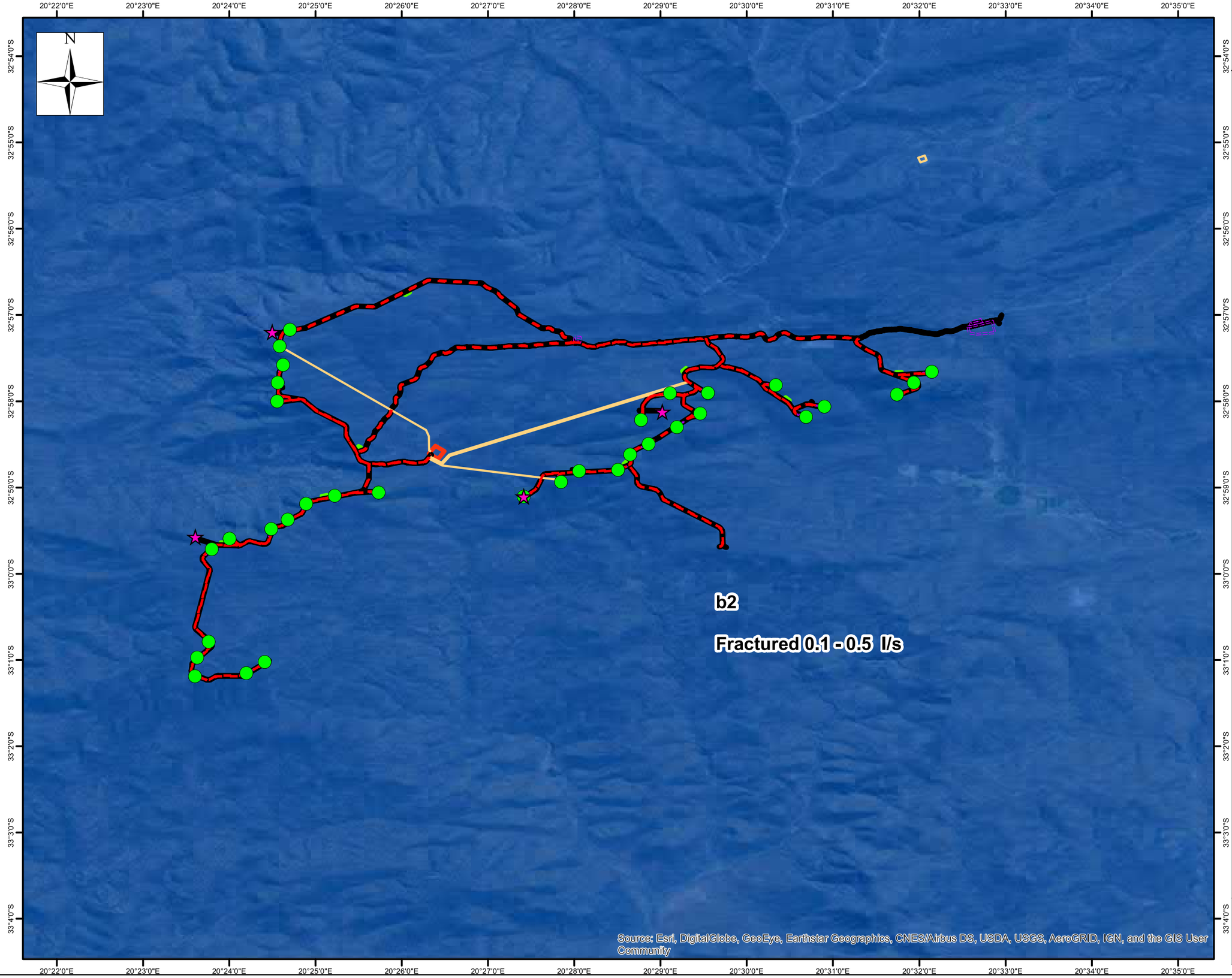
Kilometers

0 1.25 2.5 5

Map No.:	Scale (A3):
05	1:79 000

Designed and detailed under the controls established by our quality management system that meet the requirements of ISO 9001:2000 which has been independently certified by DEKRA Certification under certificate number 90906882.

BRANDVALLEY WEF GEOTECHNICAL DESKTOP STUDY: GEOHYDROLOGY MAP (MAP 6)



JG AFRIKA

PO Box 794
Hilton 3245

Tel: (033) 343 6789
Fax: (033) 343 6788

Legend

- Met masts
- Turbine positions
- 33kV Medium voltage cables
- 33kV OHL Route
- Hardstands
- Laydown area
- Roads
- Substation and O&M Building
- Temporary Earth Works

Kilometers

0 1.25 2.5 5

Map No.:	Scale (A3):
06	1:79 000

Appendix B: WSP's Impact Assessment Methodology

IMPACT ASSESSMENT METHODOLOGY

ASSESSMENT OF IMPACTS AND MITIGATION

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[1], indirect[2], secondary[3] as well as cumulative[4] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[5] presented in **Table 0-1**.

Table 0-1: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite

[1] Impacts that arise directly from activities that form an integral part of the Project.
[2] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[3] Secondary or induced impacts caused by a change in the Project environment.
[4] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[5] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

The Pavilion, 1st Floor
Cnr Portswood and Beach Road, Waterfront
Cape Town, 8001
South Africa

T: +27 21 481 8700
F: +086 606 7121
www.wsp.com

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in **Figure 1** below.

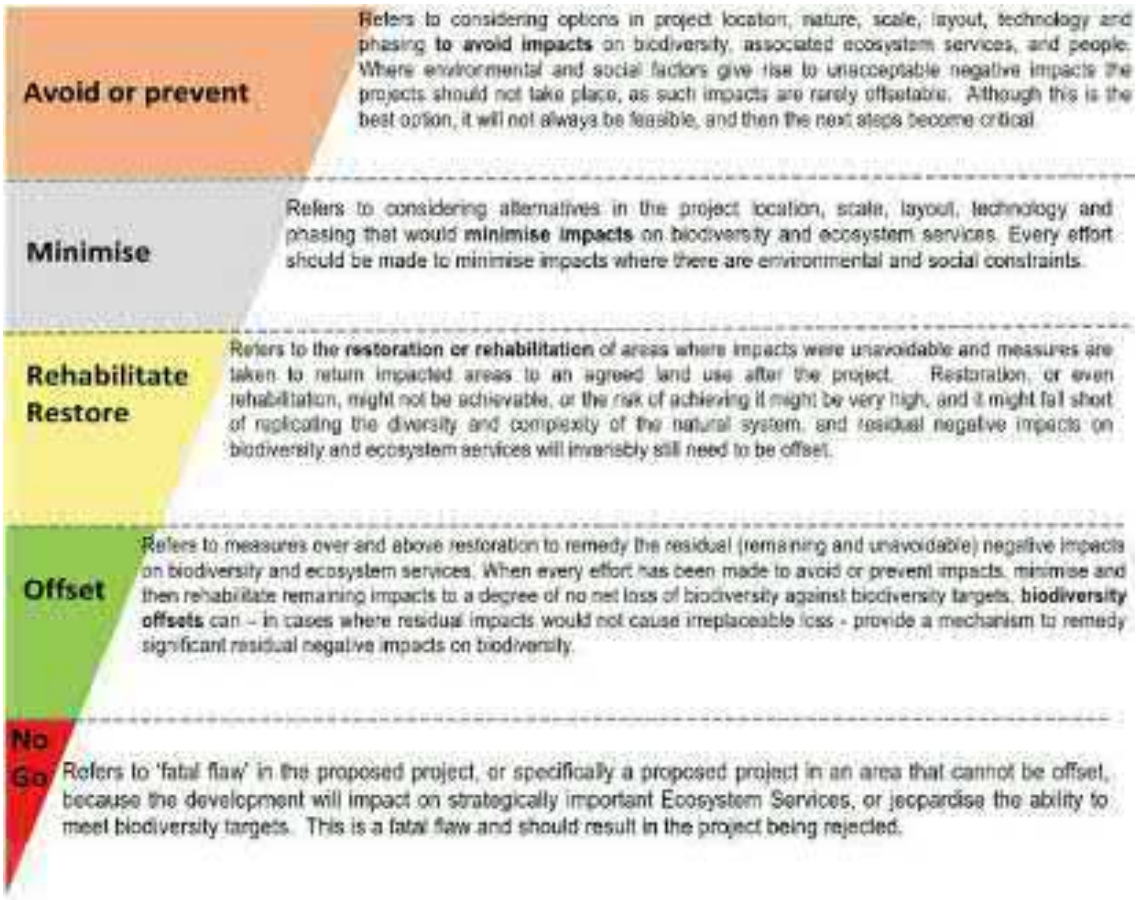


Figure 1: Mitigation Sequence/Hierarchy

Project Name	Proposed Development of the Brandvalley WEF and Associated Infrastructure in the Western and Northern Cape Province
Impact Assessment	Geotechnical

CONSTRUCTION

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	Subsoil Removal	Increase Soil Erosion	Construction	Negative	Moderate	4	2	3	3	5	**60**	**N3**	2	1	1	2	2	**12**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
Impact 2:	Potential Oil Spillage	Ground and Surface Water Contamination	Construction	Negative	Moderate	4	3	5	5	4	**68**	**N4**	3	1	3	1	2	**16**	**N2**
					Significance	**N4 - High**							**N2 - Low**						

OPERATIONAL

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Displacement of natural material	Increase Soil Erosion	Operational	Negative	Moderate	3	2	3	4	4	**48**	**N3**	2	1	1	4	2	**16**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Potential Oil Spillage	Ground and Surface Water Contamination	Operational	Negative	Moderate	3	2	5	5	3	**45**	**N3**	2	1	3	1	2	**14**	**N1**
					I	**N3 - Moderate**							**N1 - Very Low**						

DECOMISSIONING

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Subsoil Removal	Increase Soil Erosion	Decommissioning	Negative	Moderate	4	2	3	3	5	**60**	**N3**	2	1	1	2	2	**12**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
Impact 2:	Potential Oil Spillage	Ground and Surface Water Contamination	Decommissioning	Negative	Moderate	4	3	5	5	4	**68**	**N4**	3	1	3	1	2	**16**	**N2**
					Significance	**N4 - High**							**N2 - Low**						

CUMULATIVE

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Subsoil Removal	Increase Soil Erosion	Cumulative	Negative	Moderate	4	2	3	3	5	**60**	**N3**	2	1	3	3	2	**18**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Proposed Construction the 140MW Brandvalley Wind Energy Facility, Western and Northern Cape Province

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	JG Afrika (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	
Specialist name:	Khuthadzo Bulala			
Specialist Qualifications:	BSc Hons Geology			
Professional affiliation/registration:	Cand Sci Nat			
Physical address:	06 Pin Oak Avenue, Hilton, Pietermaritzburg			
Postal address:	06 Pin Oak Avenue, Hilton, Pietermaritzburg			
Postal code:	3245	Cell:		
Telephone:	033 343 6700	Fax:	033 343 6701	
E-mail:	bulalak@jgafrika.com			

2. DECLARATION BY THE SPECIALIST

I, Khuthadzo Bulala, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

JG Afrika (Pty) Ltd

Name of Company:

01/03/2021

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Khuthadzo Bulala, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

JG Afrika (Pty) Ltd

Name of Company

01/09/2021

Date

COMMISSIONER OF OATHS
DAWN JANET BURGIN
9/1/6/2 (R/O) KZN (PIETERMARITZBURG)
6 PIN OAK AVENUE, HILTON

Signature of the Commissioner of Oaths

01/09/2021

Date

Appendix C: Specialist's CV

KHUTHADZO BULALA

Profession	*Engineering Geologist*
Position in Firm	*Engineering Geologist*
Area of Specialisation	*Geotechnical Engineering, Engineering Geology*
Qualifications	*BSc (Hons) (Geology) Cand. Sci. Nat.*
Years of Experience	*5.5 Years*
Years with Firm	*5 years*

SUMMARY OF EXPERIENCE

Khuthadzo is currently an Engineering Geologist based in the Pietermaritzburg office. She was originally employed by the Lesotho Highlands Development Authority (LHDA) as a young professional to work with JG Afrika on site, working on the geotechnical investigation for Phase II of the Lesotho Highlands Water Project. At the completion of the contract with LHDA, she joined JG Afrika as a permanent employee. Through her time on site, she gained valuable experience in site investigations, from assisting with the supervision of the contractor, profiling and logging, analysis of in-situ and laboratory testing, and reporting. She has been involved with a number of small to large scaled geotechnical investigation in KwaZulu-Natal.

PROFESSIONAL REGISTRATIONS & INSTITUTE MEMBERSHIPS

Cand.Sci.Nat. - Registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP) - Registration No 116482

EDUCATION

2007 – Matric – Mbilwi Secondary School
2011 – BSc (Geology) – University of Johannesburg, Johannesburg
2013 – BSc (Hons) (Geology) – University of Limpopo, Polokwane

SPECIFIC EXPERIENCE

JG Afrika (Pty) Ltd (Previously Jeffares & Green (Pty) Ltd)

2017 -
Position – Engineering Geologist

Nkobongweni Water Scheme – Project manager responsible for the field investigation and report writing for the proposed water supply project. Client: Makhaotse Narasimulu and Associates (Pty) Ltd

Koup 1 & Koup 2 – Project manager responsible for the geotechnical desktop studies for the Koup 1 and Koup 2 wind energy facilities and their associated grid components. Client: Sivest SA (Pty) Ltd.

Mfulamuni Access Road – Project manager responsible for the field geotechnical investigation and reporting for the re-gravelling of four access roads in Mahlaba, Pomeroy. Client: ZVK Holdings (Pty) Ltd

Zwelisha Moyeni Waste-Water Treatment Works – Project manager responsible for the filed investigation and the report writing for the proposed WWTW extensions. Client: JG Afrika (Pty) Ltd Water Division

Hammersdale Waste-Water Treatment Works – Engineering Geologist responsible for the additional field investigation and the report writing for the proposed WWTW extensions. Client: eThekwini Municipality: Water and Sanitation Division

Emanzini Estate Geohydrology Assessment – Engineering Geologist responsible for the hydrocensus for the soak away pits feasibility at the proposed Mt Verde Estate. Client: Emanzini Private Reserve

Mt Verde Geohydrology Assessment – Engineering Geologist responsible for the hydrocensus and percolation tests for the soak away pits feasibility at the proposed Mt Verde Estate. Client: Venture Partners

Ntabamhlophe Tank – Project manager responsible for the field investigation and the report writing for the proposed tank. Client: JG Afrika Water Division

Kenhardt Solar PV Plant – Project manager responsible for the field investigation and the report writing for the proposed solar PV plant. Client: Scatec Solar South Africa.

Heidelberg Cemetery – Project manager and field geologist responsible for the investigation and and the report writing for the proposed existing Heidelberg cemetery extension. Client: Marang Environmental and Associates (Pty) Ltd

Cornubia Fills – Engineering geologist responsible for the field investigation and the report writing for the proposed cut and fill assessments for the Cornubia Boulevard Transit Mall development. Client: Smec

Kokstad CRU Contamination Study – Engineering geologist responsible for the contamination study for the Kokstad community residential units' phase 2 study. Client: Ingcweti Ace Technology

Mandalathi Hall – Project manager responsible for the geotechnical investigation and report writing for the proposed Mandalathi hall. Client: Dartingo Consulting Engineers (Pty) Ltd

Umgungundlovu Landfill Site – Engineering geologist responsible for the percussion drilling site supervision and the hydrocensus for the geohydrological assessment. Client: Séché South Africa

Gluckstaadt Water Supply Scheme – Engineering geologist responsible for the geotechnical investigation and report writing for bulk and reticulation pipeline routes, pump stations, reservoirs and water treatment works for the proposed development. Client: SiVEST

Agribusiness Development Agency Rabbitries – Project manager responsible for the geological investigation and report writing for five ADA Rabbitires development. Client: JG Afrika Agricultural Department. Client: JG Afrika Agricultural Department

Alfred Duma Cemetery – Engineering geologist responsible for writing the site selection desktop study report for eight sites in the Alfred Duma Municipality. Client: Ziphelele Planning and Environmental Consultancy

Eskom Radio Towers – Engineering geologist responsible for the field investigation and report writing for nine Eskom Towers in Eastern Cape. Client: Eskom

220 Murray Road – Project manager, responsible for managing field investigation (conducted by Muhammad Osman) and writing an infill geotechnical investigation report for a multi-story development in Hayfields. Client: Green Door Environmental

Giba Industrial Development – Engineering geologist responsible for the field investigation for Giba Industrial Development and assisted with the Geotech report. Client: Sultex Holdings (Pty) Ltd

Rietfontein Dam Geotechnical Investigation – Project manager, field geologist involved with the geotechnical investigations and reporting for the founding conditions and material investigation of the proposed Rietfontein Dam in Eastern Cape. Client: Calvus Properties Client:

Kirkwood Borrow pit and Retaining Walls – Engineering geologist involved in the geotechnical investigation and reporting for the borrow pit and retaining wall foundations of the proposed R336 Road Upgrade. Client: Royal Haskoning

83 West Street – Project manager, field geologist involved with the geotechnical investigations and report writing. Client: Private Developer

Eastwood Pedestrian Bridge – Project manager, field geologist involved with the geotechnical investigations and report writing. Client: High End Construction

N3 Quarry Logging – Geologist involved in the geotechnical logging of quarries between Durban and Pietermaritzburg, Client: South African National Road Agency Limited

N2 Kangela to Pongola Borrow Pit Geotechnical Investigations – Assisted with the geotechnical report, Client: South African National Road Agency Limited

N2 Kangela to Pongola Road Widening Geotechnical Investigations – Assisted with the geotechnical report, Client: South African National Road Agency Limited

Gowrie Farm Stand No.295 Geotechnical Investigations – Project manager, field geologist involved with the geotechnical investigations and report writing. Client: Delute Construction

45 Richard Carte Road – Geologist involved with the field investigations for the refurbishment of the warehouse. Client: T2 Design Lab

Darvil Sludge Dam – Geologist involved with the field investigations for the founding conditions, slope stability and materials investigations. Client: Umgeni Water

Acaciavale Landfill Closure Geotechnical Investigation- Geologist involved in the field investigation and the report writing. Client: Alfred Duma Municipality

Ntaba Ridge Plots Geotechnical Investigation- Project manager, field geologist involved in the geotechnical investigation at several plots. Involved in trial pitting, profiling and sampling and report writing.

Umhlatuze Cemetery Feasibility Study- Geologist involved in the project management, desktop study report, field investigation and the report writing. Client: uMhlatuze Municipality

Harry Gwala Irrigation Scheme – Client: Department of Rural Development and Land Reform

- Responsible for augering, soil profiling and sampling of the soils
- Assisted with the GIS for the various proposed sites
- Report writing for the project

Intaba Ridge Estate Landswop for Cemetery Geotech Investigation- Field geologist and involved in trial pitting, profiling and sampling.

Horseshoe, Mkhuphula and Nkungumathe Irrigation Scheme – Geologist involved in soil survey and report writing. Client: Department of Rural Development and Land Reform.

Geotechnical Investigations for Maryvale Housing- field geologist and involved in a shallow geotechnical investigation for a housing development. Client: eThekwini Municipality

Manzamnyama River Bridge Geotechnical Investigations – field geologist, involved in a deep geotechnical investigation for a new bridge. Client: Naidu Consulting

Cedara Petrol Filling Station Geotechnical Investigations- field geologist, involved in geotechnical investigations for various structures – Involved in trial pitting, profiling, percolation testing and sampling. Client: Barco Petroleum

Lesotho Highlands Water Project: Phase II (165m high Polihali Dam and Transfer Tunnel)- Assisted with the geotechnical reports for the Polihali Dam Polihali Transfer Tunnel. Client: Lesotho Highlands Development Authority

Mount Edge Combe Underpass Geotechnical Investigations- Involved in geotechnical logging and sampling. Client: Naidu Consulting

Lesotho Highlands Water Project: Phase II: Site geologist for one year based at the Polihali Dam and Transfer Tunnel site in Lesotho. Assisted with the geotechnical rotary core logging of boreholes drilled across the various proposed dam and transfer tunnel design components. Gained valuable experience in logging of the Lesotho Basalts. Client: Lesotho Highlands Development Authority

Lesotho Highlands Development Authority

Mar 2016-Aug 2016
Position – Engineering Geologist Intern

Lesotho Highlands Water Project: Phase II Engineering Geologist Intern at the Polihali Dam Site in Lesotho, seconded to JG Afrika, assisting supervising the LHDA Contract 4016, Polihali Dam and Transfer

Tunnel Geotechnical Investigation. Assisted with borehole logging, and supervision and administration of the rotary core drilling investigation. Client: Lesotho Highlands Development Authority

While seconded to JG Afrika:

Albert Falls: - field geologist involved in geotechnical investigations for a pipeline. Involved in trial pitting, profiling and sampling. Client: BVI Consulting Engineers

Umlazi Housing- field geologist involved in geotechnical investigations for various structures. Involved in trial
pitting, profiling and sampling. Client: BVI Consulting Engineers

South Coast National Route R61- Assistant field geologist involved in geotechnical investigations. Client: South African National Road Agency Limited

PERSONAL DETAILS

Nationality – South African
Date of Birth – 1990-03-30
Domicile – Thohoyandou, South Africa

Languages
English – Good
English - Very Good
Tshivenda - Very Good
Sesotho - Good
Setswana - Good
Sepedi - Good

UNIVERSITY OF LIMPOPO

WE,
THE UNDERSIGNED,
HEREBY CERTIFY THAT

BULALA KHUTHADZO
(201213617)

HAS BEEN AWARDED THE DEGREE

Bachelor of Science Honours

AT A CONGREGATION OF THE UNIVERSITY

Executive Dean

Registrar

Vice-Chancellor and Principal

24 MAY 2017

UNIVERSITY OF LIMPOPO: FORMERLY THE MEDICAL UNIVERSITY OF SOUTHERN AFRICA AND THE UNIVERSITY OF THE NORTH

T 34342

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Khuthadzo Bulala

Registration Number: 116482

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Geological Science (Candidate Natural Scientist)

Effective **9 November 2016** Expires **31 March 2022**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

JAMES THOMAS MAXWELL (TOM) SPEIRS

Profession	*Geologist*
Position in Firm	*Senior Associate*
Area of Specialisation	*Geotechnical/ Engineering Geology*
Qualifications	*Pr.Sci.Nat., BSc*
Years of Experience	*35 Years*
Years with Firm	*32 Years*

SUMMARY OF EXPERIENCE

Tom Speirs has thirty-four years of experience in the fields of engineering geology, geotechnical and materials engineering. He has undertaken geotechnical, geological and materials work throughout Southern Africa, East, West and Central Africa, Madagascar and eastern Australia.

His responsibilities have included all phases of projects from preparing initial proposals and cost estimates through the review and investigation stages to the compilation of completion reports, as well as providing technical input during construction.

He currently manages the technical aspects of the geotechnical division in the Pietermaritzburg branch, including mentorship of subordinates, peer review and quality control.

His fields of expertise include road and dam geotechnical investigations, foundations, identification of construction material sources, slope stabilisation, engineering geological and land utilisation mapping.

PROFESSIONAL REGISTRATIONS & INSTITUTE MEMBERSHIPS

Pr Sci Nat- Registered with the South African Council for Natural Scientific Professions (SACNASP) - Registration No. 400104/94.

NHBRC Registered with the National Home Builders Registration Council (NHBRC) as a competent person (geotechnical). Registration No. 601708.

EDUCATION

1984 – Bachelor of Science – University of Natal

SPECIFIC EXPERIENCE

JG Afrika (Pty) Ltd

2014 to Date
Position - Senior Associate

Anadarko LNG Project - Geotechnical investigations for infrastructure development for the Anadarko liquified natural gas (LNG) project near Palma, Mozambique. Client: WBHO.

Usuthu Dam – Reconnaissance and co-ordination of geotechnical investigations for an off-channel storage dam near Nongoma. Client: RAWS Consulting Engineers

Moses Mabhida Road – Temporary support assessments of a rail embankment for the widening of Moses Mabhida Road in Pietermaritzburg. Client: SiVest.

Varies Geotechnical Investigations for Developments – including a multi-purpose sport s centre in Matatiele, pump-stations for the Mkhupula and Nkungumathe irrigations schemes, multi-storey residential blocks on a site with perched groundwater conditions at Berkshire Downs. Client: Various.

Various SANRAL projects - Co-ordinating and managing geotechnical and materials investigations on national roads projects, including National Route 2 Section 27 between Ballito and the Umvoti Toll Plaza, National Route 2 Sections 30, 31 and 32 between Kangela and Pongola. Slope stability assessments on National Route 2 Section 3 between Caledon and Riviersonderend. Client: SANRAL.

Rietvallei to Mamelodi - Conducting infill geotechnical investigations for the 1.2m diameter pipeline from Rietevallei to Bronberg Reservoir and the 1.4m diameter pipeline from Bronberg to Mamelodi. Client: Rand Water.

Grootgeluk Coal Mine - Geotechnical investigations for strategic coal stockpiles at the Grootgeluk Coal Mine, Lephalale. Client: Exxaro.

Main Road 7 Section 4 - Geotechnical assessment of fill instability on Main Road 7 Section 4, near Underberg. Client: Emzansi Engineers.

Maputo and Tembe River Dam Site Investigations - Reconnaissance of potential dam sites on the Maputo and Tembe Rivers in Maputo Province and the Monapo River in Nampula Province, Mozambique. Client: Conseng.

Maputsoe Urban Roads - Investigations to identify sources of construction materials for the upgrading of the Maputsoe Urban Roads in Lesotho. Client:

Stephen Dlamini Dam - *Ad hoc* investigations to identify potential dam and road construction materials for the construction of the Stephen Dlamini Dam, near Bulwer, KZN. Client: Ubambiswano Projects.

Polihali Dam and Polihali to Katse Transfer Tunnel - *Ad hoc* support on the geotechnical investigations for the Polihali Dam and Polihali to Katse Transfer Tunnel, forming part of the Phase 2 Lesotho Highlands Water Project. Client: LHDA.

Greater Paninkuku Dam, Cabhane Weir and Kilmon Dam - Geotechnical investigations for the proposed Greater Paninkuku Dam, Cabhane Weir and Kilmon Dam in KZN. Client: Ubambiswano Projects.

Mzimvubu Water Project - Detailed feasibility geotechnical investigations for the Laleni Dam, Tunnel and Hydropower Scheme, which forms part of the Mzimvubu Water Project in the Eastern Cape. Client: DWAF.

Matimba Power Station - Geotechnical stability investigations for the proposed raising and extension of an existing ash discard dump at the Matimba Power Station, near Lephalale, Limpopo. Client: RHDHV

Various - Geotechnical investigations for housing and commercial developments comprising single and multi-storey buildings, including a four-storey staff housing complex in the Estcourt Prison and the three-storey Hilton Life Hospital expansion. Client: Various.

Various - Geotechnical investigations for water and sewer reticulation, including the Mandlakazi Bulk Water Supply Scheme, the Mimosadale Water Supply Scheme, Impendle Village waste-water treatment works and outfall sewer, the tertiary pipelines and reservoirs forming part of the Metolong Dam Water Supply Programme in Lesotho. Client: Various

Various - Road construction materials assessments for the EN4 near Maputo in southern Mozambique and the EN1 between Muepane and Quissanga, northern Mozambique. Client: WBHO

2012 to 2014
Position – Associate

Mzimvubu Water Project - Geotechnical suitability assessments of three shortlisted dam sites on the Mzimvubu Water Project in the Eastern Cape. Subsequent feasibility level geotechnical investigations of the selected Ntabelanga dam site. Client: DWAF

Kalia Iron Ore Mine to Yomboyelli - Materials assessments for a 280km haul route from the Kalia Iron Ore Mine to Yomboyelli in Guinea. Client: WBHO.

Mapochs Mine - Geotechnical investigation of embankment distress and stability of Silt Paddocks 16 and 17 at the Mapochs Mine, near Roossenekal. Client: EVRAZ Highveld Steel & Vanadium..

Ubombo Sugar Mill and Big Bend Station - Geotechnical and materials investigations for the 16.5km railway line between the Ubombo Sugar Mill and Big Bend Station in Swaziland- Client: Swaziland Railways.

Noblesfontein Wind Power Plant - Geotechnical investigations for the proposed 75MW Noblesfontein Wind Power Plant near Victoria West in the Northern Cape. Client: Gestamp Wind.

Upington Airport Solar Project - Geotechnical investigation for the proposed 10MW PV power plant for the Upington Airport Solar Project. Client: Pele Green Energy

Jeffares & Green (Pty) Ltd

2008 to 2012
Position- Secondment to Bergstan Gauff Jeffares & Green Dikgatlhong Dam Project Joint Venture

Dikgatlhong Dam - Resident engineering geologist / materials engineer on the construction of the Dikgatlhong Dam in Botswana- a 4.6km long by 41m high zoned earth-fill dam with a full supply storage capacity of 400 million m³. Duties included the evaluation of embankment foundations, foundation grouting, geological mapping, excavation classification, sourcing of construction materials, instrumentation, quality control and construction monitoring. Client: Botswana Department of Water Affairs.

Jeffares & Green (Pty) Ltd

2001 to 2008
Position- Associate

Water Pipeline between Benoni and Mamelodi - Geotechnical investigations for the duplication of the water pipeline between Benoni and Mamelodi, east of Pretoria. A significant proportion of the route is underlain by dolomite. Client: Rand Water.

Various - Geotechnical investigations for numerous residential and commercial developments in KZN, Client: Various.

Teekloof and Verlatekloof Passes - Rock slope stability analyses of the Teekloof and Verlatekloof passes in the Northern Cape, Client: Northern Cape Department of Transport.

Various - Reconnaissance and initial geotechnical investigations of potential dam sites for the Lesotho Lowlands Water Supply Scheme. Co-ordinated the geotechnical investigation of two weir sites and an off-channel storage dam on the Black Mfolozi River, near Nyokeni in northern KZN. Client: Various

Kembe Hydro-Electric Power Plant - Preliminary geotechnical investigations for the Kembe hydro-electric power plant in the Central African Republic.

Various - Geotechnical and materials investigations for the rehabilitation of National Route 2 Section from the Pongola River to Pongola town, the N6/8 near Bloemfontein, Main Road 19 between Bhunya and Sandlane in Swaziland and the construction of a new a mine haul road for QMM in eastern Madagascar, Client: SANRAL, Swaziland Roads Department, QMM.
Hlabisa / Thuni Dams - Geotechnical investigations for the Hlabisa Dam in northern KZN and the Thuni Dam in north eastern Botswana, Client: KZN DOT, Botswana Department of Water affairs.

Roads in the Shinyanga Region - Conducted materials investigations for roads in the Shinyanga region of Tanzania, including roads from Shinyanga to Jomu, Jomu to Isaka and Jomu to Nzega. Client: Grinaker-LTA.

MR235/1 between Nkangala and Hlabisa - Assistant Resident Engineer on the contract for the construction of MR235/1 between Nkangala and Hlabisa in northern KwaZulu-Natal. Duties included contract monitoring and administration, materials assessment and verification, slope stability assessments, co-ordination of laboratory testing and community liaison. Also undertook the geotechnical and materials investigations for MR235/2 between Hlabisa and Bazini Client: KZNDOT

Buhemba Mine - Tailings dam investigation for the Buhemba Mine in Tanzania, Client: Merrameta

Victoria Road in the Cape Peninsula - Slope stability assessments along Victoria Road in the Cape Peninsula, Client: PAWC

Jeffares & Green (Pty) Ltd

1999 to 2001
Position- Senior Engineering Geologist

Various - Geotechnical and materials investigations for the upgrading of the Kei Cuttings in the Eastern Cape, the road between Nhlangano and Sicunusa in Swaziland, the John Ross Highway between Empangeni and Richards Bay, P102 south of Pretoria, the N7 north of Cape Town, Victoria Road between Camps Bay and Llandudno, Khetha Road in Mpendle, R56 near Rietvlei in southern KZN, D81 in Swaziland and the road between Chiweta and Karonga in Northern Malawi. Conducted regional studies to locate potential gravel materials for road construction, either usable naturally or by means of blending, on the

Cape West Coast, the Stormberg region of the Eastern Cape and in northern KZN. Compiled a database of gravel road construction materials for the West Coast District. Client: Various.

Various - Geotechnical foundation assessments for buildings, commercial developments and bridges. Client: Various

Various - Geotechnical assessments of structural distress in buildings for insurance claim loss adjustments. Client: Mutual & Federal

Ramotswa Regional Landfill - Conducted the geotechnical investigations for the Ramotswa Regional Landfill in southern Botswana. Included a preliminary assessment to locate candidate sites, ranking, final selection and detailed investigation of the selected site. Client: Group Consult Botswana.

Gold Mines in the Geita and Musoma areas - Geotechnical investigations for infrastructure developments of gold mines in the Geita and Musoma areas of northern Tanzania. Duties included geotechnical assessments for access roads, processing plants, tailing dams and shaft stability. Client: Merrameta.

Coffey Geosciences (Pty) Ltd (Australia)

1998 to 1999
Position- Senior Engineering Geologist

Northside Storage Tunnel - Co-ordinated the geotechnical investigations and undertook core logging for the Northside Storage Tunnel in North Sydney.

Slope stability assessments in Sydney.

Geotechnical foundation assessments for building developments in Sydney.

Suitability assessment of materials for dam construction near Kempsey, NSW.

Stability assessment of rock face at McCaffery's Hill, Pyrmont and a latite rock cutting at Kiama.

Jeffares & Green (Pty) Ltd

1997 to 1998
Position- Senior Engineering Geologist

Hillendale Mine - Geotechnical investigations for the Hillendale Mine near Richards Bay, including assessments for internal roads, founding conditions for a primary processing plant and a residue disposal dam. Client: Knight Piesold.

Various - Feasibility assessments of potential construction material sources for the Platinum Highway between Rustenburg and the Botswana border. Materials investigation for the reconstruction of the N10, near Middleton in the Eastern Cape. Client: Platinum Toll Concession, SANRAL.

Various - Bridge foundation and quarry investigations for the N11 near Newcastle, northern KZN. Investigations for bridge foundations, approach roads and borrow pits near Francistown, Botswana. Client: SANRAL, Botswana DOT.

Various - Geotechnical foundation investigations for various building structures throughout South Africa and Botswana, including site classifications according to the National Home Builders Registration Council. Client: Various.

Knight Piesold (Pty) Ltd.

1996 to 1997
Position- Senior Engineering Geologist

Nhlangano to Lavumisa - Geotechnical and materials investigation for the upgrading of the 87km road between Nhlangano to Lavumisa in Swaziland. Client: Swaziland Roads Department

Various - Foundation investigations for schools, residential complexes and a water treatment plant in Gauteng and the North-West Province. Client: Various.

Mine Tailings Dams and a Discard Dump - Geotechnical investigations for mine tailings dams and a discard dump in Mphumalanga and KZN. Client: ERGO, Ingwe.

Proposed Dam Site at Masunga - Geotechnical investigation of a proposed dam site at Masunga, in the North-East District of Botswana. Site found to be geotechnically unsuitable. Then undertook the preliminary geotechnical investigation of the Ntimbale dam site, near Francistown, including the dam centre-line investigation, sourcing of construction materials and investigations for appurtenant works. Client: Botswana Department of Water Affairs

Jeffares & Green Inc.

1987 to 1996
Position- Engineering Geologist

Durban Southern Gateway - Undertook the monitoring and supervision of the geotechnical drilling contract on the Durban Southern Gateway project, including core logging and assessment of founding conditions for bridges and road embankments on deep estuarine sediments. Client: SANRAL

Various - Monitoring, stability and settlement analyses of embankments, including a number of road embankments and bridge approaches overlying deep, compressible estuarine and alluvial deposits along the KZN coast and in Gauteng. Client: SANRAL, KZN DOT, PPC Cement

South-Western Outfall Sewer - Contract supervision of piling for a pump station and bridge located on dolomite for the South-Western Outfall sewer, south of Johannesburg. Involved the on-site analysis of percussion drilling results to determine optimum pile founding depths and the monitoring of pile installations. Client: City of Johannesburg

Bulk Water Supply Scheme for Mpendle - Geotechnical feasibility investigations of potential dam sites for a proposed bulk water supply scheme for Mpendle, KZN. Included assessments of founding conditions and stability along dam centre lines and the sourcing of construction materials. Also, undertook geotechnical investigations of founding conditions for appurtenant works and the initial environmental impact assessment. Client: Umgeni Water

South West Outfall Sewer pipeline and the Roodepoort Outfall Sewer pipeline - Geotechnical investigations for the 2.2m diameter South West Outfall Sewer pipeline and the Roodepoort Outfall Sewer pipelines. Included specific investigations for pipe jacking beneath roads, railways and housing. Client: City of Johannesburg

water pipeline from Brakfontein (Halfway House) to Kwaggaspoort (Pretoria) - Geotechnical investigation for the 20km long 1.7m diameter water pipeline from Brakfontein (Halfway House) to Kwaggaspoort (Pretoria). Sections of the route underlain by dolomite. Client: Rand Water.

Various - Geotechnical investigations for structures, transit routes and buildings on problem soils, including expansive clays, collapsible sands compressible clays and silts. Client: Various.

Mzimkulu River Bridge - Undertook the geotechnical investigation for the 300m long Mzimkulu River bridge, which required founding at depths down to 55m. Client: SANRAL / KZN DOT

Various - Numerous foundation investigations throughout Southern Africa for townships, commercial developments, schools, office blocks, hospitals, factories and housing. Clint: Various.

Various - Aerial photographic interpretation for various roads, townships and engineering geological mapping projects. Undertook engineering geological and land utilization mapping of a 43 000 ha area at Rust de Winter in Limpopo Province and the environmentally sensitive Duku-Duku area in KZN. Client: SA Geological Survey

Various - The location and investigation of sources of materials for use in the construction of roads, townships, dams and brick making. Undertook reconnaissance of a 6000km² area in northern KZN to identify potential sources of road construction materials**.** Client: Various

Various - Geotechnical and materials investigations for numerous roads projects including national freeways, urban arterials, township and rural roads, entailing route assessments, identification of problem subgrades, condition evaluations of existing road pavements, slope stability analyses and sourcing of construction materials. Geotechnical testing and instrumentation for embankments, cuttings, tunnels and foundations. Supervision of numerous contracts for rotary core drilling, percussion drilling, in-situ testing, instrumentation and large diameter auger boring. Client: Various.

Various - Ad hoc tunnel mapping and rock mass characterisation for the Inanda-Wiggins Scheme. Portal stability assessments on a number of existing tunnels in the Mngeni valley of KZN. Client: Umgeni Water

1986 to 1987
Position- Assistant Resident Engineer.

Project Floor, near Naboomspruit (now Mookgophong), Limpopo Province. Contract for the dynamic consolidation of collapsing sands for sensitive structures. Duties included contract supervision, monitoring of oedometer testing and settlement analysis. Client: SA Defence Force

1985 to 1986
Position- Resident Geologist

Mpolweni Tunnel, Ulundi, KZN -Resident Geologist for 1½ years on the construction of the 3km long Mpolweni Tunnel. Construction was by drill-and-blast and the tunnel route transected basaltic lava, quartzite, tillite and dolerite dykes. Undertook the engineering geological face and long wall mapping, joint analysis, rock mass descriptions and classifications, convergence monitoring, support and excavation assessment. Client: Spoornet

CONTINUED PROFESSIONAL DEVELOPMENT

Courses

1987 - Road Infrastructure Course (NITRR).
1987 - Kaytech Geosynthetics
1992 - Waste Management Workshop
1994 - In-Situ Testing in Geotechnical Engineering (SAICE)
1996 Dolomite Seminar (SAIEG)
1996 - Workshop on Waste Aquifer Separation Principle (WASP)
1999 - A Short Workshop on Suggested Interpretation Techniques of Soil Movement with Emphasis on Heave and Collapse Conditions (SAIEG)
1999 - Risk of Collapse of Formations in Berea Reds (SAICE)
2001 - Ground Improvement (SAICE)
2002 - Engineering Geology for Developing Countries, 9th IAEG Congress.
2004 - Workshop on Compaction of Road Materials (SARF)
2005 - Workshop on soil Stabilisation (SARF)
2005 - Geosynthetics in Road Construction (GIGSA)
2008 - Introduction to Geosynthetics (SAICE)
2009 - Sustainable Development of Dams in South Africa (SANCOLD)
2010 - Basic Principles of Design, Construction and Evaluation of Small to Medium Dams, especially Embankment Dams (SANCOLD)
2015 - Eurocode 7 Geotechnical Design (SAICE)
2017 - Filtration and Drainage with Geosynthetics (Kaytech)

Published Papers

2009 - Schreiner, HD, Norris, JC, Speirs, T, Melvill, AL "Non-Erosion Filtration Tests for Dam Filter Design" SANCOLD Conference, November 2009.

PERSONAL DETAILS

Nationality – South African
Date of Birth – *1958/11/02*
Domicile – Pietermaritzburg, South Africa

Languages

English – Excellent
isiZulu – Very Good
Afrikaans – Good
Ndebele – Good
Seswati – Fair
Xhosa – Fair

Universitas Nataliensis

hoc scripto nos, Universitatis Nataliensis
Vice-Cancellarius, Registrarius, testamur

JAMES THOMAS RASKELL SPEIRS

Gradum Scientiae Baccalaurei

adeptum

Vice-Cancellarius

Registrarius

[illegible]

400104/94

South African Council for Natural Scientific Professions

This is to certify that

James Thomas Maxwell Speirs

has been registered as a Professional Natural Scientist
in terms of section 11 of the Natural Scientific Professions Act, 1993

SACNASP

1994/09/23
Pretoria

President

Registrar

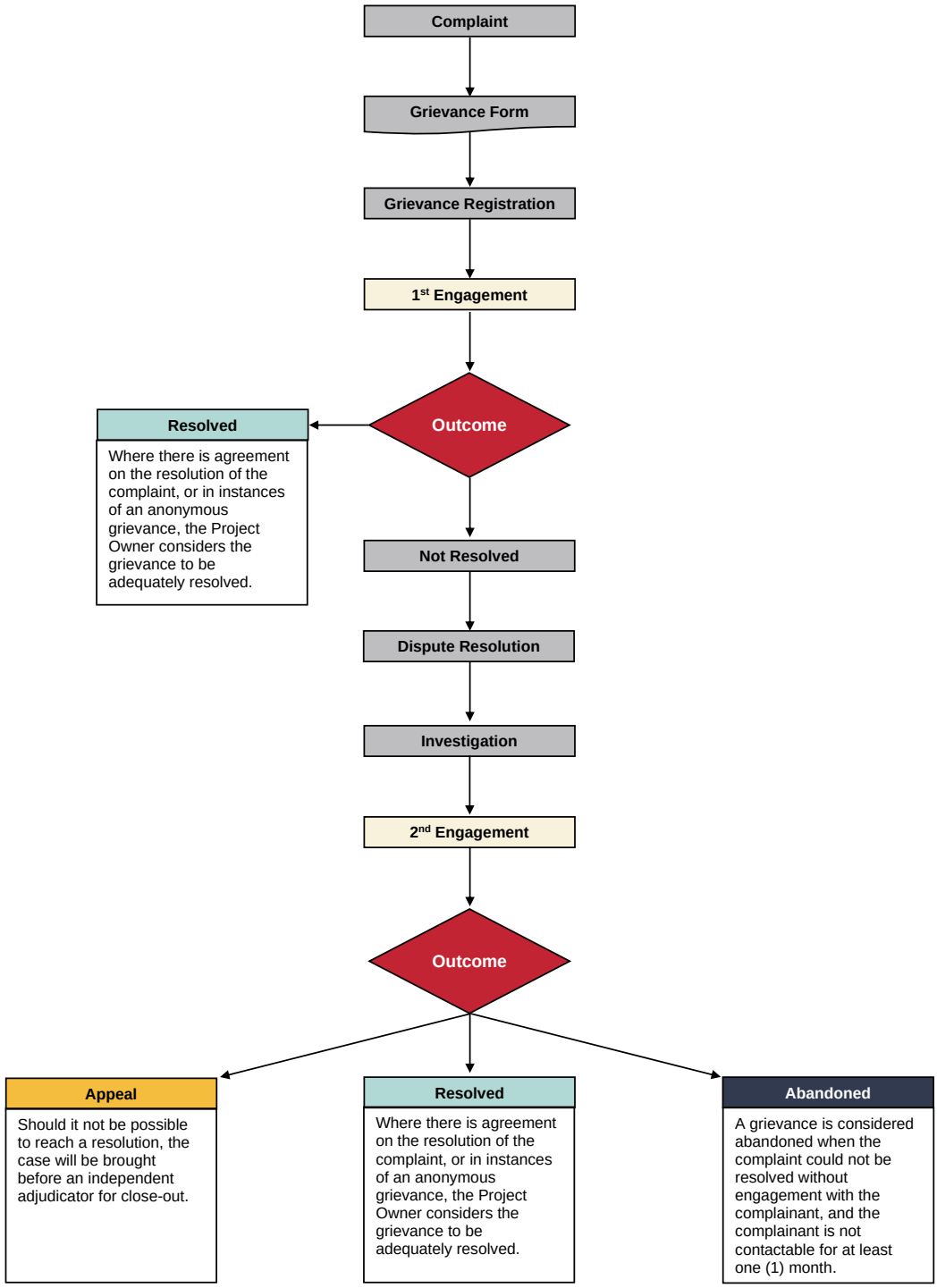
APPENDIX

P EXTERNAL STAKEHOLDER GRIEVANCE MECHANISM

Stakeholder Grievance Mechanism

The Project shall ensure that there an accessible grievance mechanism available to all external stakeholders, e.g., landowners, community members, or any other stakeholder impacted by the Project.

The mechanism shall follow the outline below:



The grievance mechanism shall include an escalation of external stakeholder grievances to the Project Shareholders to provide assurance that grievances are addressed timeously and adequately.

The Grievance Procedure, including the mechanisms for raising a grievance, shall be made project specific and be made available to external stakeholders.

Accessibility shall be ensured by the Project's Community Liaison Officers, for example through physical grievance boxes accessible in Laingsburg and Sutherland, online, or any other medium applicable and suitable to the Project.

APPENDIX

Q COMMUNITY HEALTH AND SAFETY PLAN

Community Health, Safety and Security Plan

The Project shall ensure that a project-specific Community Health, Safety and Security Plan (CHSSP) is developed and implemented throughout the which takes into account all potential impacts to communities in the project's area of influence, including security impacts. The plan shall apply to all project contractors and individuals.

While a project Security Management Plan shall be implemented on site, it is understood that this plan shall focus on the security of the Project, and project-associated resources.

Potential impacts on security in the community as a result of activities associated with the project, and the potential impacts of project security forces on the community must be managed appropriately.

The Project shall take cognisance of concerns raised by community stakeholders, including their experiences with other developments in the area as they pertain to potential damage to property, stock losses, and neglecting to manage farm gates appropriately.

In the compilation of the CHSSP, the aspects to be considered shall therefore include, at a minimum:

- Stock theft, poaching and damage to / loss of farm infrastructure, including gates, fences, solar panels, irrigation pipes, etc.
- Damage to roads (public and internal farm roads) related to construction traffic and transport of workers to and from site on a daily basis.
- Impact on water resources (water quality and availability).
- Impacts associated with influx and presence of construction workers, including, antisocial behaviour, gender violence, crime, alcohol and substance abuse and spread of diseases.
- Risks posed by behaviour of security personnel and abusive use of power.
- Safety and health risks posed by construction related activities, including the transport of materials and workers to site on daily basis and on-site construction activities.

Potential emergencies that may arise due to project activities must be included in the CHSSP, or the Project's emergency preparation and response plans.

Community complaints and concerns will be captured and addressed through the project's Grievance Mechanism, which shall be designed to provide a simple, fair and transparent process for all external parties to provide feedback and to raise grievances.

The CHSSP shall be compiled following stakeholder engagement, and shall be reviewed as required following changes in circumstances, project phases or following an incident which impacts, or could have reasonably impacted, the community.