WILDERBEESTKUIL PV GENERATION (PTY) LTD

Proposed Construction of Wildebeestkuil Solar Photovoltaic (PV) Plants and 132kV Power Lines (Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line) on the Farm Wildebeestkuil No. 59 near Leeudoringstad, North West Province

Surface Water Delineation and Assessment Report

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Confidentiality Statement

WILDERBEESTKUIL PV GENERATION (PTY) LTD

PROPOSED CONSTRUCTION OF WILDEBEESTKUIL SOLAR PHOTOVOLTAIC (PV) PLANTS AND 132KV POWER LINES (WILDEBEESTKUIL 1 SOLAR PV PLANT AND 132KV POWER LINE & WILDEBEESTKUIL 2 SOLAR PV PLANT AND 132KV POWER LINE) ON THE FARM WILDEBEESTKUIL NO. 59 NEAR LEEUDORINGSTAD, NORTH WEST PROVINCE

SURFACE WATER DELINEATION AND ASSESSMENT REPORT

EXECUTIVE SUMMARY

A surface water delineation and impact assessment is provided in this report for the proposed solar PV developments. Findings were based on a method for delineating wetlands and riparian habitats as per the **Department of Water Affairs and Forestry 2005** guidelines. Ultimately, it was found that there are two (2) Artificial Depression Wetlands, one (1) Drainage Line and one (1) Natural Depression Wetland within the study site and the proposed power line corridors[1].

A present ecological status (PES) determination was undertaken for Natural Depression Wetland 1. Accordingly, the PES of Natural Depression Wetland 1 was categorised to have an overall PES – D (Largely Modified).

The wetland ecosystem services and environmental sensitivity and importance were assessed and provided for Artificial Depression Wetlands 1 and 2 as well as Natural Depression Wetland 1. These assessments were undertaken to determine their functionality and sensitivity. With regards to the potential wetland ecosystems services provided by each wetland, Artificial Depression Wetland 1 scored highest was in terms of sediment trapping followed closely by phosphate trapping, erosion control and flood attenuation. Artificial Depression Wetland 2 scored highest in terms of erosion control, with other potential wetland ecosystem services provided at a slightly lower degree including sediment trapping, phosphate trapping, flood attenuation, maintenance of biodiversity and toxicant removal. For Natural Depression Wetland 1, the potential wetland ecosystem service provided which scored highest includes sediment trapping. The sediment trapping function of this wetland can be said to be one of the primary functions of an endorheic wetland. Other potential wetland ecosystem services provided at a slightly lower degree include phosphate trapping and erosion control. This is closely followed by toxicant control and nitrate removal. Other potential wetland ecosystem services which could potentially be provided, which scored to

[1] It should be noted that a combined report has been compiled for both the proposed Wildbeestkuil 1 Solar PV Plant & 132kV Power Line and Wildebeestkuil 2 Solar PV Plant & 132kV Power Line. This is due to the fact that the proposed solar PV plants and 132kV power line corridors are located on the same properties, are identical in nature and have the same associated impacts and recommended mitigation measures. Where certain findings and/or mitigation measures are project specific, this has been indicated in the relevant section of this report.

a lesser degree, include flood attenuation, education and research, tourism and recreation, natural resources and maintenance of biodiversity.

The EISC for the surface water resources were determined. The results were as follows:

- Natural Depression Wetland 1 was categorised as a Class C (Moderate);
- Artificial Depression Wetland 1 was categorised as a Class C (Moderate); and
- Artificial Depression Wetland 2 was categorised as a Class B (High).

The **Department Of Water Affairs (2014)** database shows that the nearby Leeudoringspruit is classified as having a PES: B (Largely natural), EI: Moderate and ES: Moderate. This watercourse will not be directly impacted by the proposed developments as is it located approximately 150m from the study site.

The functional assessments undertaken were used to inform a 50m buffer zone that was applied to the identified surface water resources.

In terms of potentially applicable environmental and water related legislation, several listed activities and water uses have been identified that are likely to be applicable to the proposed developments. Accordingly, in terms of National Environmental Management Act (1998) and the EIA Regulations (2014), Activities 12 and 19 of Government Notice 983, and Activity 14 of Government Notice 985 have been identified as being applicable based on the scenarios presented in the sub-section. With respect to the National Water Act (1998), water uses (c) and (i) are also applicable where stipulated. The aforementioned identified environmental listed activities and water uses should however be confirmed in consultation with the relevant government departments.

Foreseen potential negative impacts in terms of the pre-construction, construction, operation and decommissioning phases of the proposed developments were identified and assessed. Mitigation measures have been stipulated and must be included and implemented as part of the respective Environmental Management Programmes (EMPrs) for the proposed developments. Due to the fact that the proposed solar PV plants and power line corridors are located on the same properties and are identical in nature, the same impacts have been identified for both proposed solar PV plants and 132kV power lines. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants and 132kV power lines. The impacts for each phase of the proposed developments are summarised as follows:

PRE-CONSTRUCTION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**
Temporary Building Zone	- 20 (low negative)	- 7 (low negative)
CONSTRUCTION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**
Vehicle and Machinery Degradation	- 33 (medium negative)	- 30 (medium negative)

Human Degradation of Flora and Fauna associated with the Surface Water Resources	- 18 (low negative)	- 5 (low negative)
Degradation and Removal of Soils and Vegetation associated with the Surface Water Resources	- 36 (medium negative)	- 22 (low negative)
Increased Run-off and Sedimentation	- 33 (medium negative)	- 9 (low negative)
OPERATION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**
Vehicle Damage to the Surface Water Resources	- 33 (medium negative)	- 7 (low negative)
Stormwater Run-off Impacts to Surface Water Resources	- 33 (medium negative)	- 10 (low negative)

It is not anticipated that the proposed developments will need to be decommissioned. However, should this need to take place, all relevant identified potential construction impacts will be applicable and the relevant mitigation measures must be implemented as far as practically possible and where applicable.

For cumulative potential impacts, surrounding renewable energy projects are located a relatively considerable distance from the proposed developments' study site and direct and indirect surface water impacts will be negligible. In consideration of the nearby Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant (part of separate respective BA processes), indirect impacts in terms of increased run-off, sedimentation and erosion may potentially be expected. However, none of the surface water resources appear to be hydrologically connected. Downstream impacts are therefore unlikely. Additionally, aside from the distance (approximately 1km) which separates the two renewable energy developments, the R502 and existing railway line acts as a barrier between the two project sites. In light of the above, it is not expected that the cumulative impacts will be significant in so far as the mitigation measures are implemented, and the surface water resources are not affected, degraded or lost.

Finally, in terms of final specialist recommendations, it is strongly recommended that the preferred power line option (namely Option 1) is presented as the preferred alternatives for the environmental authorization process. Where this is not possible, the more intensive mitigation measures stipulated will need to be implemented where the necessary environmental authorization and water use license is obtained.

The existing site access roads currently routes through Drainage Line 1 and is in the buffer zone of Artificial Depression Wetland 1 on the study site. It is highly recommended that the access route is re-aligned outside of all the delineated surface water resources as well as the associated buffer zones where possible. Should this not be possible, the more intensive mitigation measures stipulated will need to be implemented where the necessary environmental authorization and water use license are obtained. Please note that the crossing of the wetland by the road is not a fatal flaw.

The risk assessment matrix is attached as **Appendix D**, and notes that all risks are considered Low, and appropriate mitigation measures have been proposed.

Finally, all the identified triggered activities and water uses identified should be confirmed with the relevant government authoritative departments.

Based on the findings above, with the implementation of the control and mitigation measures stipulated herein, it is the opinion of the specialist that the proposed development may proceed.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix B
b) a declaration that the specialist 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;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5
(cB) a Proposed Construction of the Leeudoringstad Solar Photovoltaic (PV) Energy Facility - Wildebeest 1 Solar PV Plant and 132kV Power Line & Wildbeestkuil 2 Solar PV Plant and 132kV Power Line Projects near Leeudoringstad, North West Province of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 5.2
e) a Proposed Construction of the Leeudoringstad Solar Photovoltaic (PV) Energy Facility - Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line Project near Leeudoringstad, North West Province of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 3
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;	Section 5
g) an identification of any areas to be avoided, including buffers;	Section 5
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;	Section 5
i) a Proposed Construction of the Leeudoringstad Solar Photovoltaic (PV) Energy Facility - Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line	Section 1.3

Projects near Leeudoringstad, North West Province of any assumptions made and any uncertainties or gaps in knowledge;	
j) a Proposed Construction of the Leeudoringstad Solar Photovoltaic (PV) Energy Facility - Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line Projects near Leeudoringstad, North West Province of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 8
k) any mitigation measures for inclusion in the EMPr;	Section 8
l) any conditions for inclusion in the environmental authorisation;	Section 8 & 9
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8 & 9
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 10
o) a Proposed Construction of the Leeudoringstad Solar Photovoltaic (PV) Energy Facility - Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line Project near Leeudoringstad, North West Province 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	N/A
q) any other information requested by the competent 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.	Noted

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SURFACE WATER DELINEATION AND ASSESSMENT REPORT

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SURFACE WATER DELINEATION AND ASSESSMENT REPORT

1 INTRODUCTION

Wildebeestkuil PV Generation (Pty) Ltd (hereafter referred to as "Wildebeestkuil PV Generation") is proposing to construct two (2) Solar Photovoltaic (PV) Power Plants with export capacities of up to 9.9 megawatt (MW) as well as two (2) 132kV power lines (namely the Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line) and associated infrastructure on Portion 22, 13 and 14 of the Farm Wildebeestkuil No. 59, approximately 4km east of the town of Leeudoringstad, North West Province (hereafter referred to as the "proposed developments"). The proposed developments are located within the Maquassi Hills Local Municipality. The overall objective of the proposed solar PV plant and power line developments is to generate electricity to feed into the national electricity grid. This study is specifically related to the proposed construction of two power plants and associated 132kV power lines (namely the Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line), each of which will have an export capacity of up to 9.9MW, as well as associated infrastructure on Portions 22, 13 and 14 of the Farm Wildebeestkuil No. 59 near Leeudoringstad, North West Province (hereafter referred to as, "the proposed developments").

In order to determine the potential impacts of the proposed development on surface water resources specifically, a delineation and impact assessment is required. Accordingly, SiVEST Environmental Division has been appointed as the independent surface water specialist consultant to undertake the surface water assessment for the proposed developments[2].

The aim of the surface water assessment was to identify and delineate any surface water resources that may be impacted on by the proposed developments. This was undertaken by initially identifying surface

[2] It should be noted that a combined report has been compiled for both the proposed Wildbeestkuil 1 Solar PV Plant & 132kV Power Line and Wildebeestkuil 2 Solar PV Plant & 132kV Power Line. This is due to the fact that the proposed solar PV plants and 132kV power line corridors are located on the same properties, are identical in nature and have the same associated impacts and recommended mitigation measures. Where certain findings and/or mitigation measures are project specific, this has been indicated in the relevant section of this report.

water resources from a desktop perspective. Information was then taken into the field for groundtruthing, verification and delineation. A secondary aim was to determine the present ecological state, ecosystem services and ecological importance and sensitivity of any identified wetland(s). Suitable buffer zones for the identified surface water resources were also applied based on fieldwork findings and the relevant functional assessments. Once all surface water resources had been identified, delineated and assessed, the legislative implications of the proposed developments affecting surface water resources were investigated. Following this, an impact assessment was undertaken to determine the severity, degree and significance of potential impacts as a result of the proposed developments. Where identified, mitigation measures have been stipulated in order to avoid or minimise potential impacts. At a broader level, the potential cumulative impacts have also been assessed from a surface water perspective. Finally, specialist recommendations have been provided to inform the layouts of the respective proposed developments considering surface water resources on the study site[3].

1.1 Legislative Context

1.1.1 National Water Act, 1998 (Act No. 36 of 1998)

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) was created in order to ensure the protection and sustainable use of water resources (including wetlands) in South Africa. The NWA recognises that the ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users. Bearing these principles in mind, there are a number of stipulations within the NWA that are relevant to the potential impacts on rivers, streams and wetlands that may be associated with the proposed development. These stipulations are explored below and are discussed in the context of the proposed developments.

Firstly, it is important to discuss the type of water resources protected under the NWA. Under the NWA, a 'water resource' includes a watercourse, surface water, estuary, or aquifer. Specifically, a watercourse is defined as (*inter alia*):

- A river or spring;
- A natural channel in which water flows regularly or intermittently; and
- A wetland, lake or dam into which, or from which, water flows.

In this context, it is important to note that reference to a watercourse includes, where relevant, the bed and banks. Furthermore, it is important to note that water resources, including wetlands, are protected under the NWA. 'Protection' of a water resource, as defined in the NWA entails the:

[3] Due to the fact that the proposed solar PV plants and 132kV power line corridors are located on the same properties and are identical in nature, the same impacts have been identified for both proposed solar PV plants and 132kV power lines. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants and 132kV power lines.

- Maintenance of the quality and the quantity of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource; and
- Rehabilitation of the water resource.

In the context of the proposed developments and implications towards surface water resources potentially occurring on the study site, the definition of pollution and pollution prevention contained within the NWA is relevant. 'Pollution', as described by the NWA, is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (*inter alia*):

- Less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- Harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

The inclusion of physical properties of a water resource within the definition of pollution entails that any physical alterations to a water body (for example, the excavation of a wetland or changes to the morphology of a water body) can be considered to be pollution. Activities which cause alteration of the biological properties of a watercourse, i.e. the fauna and flora contained within that watercourse are also considered pollution.

In terms of **Section 19** of the NWA, owners / managers / people occupying land on which any activity or process undertaken which causes, or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include measures to (*inter alia*):

- Cease, modify, or control any act or process causing the pollution;
- Comply with any prescribed waste standard or management practice;
- Contain or prevent the movement of pollutants;
- Remedy the effects of the pollution; and
- Remedy the effects of any disturbance to the bed and banks of a watercourse.

Where any activities will occur to surface water resources with regards to the above, a water use license application process must be undertaken in order to obtain a permit to impact on any surface water resource. For water uses c) and i) specifically, a General Authorisation may be registered under Government Notice 509 of August 2016 (Notice No. 40229) as per **Section 8** where the outcome of the assessment of the Risk Assessment Protocol shows that the proposed developments will have a Low Risk. This notice is only applicable to where activities take place within a 500m regulated area (within 500m radius) around wetlands. Where the outcome of the Risk Assessment Protocol shows that the proposed developments will have a Medium to High Risk, a water use license application process is to be undertaken in order to obtain a permit to impact on surface water resources. For watercourses, the regulated area includes impacts taking place within the extent of the watercourse. The extent of a watercourse includes the outer edge of a wetland associated with a watercourse (i.e. channeled valley bottom wetland), outer edge of the riparian habitat or the 1:100 year flood line (whichever is greatest).

1.1.2 National Environmental Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management, 1998 (Act No. 107 of 1998) (NEMA) was created essentially to establish:

- Principles for decision-making on matters affecting the environment;
- Institutions that will promote co-operative governance; and
- Procedures for co-ordinating environmental functions exercised by organs of the state to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment.

It is stipulated in NEMA *inter alia* that everyone has the right to an environment that is not harmful to his or her health or well-being. Moreover, everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

Accordingly, several of the principles of NEMA contained in **Chapter 1 Section 2**, as applicable to wetlands, stipulate that:

- Development must be socially, environmentally and economically sustainable;
- Sustainable development requires the consideration of all relevant factors including the following:
    - That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied.
    - That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied.
    - That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.
- The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

In line with the above, **Chapter 7** further elaborates on the application of appropriate environmental management tools in order to ensure the integrated environmental management of activities. In other words, this chapter of NEMA addresses the tools that must be utilised for effective environmental management and practice. Under these auspices, the Environmental Impact Regulations (2006, 2010 and 2014 as amended) were promulgated in order to give effect to the objectives set out in NEMA. Subsequently, activities were defined in a series of listing notices for various development activities. Should any of these activities be triggered, an application for Environmental Authorisation subject to a Basic

Assessment (BA) or Environmental Impact Assessment (EIA) process is to be applied for. Fundamentally, applications are to be applied for so that any potential impacts on the environment in terms of the listed activities are considered, investigated, assessed and reported on to the competent authority charged with granting the relevant environmental authorisation.

The above stipulations of the NWA and NEMA have implications for the proposed developments in the context of surface water resources. Accordingly, implications and potential impacts / issues of the proposed developments on potentially affected surface water resources are addressed later in this report (**Section 7 & 8**).

1.2 Definition of Surface Water Resources as Assessed in this Study

1.2.1 Wetlands

The lawfully accepted definition of a wetland in South Africa is provided in the NWA. Accordingly, the NWA defines a wetland as, *"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".*

Moreover, wetlands are accepted as land on which the period of soil saturation is sufficient to allow for the development of hydric soils, which in normal circumstances would support hydrophytic vegetation (i.e. vegetation adapted to grow in saturated and anaerobic conditions).

Inland wetlands can be categorised into hydrogeomorphic units (HGM units). **Ollis *et al.* (2013)** have described several different wetland hydrogeomorphic forms which include the following:

- Channel (river, including the banks): a linear landform with clearly discernable bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit.
- Channelled valley-bottom wetland: a valley-bottom wetland with a river channel running through it. Channelled valley-bottom wetlands must be considered as wetland ecosystems that are distinct from, but sometimes associated with, the adjacent river channel itself, which must be classified as a "river".
- Unchannelled valley-bottom wetland: a valley-bottom wetland without a river channel running through it.
- Floodplain wetland: a wetland area on 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. Floodplain wetlands must be considered as wetland ecosystems that are distinct from but associated with the adjacent river channel itself, which must be classified as a "river".

- Depression: a wetland or aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates.
- 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.
- Hillslope seep: a wetland area located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope.

1.2.2 Riparian Habitat

Riparian habitats may potentially occur in the study area. Riparian habitats (also known as riparian areas or zones) include plant communities usually adjacent to or along natural channels that are affected by surface and subsurface flows (**DWAF, 2005**). Riparian habitats can be found on the edges of lakes, or drainage lines but are more commonly associated with channelled flowing systems like streams and rivers. Riparian habitats can also be associated with wetlands that are similarly associated with streams and rivers. These are defined as riparian wetlands.

1.2.3 Watercourses

According to the NWA, a watercourse falls within the ambit of a 'water resource'. For watercourses however, the following is relevant:

- A river or spring; and
- A natural channel in which water flows regularly or intermittently.

Watercourses may be perennial or non-perennial in nature. Moreover, non-perennial watercourses can encompass seasonal or ephemeral watercourses (including drainage lines) depending on the climate and other environmental constraints.

Any of the above mentioned wetland forms, riparian habitats or watercourses may occur within the study area. The types of surface water resources identified are addressed later in the report (**Section 6**).

1.3 Assumptions and Limitations

This study has focused on a short term study whereby the identification, delineation and assessment of surface water resources found within the study site has been undertaken. A detailed in-field delineation of all surface water resources in the wider area has not been undertaken. Additionally, given the short term

nature of the study, the study should not be undertaken to be a comprehensive study of vegetation and faunal species occurrence for the surface water resources on the study site.

The fieldwork component was undertaken on the 13th September 2016 and the 19th of August 2020. Given the once-off nature of the assessment, seasonal limitations apply. This study should therefore not be taken as a comprehensive study of vegetation and faunal species occurrence for the surface water resources identified on the study site, since some species may not have been present at the time.

A Global Positioning System (GPS) device was used to groundtruth surface water resources as well as for delineation purposes. The GPS is expected to be accurate from 5m up to 15m depending on meteorological conditions.

It must be noted that the Present Ecological Status (PES) was not assessed in this study for the artificial wetlands. The WET Health methodology (**Macfarlane *et al*., 2009**) focuses on natural wetlands and assessing the deviation from the reference natural condition. Artificial wetlands are created and therefore do not have a reference condition from which to assess since they are created for specific purposes and are not naturally occurring systems.

The WET-EcoServices **(Kotze *et al*., 2009)** methodology is limited to wetlands. This was not applied to any watercourses (i.e. drainage lines) identified.

Groundwater, hydrology, aquatic studies of fish, invertebrates, amphibians etc. have not been included in this study.

Use of database information for the desktop assessment included the National Freshwater Ecosystem Priority Areas **(NFEPA, 2011)** database. This database is a national level database and some smaller surface water resources may not be identified if the database. Additionally, mainly wetlands with permanent inundation are included in the database. Therefore, wetlands with seasonal and temporary saturation cycles may not be included. The fieldwork component was included in the assessment to verify the desktop database information in order to address these shortcomings.

As an avifaunal component to the biodiversity assessment is being carried out for the proposed developments, impacts as related to avifauna are not included in this report. It is assumed that potential impacts to avifauna are included in the standalone avifauna assessment.

2 PROJECT TECHNICAL DESCRIPTION

As previously stated, the overall objective of the proposed Wildebeestkuil solar PV plants and 132kV power lines (Wildbeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line) is to generate electricity to feed into the national electricity grid. The generated electricity will

be purchased by PowerX (Pty) Ltd (here after referred to as “PowerX”). One of the aims of PowerX is to enable electricity generation within local municipalities. PowerX hold a NERSA-issued electricity trading license which allows them to purchase energy generated from clean and renewable resources and wheel the power using the national transmission and distribution network, to its customers. The purchased electricity will be sold nationwide.

Each of the proposed solar PV plants and 132kv power lines will be developed under a Special Purpose Vehicle (SPV). The SPV, Wildebeestkuil PV Generation, is currently owned by Upgrade Energy South Africa (Pty) Ltd. Once Commercial Operation Date (COD) is accomplished, 100% of the Wildebeestkuil PV Generation shares will be transferred to the new owners of the proposed developments.

Additionally, the proposed solar PV plants and 132kV power lines will be connecting to the proposed Leeudoringstad Solar Plant Substation located in the Leeuwbosch Farm (namely Portion 37 of the Farm Leeuwbosch No. 44) which will also require a separate Environmental Authorisation (EA)[4].

2.1 Solar Power Plant and Power Line Technical Details

The proposed developments will entail the construction of two solar photovoltaic (PV) plants with voltage capacities of up to 9.9 MW respectively as well as two 132kV power lines (namely the Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line) on Portions 13, 14 and 22 of the Farm Wildebeestkuil No. 59 near Leeudoringstad, Maquassi Hills Local Municipality, North West Province.

The generated electricity will be purchased from Wildebeestkuil PV Generation by PowerX (Pty) Ltd (here after referred to as “PowerX”). One of the aims of PowerX is to enable electricity generation within local municipalities. PowerX hold a NERSA-issued electricity trading license which allows them to purchase energy generated from clean and renewable resources and wheel the power using the national transmission and distribution network, to its customers. The purchased electricity will be sold directly to commercial and light industrial consumers within the Maquassi Hills Local Municipality and the customers’ electricity bill will get off-set by the Maquassi Hills Local Municipality.

The following key components are to be constructed for each proposed solar PV plant:

- Solar PV field (arrays) comprising multiple PV modules
- PV panel mountings. PV panels will be single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology

[4] Proposed Leeudoringstad Solar Plant Substation part of separate BA process and will be authorised under a separate EA.

- Each PV module will be approximately 2.5m long and 1.2m wide and mounted on supporting structures above ground. The final design details will become available during the detailed design phase of the proposed development, prior to the start of construction
- The foundations will most likely be either concrete or rammed piles. The final foundation design will be determined at the detailed design phase of the proposed development

In addition, related infrastruture required are:

- Underground cabling (≈0.8m × 0.6 wide)
- Permanent Guard House (≈871m²)
- Temporary building zone (2994m²)
- Switching Substation (≈2000m²)
- Internal gravel roads (3.5m width)
- Upgrade to existing roads; and
- Site fencing (≈2.1m high)

In addition to the above, the electricity generated by the proposed solar PV plants (namely the Wildebeestkuil 1 Solar PV Plant and Wildebeestkuil 2 Solar PV Plant) will be fed into the national electricity grid via 132kV power lines[5], which will connect to the Leeudoringstad Solar Plant Substation (part of a separate BA process). For the purpose of the BAs, corridors between approximately 60m and 150m wide were assessed for the proposed power line corridor route alternatives for each proposed solar PV plant (see **Section 3** below). This is to allow for flexibility to route the proposed power lines within the assessed corridors. As such, the selected preferred power lines will be routed within the assessed corridors. The final servitudes will be routed within the power line corridors, and it expected that the servitudes will not exceed 31m.

Once fully developed, the intention is to generate electricity (by capturing solar energy) to feed into the national electricity grid and "wheel" the power to customers based on a power purchase agreement (PPA). Additionally, an agreement is in place to sell the energy to PowerX, who hold a National Energy Regulator of South Africa (NERSA)-issued electricity trading license which allows them to purchase energy which is generated from clean and renewable resources and and "wheel" the power, using the national transmission and distribution network, to its customers.

The construction phase will be between 12 and 24 months and the operational lifespan will be approximately 20 years, depending on the length of the PPA with the relevant off taker.

[5] Each proposed solar PV plant will consist of one (1) associated 132kV power line which will connect the respective PV plant to the Leeudoringstad Solar Plant Substation (part of a separate BA process). The proposed 132kV power lines will form part of the respective Wildebeestkuil solar PV plants and will be authorised under the respective Wildebeestkuil solar PV plant EAs.

2.2 Project Location

The proposed developments are located approximately 4km east of the town of Leeudoringstad, North West Province. A number of farms make up the application site or "study site" for the proposed solar PV plants. These farms include:

- Portion 13 of the Farm Wildebeestkuil 59;
- Portion 14 of the Farm Wildebeestkuil 59; and
- Portion 22 of the Farm Wildebeestkuil 59.

A number of farms are also traversed by the proposed corridors associated with the 132kV power lines. These farms include:

- Portion 7 of the Farm Leeuwbosch No. 44;
- Portion 29 of the Farm Leeuwbosch No. 44;
- Portion 35 of the Farm Leeuwbosch No. 44;
- Portion 37 of the Farm Leeuwbosch No. 44;
- Portion 38 of the Farm Leeuwbosch No. 44[6];

The study site is shown in the locality maps below (Figure 1 **and Figure 2**).

[6] Portion 38 of the Farm Leeuwbosch No. 44is a road servitude

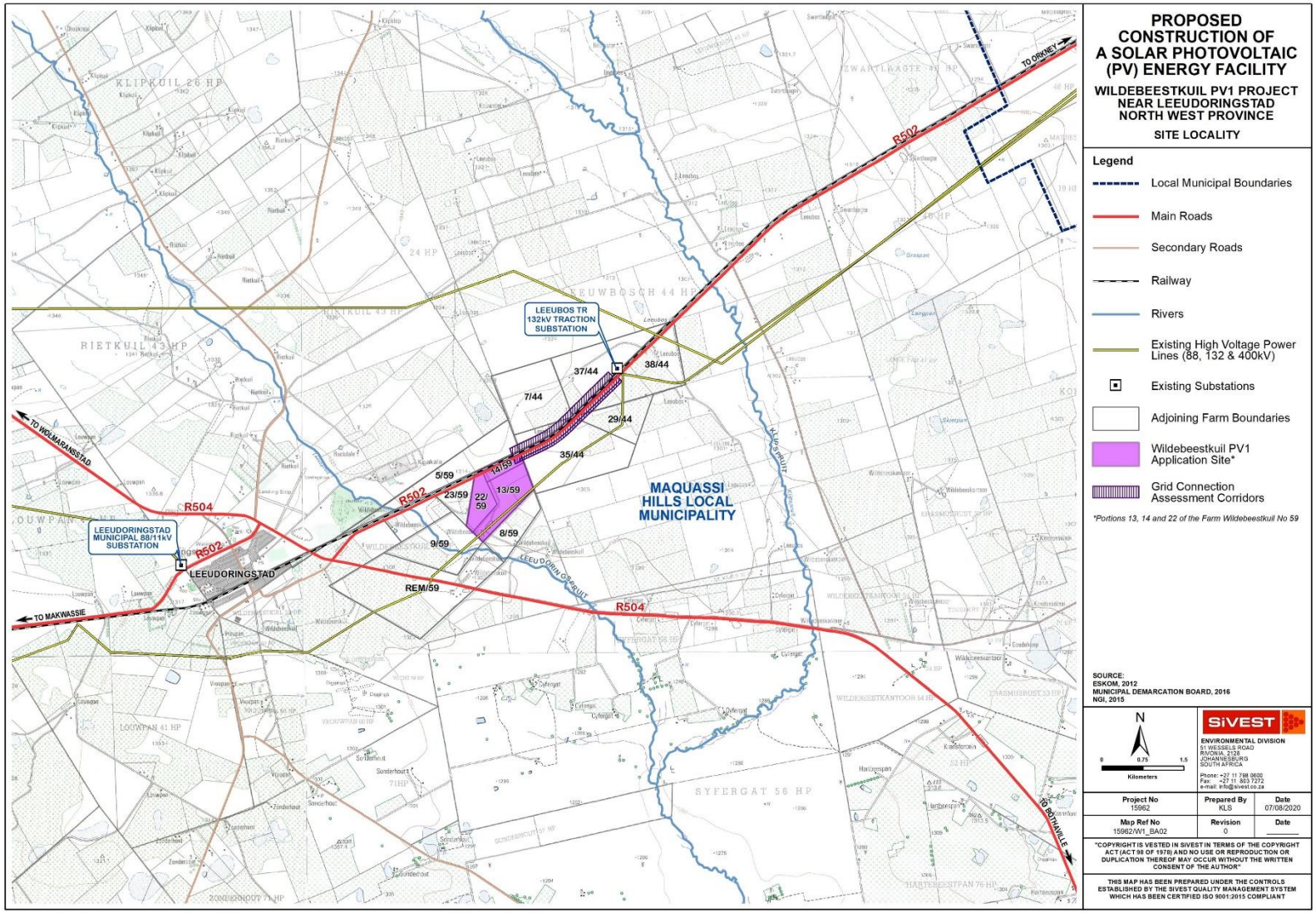

Figure 1. Locality Map – Wildebeestkuil 1 Solar PV Plant and 132kV Power Line

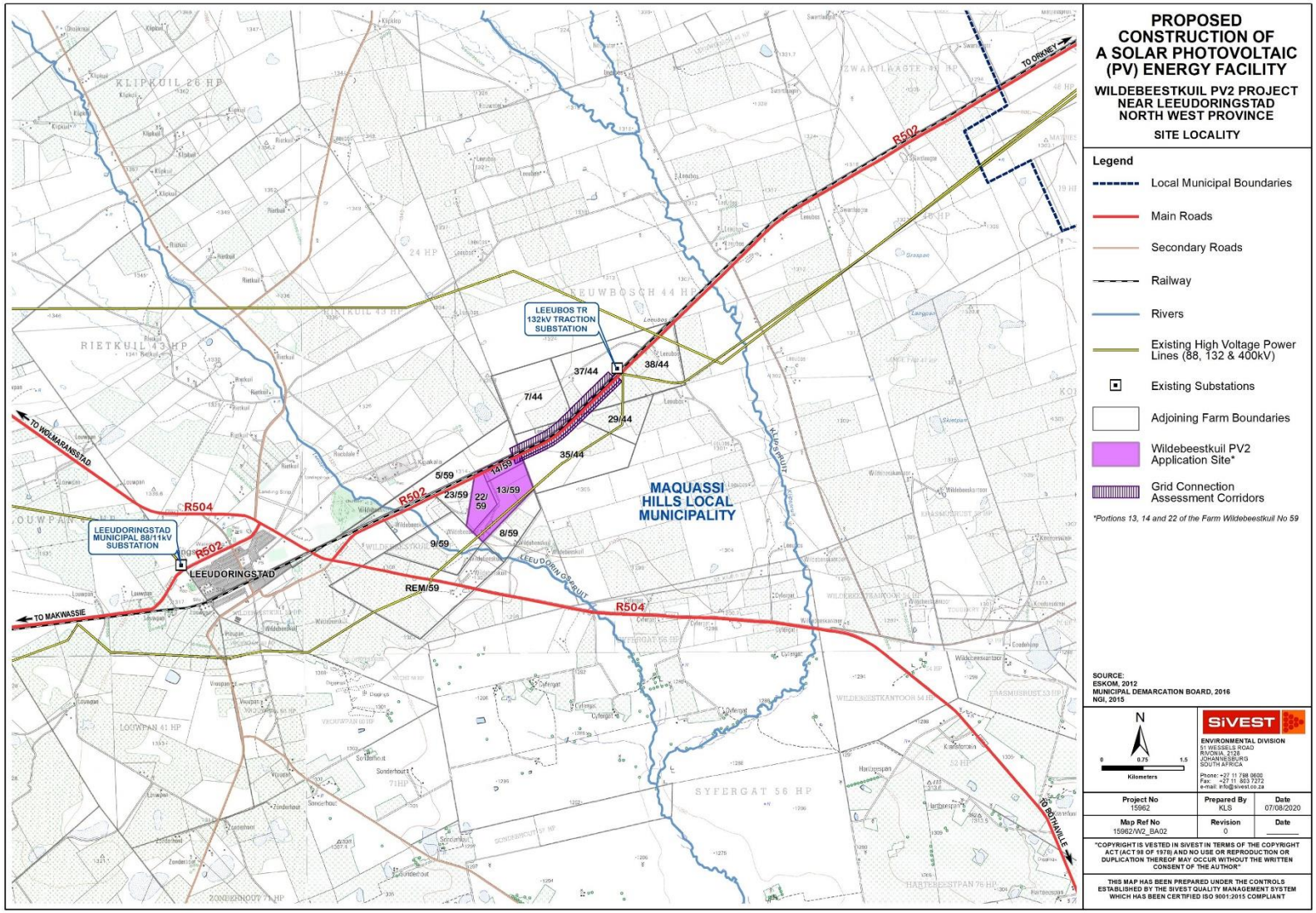

Figure 2. Locality Map - Wildebeestkuil 2 Solar PV Plant and 132kV Power Line

2.3 Location alternatives

No site alternatives for the proposed developments are being considered as the placement of solar PV installations and associated power lines is dependent on several factors, all of which are favourable at the proposed site location. This included solar resource, land availability and topography, environmental sensitivities, distance to the national grid, solar resource site accessibility and current land use.

2.4 Technology alternatives

No other activity / technology alternatives are being considered. Renewable energy development in South Africa is highly desirable from a social, environmental and development point of view. Based on the flat terrain, the climatic conditions and current land use being agricultural, it was determined that the proposed site would be best-suited for solar PV plants and associated power lines, instead of any other type of renewable energy technology. It is generally preferred to install wind energy facilities (WEFs) on elevated ground. In addition, concentrated solar power (CSP) installations are not feasible because they have a high water requirement and the project site is located in a relatively arid area. There is also not enough rainfall in the area to justify a hydro-electric plant. Therefore, the only feasible technology alternative on this site is solar PV and as such this is the only technology alternative being considered. The impacts on the environment of the different types of PV technology and power line towers are the same during construction, operation and decommissioning. The choice of technology used will ultimately be determined by technological and economic factors at a later stage.

2.5 Layout alternatives

Design and layout alternatives were considered and assessed as part of a previous BA process that was never completed, and as such the PV development areas, Guard houses, Temporary Building Zones and Switching Substation sites (and all other associated infrastructure) have been placed to avoid site sensitivities identified as part of a previous BA process as well as this current BA process. Specialist studies were originally undertaken in 2016 and all current layouts and/or positions being proposed were selected based on the environmental sensitivities identified as part of these studies in 2016. All specialist studies which were undertaken in 2016 were however updated in 2020 (including ground-truthing, where required) to focus on the impacts of the layouts being proposed as part of the current projects. The results of the updated specialist assessments have informed the layout being proposed as part of the current BA process. The proposed layouts have therefore been informed by the identified environmental sensitive and/or “no-go” areas.

Three (3) power line corridor route alternatives for the proposed 132kV power line were however identified and comparatively assessed as part of the current BA process. These alternatives essentially provide for different power line route alignments contained within assessment corridors. The power line corridor route alternatives were informed by the identified environmental sensitive

and/or “no-go” areas. The alternatives which have been considered and comparatively assessed as part of the current BA process are detailed in **Section 6**. The results of the comparative assessment of power line corridor route alternatives are also provided in **Section 6**.

2.6 The operational aspects of the activity

No operational alternatives were assessed as part of the current BA, as none are available for solar PV installations and power lines.

2.7 ‘No-go’ alternative

The ‘no-go’ alternative is the option of not fulfilling the proposed solar PV and power line projects. This alternative would result in no environmental impacts from the proposed projects on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report. Implementing the ‘no-go’ option would entail no development.

The ‘no-go’ option is a feasible option; however, this would prevent the Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & WIldebeestkuil 2 Solar PV Plant and 132kV Power Line from contributing to the environmental, social and economic benefits associated with the development of the renewables sector.

3 METHODOLOGY

3.1 Desktop Delineation of Surface Water Resources

The first step in the surface water resources assessment was to identify all surface water resources on the study site. This was undertaken using Geographic Information System (GIS) software. The software ArcView developed by ESRI was used. The collection of data source information encompassed (but is not limited to) 1:50 000 digital topographical maps, the North West Province Biodiversity Conservation Assessment Plan **(NWBCA, 2008)**, National Freshwater Ecosystem Priority Areas **(NFEPA, 2011)** database, the North West and National Environmental Potential Atlas **(ENPAT, 2000 & 2002)** database as well as the National Biodiversity Assessment **(SANBI, 2012)** database. The use of Google Earth™ imagery supplemented these data sources.

Utilising these resources, identified surface water resources were mapped and highlighted for the in-field phase of the assessment. The supplementary use of satellite imagery (**Google Earth™**) allowed for other potentially overlooked surface water resources, not contained within the above mentioned databases, to be identified and ground-truthed in the field work phase.

3.2 Field-based Delineation Techniques

3.2.1 Wetlands

Wetland delineations are based primarily on soil characteristics or soil "wetness" indicators. For an area to be considered a wetland, redoximorphic features must be present within the top 50cm of the soil profile **(Collins, 2005)**. Redoximorphic features are the result of the reduction, translocation and oxidation (precipitation) of Fe (iron) and Mn (manganese) oxides that occur when soils alternate between aerobic (oxygenated) and anaerobic (oxygen depleted) conditions. Only once soils within 50cm of the surface display these redoximorphic features, can the soils be considered 'hydric soils'. Hydric soils, which are soils that are found within wetlands, are defined by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) as being, "soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part". These anaerobic conditions would typically support the growth of hydromorphic vegetation (vegetation adapted to grow in soils that are saturated and starved of oxygen) and are typified by the presence of redoximorphic features. Redoximorphic features typically occur in three types **(Collins, 2005)**:

- A reduced matrix - i.e. an in situ low chroma (soil colour), resulting from the absence of Fe3+ ions which are characterised by "grey" colours of the soil matrix;
- Redox depletions - the "grey" (low chroma) bodies within the soil where Fe-Mn oxides have been stripped out, or where both Fe-Mn oxides and clay have been stripped. Iron depletions and clay depletions can occur;
- Redox concentrations - Accumulation of iron and manganese oxides (also called mottles). These can occur as:
    - Concretions - harder, regular shaped bodies;
    - Mottles - soft bodies of varying size, mostly within the matrix, with variable shape appearing as blotches or spots of high chroma colours;
    - Pore linings - zones of accumulation that may be either coatings on a pore surface, or impregnations of the matrix adjacent to the pore. They are recognized as high chroma colours that follow the route of plant roots, and are also referred to as oxidised rhizospheres.

The potential occurrence / non-occurrence of wetlands and wetland (hydric) soils on the study site were assessed mainly according to the **DWAF (2005)** guidelines, "A practical field procedure for

the identification and delineation of wetlands and riparian areas". The draft **DWAF (2008)** guidelines, "Update Manual for the Identification and Delineation of Wetlands and Riparian Areas" was also consulted as a supplementary guideline. This document was only used as a supplementary guideline as it is currently not finalised.

According to the **DWAF (2005)** guidelines, soil wetness indicators (i.e. identification of redoximorphic features) are the most important indicator of wetland occurrence. This is mainly due to the fact that soil wetness indicators remain in wetland soils, even if they are degraded or desiccated. It is important to note that the presence or absence of redoximorphic features within the upper 50cm of the soil profile alone is sufficient to identify the soil as being hydric or non-hydric (non-wetland soil) **(Collins, 2005)**. Three other indicators (vegetation, soil form and terrain unit) are typically used in combination with soil wetness indicators to supplement findings. Where soil wetness and/or soil form could not be identified, information and personal professional judgment was exercised using the other indicators to determine what area would represent the outer edge of the wetland.

Importantly, it must be recognised that there can be up to three saturation zones to every wetland including a permanent zone, seasonal zone and the temporary zone. Each zone is differentiated based on the degree and duration of soil saturation. The permanent zone usually reflects soils that indicate saturation cycles that last more or less throughout the year, whilst the seasonal zone may only reflect soils that indicate saturation cycles for a significant period during the rainy season. Lastly, the temporary zone reflects soils that indicate the shortest period(s) of saturation that are long enough, under normal circumstances, for the formation of hydromorphic soils and the growth of wetland vegetation **(DWAF, 2005)**. It must be noted that not all wetlands will have all three saturation zones. In arid and semi-arid regions, wetlands are often only associated with temporary saturation zones or temporary and seasonal saturation zones, thereby lacking the permanent zone.

Vegetation identification was based on identifying general plant species within the wetland boundaries focusing on the occurrence of hydrophytic (water loving) wetland vegetation. In identifying hydrophytic vegetation, it is important to distinguish between plant species that are **(DWAF, 2005)**:

- Obligate wetland species (ow): always grows in wetland - >99% chance of occurrence;
- Facultative wetland species (fw): usually grow in wetlands – 67-99% chance of occurrence;
- Facultative species (f): are equally likely to grow in wetlands and non-wetland areas – 34-66% chance of occurrence;
- Facultative dry-land species (fd): usually grow in non-wetland areas but sometimes grow in wetland = 1-34% chance of occurrence.

The actual delineation process essentially entailed drawing soil samples, at depths between 0-50 cm in the soil profile, using a soil augur. This is done in order to determine the location of the outer edge of the temporary zone for wetlands. The outer edge of the temporary zone will usually

constitute the full extent of the wetland, thereby encompassing any other inner lying zones that are saturated for longer periods. Where the appropriate wetland soil form is of interest, soil samples are drawn up to a depth of 1.2 metres (where possible).

Where a wetland was identified, a conventional handheld Global Positioning System (GPS) was used to record the points taken in the field. The GPS points were then imported into a GIS system for mapping purposes. A GIS shapefile was created to represent the boundaries of the delineated wetlands or other surface water resources.

3.2.2 Riparian Habitat

In terms of watercourses and riparian habitats, the **DWAF (2005)**, the assessment for riparian habitats requires the following aspects to be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

The topography associated with a watercourse can (but not always limited to) comprise the macro channel bank. This is a rough indicator of the outer edge of the riparian habitat.

The riparian habitat relies primarily on vegetation indicators. The outer edge of the riparian habitat can be delineated where there is a distinctive change in the species composition to the adjacent terrestrial area or where there is a difference in the physical structure (robustness or growth forms – size, structure, health, compactness, crowding, number of individual plants) of the species from the adjacent terrestrial area (**DWAF, 2005**).

Riparian habitats are usually associated with alluvial soils (relatively recent deposits of sand, mud or any type of soil sediment) (**DWAF, 2005**). This indicator is not commonly viewed as the primary indicator but rather as a supplementary indicator to confirm either topographical or vegetation indicators, or both.

Where riparian habitats occur, the above mentioned indicators were used to identify the outer edge. A GPS was used to record the points taken in the field.

3.2.3 Drainage Lines

In terms of drainage lines, there are no official methodologies or guidelines for delineating drainage lines in the country. As such, the environmental indicators used to identify riparian habitats (such as topography associated with a watercourse, alluvial soils and deposited materials, and

vegetation), which also form integral biophysical components of drainage lines were used to identify these temporary conduits for run-off.

Where drainage lines were identified, the above mentioned indicators were used to determine the outer edge. A GPS was used to record the points taken in the field.

Where drainage lines are present, it is possible to determine the hydrological regime which provides information on the functionality of the systems. **Ollis *et al* (2013)** maintain that the hydrological regime can be characterised by the frequency and duration of flow (i.e. perenniality), classified as follows:

- Perennial – flows continuously throughout the year in most years;
- Non-perennial – does not flow continuously throughout the year, although pools may persist. Can be subdivided as follows:
    - Seasonal – with water flowing for extended periods during the wet season/s (generally between 3 to 9 months duration) but not during the rest of the year;
    - Intermittent – water flows for a relatively short time of less than one season's duration (i.e. less than approximately 3 months), at intervals varying from less than a year to several years;
    - Unknown – for rivers where it is not known whether a non-perennial system is seasonal or intermittent.
- Unknown – for rivers where the flow type is not known.

Additionally, once identified, it is possible to classify rivers into three channel types. The channel types are based on the changing frequency of saturation of soils in the riparian zone which can be classified *inter alia* as follows **(DWAF, 2005)**:

- A Section – Least sensitive watercourses in terms of impacts on water yield from the catchment. They are situated in the unsaturated zone and do not have riparian habitats or wetlands. Not as hydrologically sensitive as B and C Sections;
- B Section – In the zone of the fluctuating water table and only have baseflow at any point in the channel when the saturated zone is in contact with the channel bed. Baseflow is intermittent in this section, with flow at any point in the channel dependent on the current height of the water table. The gradient of the channel bed is flat enough for deposition of material to take place and initial signs of flood plain development may be observed.
- C Section – Always in contact with the zone of saturation and therefore always have baseflow. These are perennial streams with flow all year round, except perhaps in times of extreme droughts. Channel gradients in these sections are very flat and a flood plain is usually present.

3.3 Present Ecological Status Determination

In order to assess wetland health, it is essential to understand how the current hydrological, geomorphological and ecological functioning of the wetland deviates from the reference condition (i.e. how have the hydrological processes and components changed from natural reference condition). In this sense, the present ecological status (PES) can be determined which provides information on the integrity/health/state of a wetland. WET-Health is a tool that is designed to provide a rapid assessment on the present ecological status of a wetland and examines the deviation from the natural reference condition by analysing the hydrological, geomorphological and vegetation components of a wetland in terms of the extent, intensity and magnitude of an impact (**Macfarlane *et al*., 2009**). This is done by assigning a score on a scale of 1 to 10 which is translated into one of six health classes ranging from A to F, with A representing completely unmodified (natural) and F representing modifications that have reached a critical level (**Macfarlane *et al*., 2009**). This is provided in **Table 1** below.

Table 1. 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 recognizable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	F

Using a combination of threat and/or vulnerability, an assessment is also made for each component (hydrological, geomorphological and vegetation) on the likely Trajectory of Change within the

wetland (**Macfarlane *et al*., 2009**). The five categories of likely change are: large improvement, slight improvement, remains the same, slight decline and rapid decline (**Macfarlane *et al*., 2009**). Overall, health of the wetland is then presented for each module by jointly representing the Present State and likely Trajectory of Change (**Macfarlane *et al*., 2009**).

For the purpose of this study, the WET-Health (**Macfarlane *et al*., 2009**) methodology (Level 2 assessment) was used to determine the PES for wetlands identified.

3.4 Wetland Ecosystem Services Assessment

Individual wetlands differ per their hydro-geomorphic characteristics and the ecosystem services that they supply to society **(Kotze *et al*., 2009)**. The ecosystem services that were assessed through the WET-EcoServices **(Kotze *et al*., 2009)** methodology are listed in **Table 2** below. The overall goal of the WET-EcoServices assessment is to assist decision makers, government officials, planners, consultant and educators in undertaking quick assessments of wetlands to reveal the ecosystem services that they supply **(Kotze *et al*., 2009)**. This ultimately provides an indication of the importance of the wetland unit. The WET-EcoServices applies only to palustrine (inland marsh-like) wetlands.

Table 2. Ecosystems Services included in WET-EcoServices (Kotze *et al*., 2009)

Ecosystem services supplied by wetlands	Indirect benefits	Hydro-geochemical benefits	Flood attenuation	
			Streamflow regulation	
			Water quality enhancement benefits	Sediment trapping
				Phosphate assimilation
				Nitrate assimilation
				Toxicant assimilation
				Erosion control
			Carbon storage	
		Biodiversity maintenance		
	Direct benefits	*Provision of water for human use*		
		Provision of harvestable resources[2]		
		Provision of cultivated foods		
		Cultural significance		
		Tourism and recreation		
		Education and research		

Each hydrogeomorphic wetland unit that was delineated within the study site was assessed using the WET-EcoServices tool. Each hydrogeomorphic unit was labelled according to the

hydrogeomorphic wetland unit it was classified as (for example, Channelled Valley Bottom Wetland). An output diagram indicating the ecosystem services offered was included.

3.5 Wetland Ecological Importance and Sensitivity

The ecological importance of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales (**DWAF, 1999**). The ecological sensitivity refers to a system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (**DWAF, 1999**). The ecological importance and sensitivity (EIS) can be calculated according to the determinants listed in **Table 3** below and attributing a suitable [7]score to each determinant. Once calculated the EIS category (EISC) can be determined (**Table 4**). The category can range from A to D with A being Very High and D being Low/Marginal.

Table 3. Environmental Importance and Sensitivity Biotic and Habitat Determinants

Determinant	Score	Confidence
Primary Determinants		
1. Rare & Endangered Species		
2. Populations of Unique Species		
3. Species/taxon Richness		
4. Diversity of Habitat Types or Features		
5. Migration route/breeding and feeding site for wetland species		
6. Sensitivity to Changes in the Natural Hydrological Regime		
7. Sensitivity to Water Quality Changes		
8. Flood Storage, Energy Dissipation & Particulate/Element Removal		
Modifying Determinants		
9. Protected Status		
10. Ecological Integrity		
TOTAL		

[7] Score guideline Very high = 4; High = 3, Moderate = 2; Marginal/Low = 1; None = 0

Confidence rating - Very high confidence = 4; High confidence = 3; Moderate confidence = 2; Marginal/low confidence = 1

MEDIAN		
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE		

Table 4. Environmental Importance and Sensitivity Categories for Biotic and Habitat Determinants

Ecological Importance and Sensitivity Category (EIS)	Range of Median	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale.	>0 and <=1	D

3.6 Surface Water Buffer Zones

A buffer zone is typically an area of vegetated, un-developed land surrounding a surface water resource that is maintained to protect, support and screen wetland flora and fauna from the disturbances associated with neighbouring land uses. As wetlands and other natural aquatic habitats are regarded as inherently ecologically sensitive habitat units, the designation of conservation buffers allows for the protection of this habitat unit that could potentially emanate from terrestrial-based activities. Ultimately, buffer zones are typically required to protect and minimise the edge impacts to wetlands and any other surface water resource.

Depending on the type of land use or development proposed, an appropriate buffer zone to protect wetlands **(DWAF, 2005)** and other surface water resources should be applied to delineations. As such, in consideration of the driving factors necessary for the functioning of surface water resources (*inter alia* including the flow drivers, water quality, geomorphology, habitat and biota), potential impacts on these drivers as a result of the proposed development were considered in the determination of an appropriate buffer zone for the identified surface water resources. Additionally, other relevant guidelines (such as the, **Gauteng Department of Agriculture and Rural**

Development (GDARD) Requirements for Biodiversity Assessments, 2014) will be taken into consideration, where applicable.

3.7 Impact Assessment Method

Current and potential impacts will be identified based on the proposed developments and potential impacts that may result for the construction, operation and decommissioning of the proposed developments. The identified potential impacts will be evaluated using an impact rating method **(Appendix A)**[8]. This is addressed in **Section 8**.

4 GENERAL STUDY AREA

The two proposed 9.9MW solar PV plants are located on Portions 13, 14 and 22 of the Farm Wildebeestkuil No. 59 which lie approximately 4km from the town Leeudoringstad situated in the Maquassi Hills Local Municipality, North West Province (**Figure 3**). As mentioned, a number of farms are also traversed by the proposed corridors associated with the 132kV power lines. These farms include Portion 7, Portion 29, Portion 35; Portion 37 and Portion 38 of the Farm Leeuwbosch No. 44 (**Figure 1** and **Figure 2**).

According to **Mucina and Rutherford (2006)**, the study site for the solar PV plants and 132kV power lines falls within the Grassland Biome. Within a biome, smaller groupings referred to as bioregions can be found which provide more specific but general details as to the biophysical characteristics of smaller areas. The development site can be found within the Dry Highveld Grassland bioregion. Going into even finer detail, vegetation units are classified which contain a set of general but more local biophysical characteristics as opposed to the entire bioregion. The study site can be found within the Vaal-Vet Sandy Grassland vegetation unit (**Figure 4** and **Figure 5**). The description of Vegetation and Landscape Features, Geology and Soils, Climate and Conservation as contained in **Mucina and Rutherford (2006)** are provided below for this vegetation unit.

4.1 Vaal-Vet Sandy Grassland

[8] Due to the fact that the proposed solar PV plants and power line corridors are located on the same properties and are identical in nature, the same impacts have been identified for both proposed solar PV plants and 132kV power lines. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants and 132kV power lines.

The vegetation and landscape features of the Vaal-Vet Sandy Grassland vegetation unit is characterised by a plains-dominated landscape with some scattered, slightly irregular undulating plains and hills. Mainly low-tussock grasslands with an abundant karroid element. The dominance of *Themeda triandra* is an important feature of this vegetation unit. Locally, the low cover of *T. triandra* and the associated increase in *Elionorus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* is attributed to heavy grazing and/or erratic rainfall.

The geology and soils of the vegetation unit comprise Aeolian and colluvial sand overlying sandstone, mudstone and shale of the Karroo Supergroup (mostly the Ecca Group) as well as older Ventersdorp Supergroup andesite and basement gneiss in the north. Soil forms are mostly Avalon, Westleigh and Clovelly. Dominant land type Bd, closely followed by Bc, Ae and Ba.

The climate of the vegetation unit is warm-temperate, with summer rainfall climate, with overall Mean Annual Precipitation (MAP) of 530mm. The unit is characterised by high summer temperatures. Severe frost (37 days per year on average) occurs in winter.

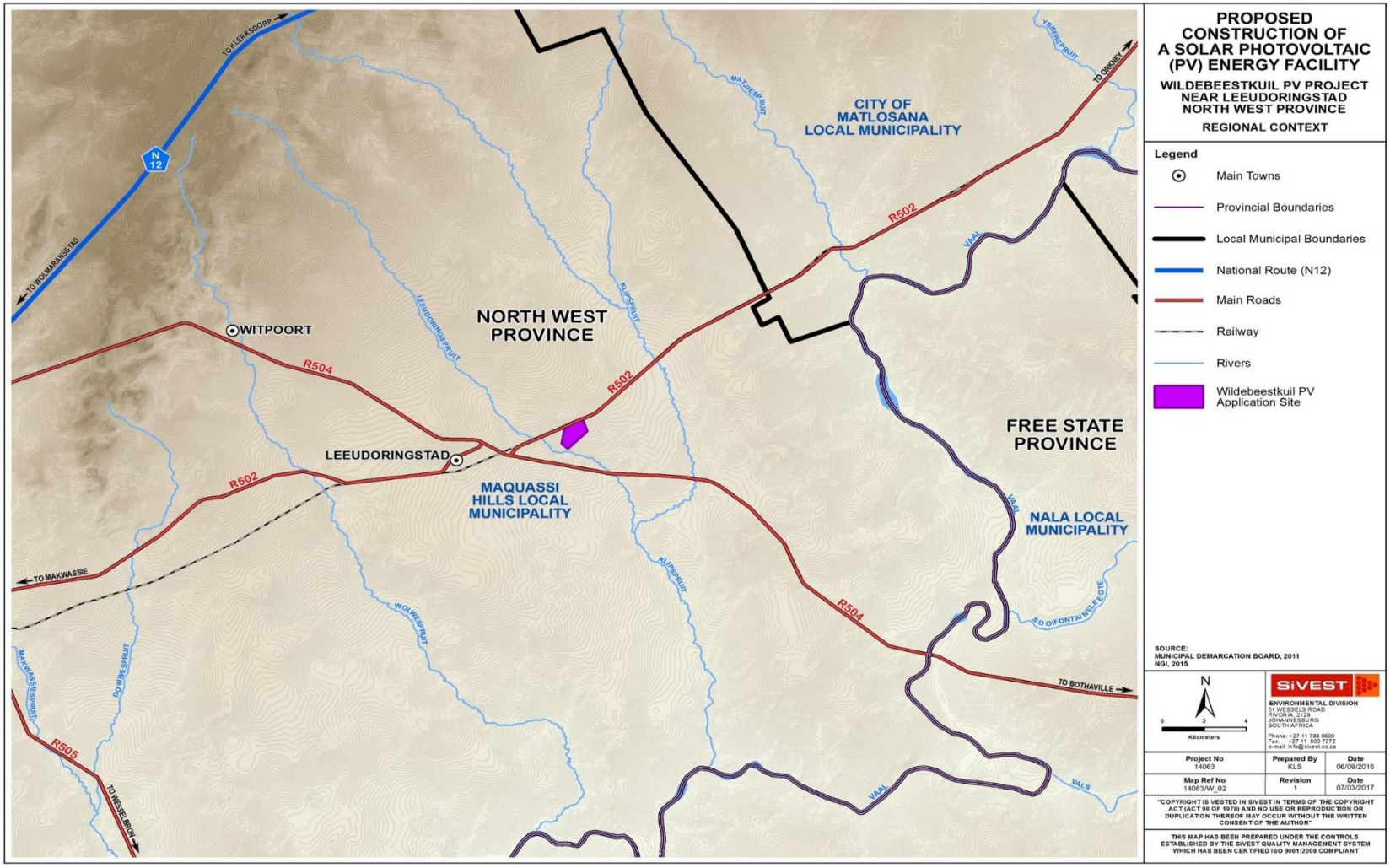

Figure 3. Regional Locality Map

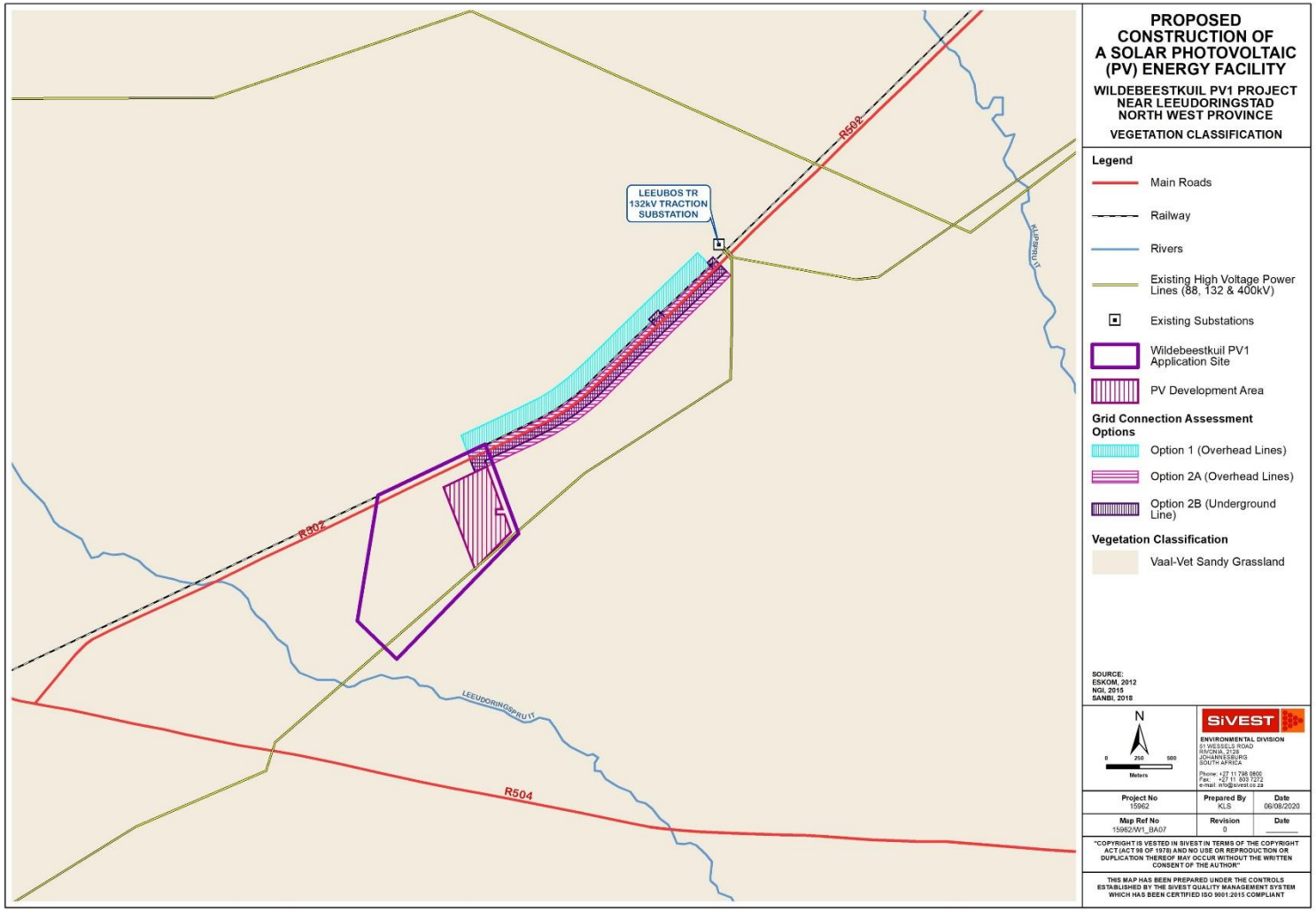

Figure 4. Vegetation Unit Map - Wildebeestkuil 1 Solar PV Plant and 132kV Power Line

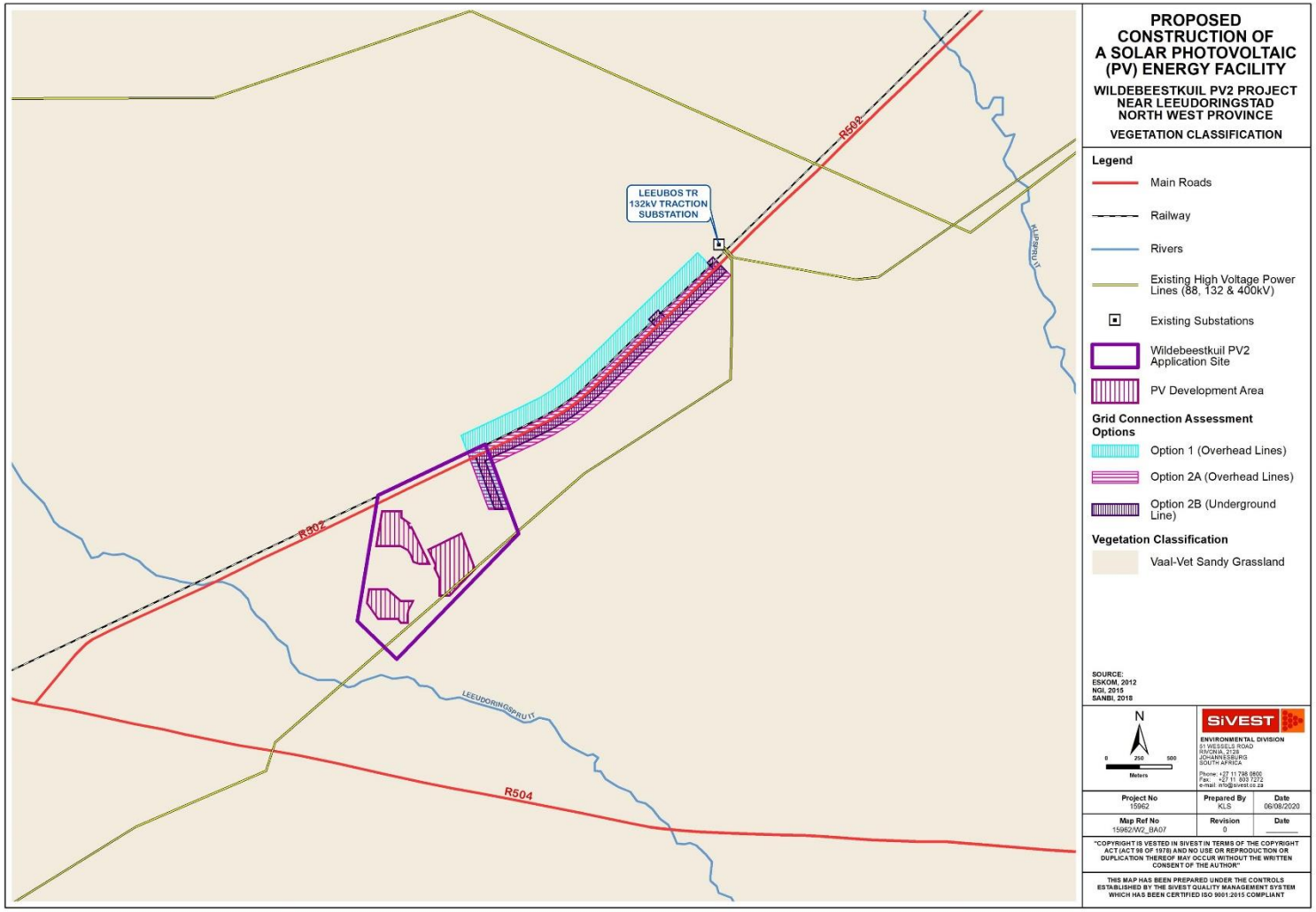

Figure 5. Vegetation Unit Map - Wildebeestkuil 2 Solar PV Plant and 132kV Power Line

5 FINDINGS OF THE WETLAND ASSESSMENT

5.1 Desktop Findings

It should be noted that a combined report has been compiled for both the proposed solar PV plants and 132kV power lines. This is due to the fact that the proposed solar PV plants and 132kV power line corridors are located on the same properties and are identical in nature. Where certain findings are project specific, this has been indicated.

In terms of the **ENPAT (2002)** national database, the study site is located within the Vaal Primary Catchment (**Figure 6**). More specifically, the study area is situated within the quaternary catchment C25A. The study site falls within the Middle Vaal Water Management Area (WMA). From the **NFEPA (2011)** database, no wetlands or watercourses could be identified directly on the study site. Additionally, no wetlands were found to be within 500m of the study site as well as the proposed power line corridors. However, the Leeudoringspruit was found to be within approximately 150m south from the southern corner of the study site boundary. The Leeudoringspruit is classified as having a PES: B (Largely natural), EI: Moderate and ES: Moderate **(DWA, 2014)**. At a general level however, the **North West Province Biodiversity Conservation Plan (2008)** database shows that the study site falls within a Critical Biodiversity Area – Category 1, making the local region ecologically significant from a conservation point of view.

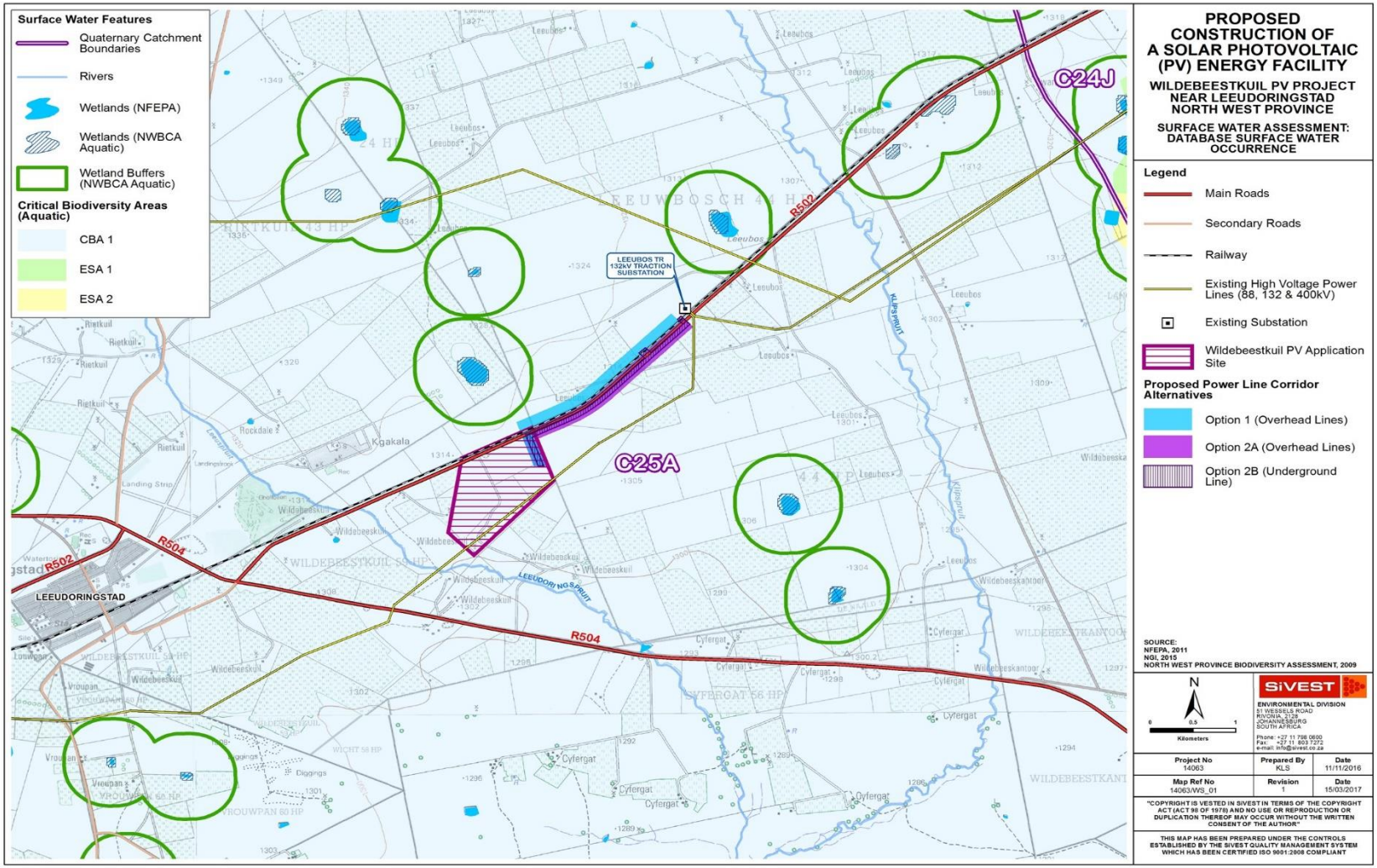

Figure 6: Database Surface Water Occurrence Map

5.2 In-field Findings and Delineations

The in-field surface water resources delineation assessment took place on the 13th September 2016, as well the 19th August 2020. The fieldwork ground-truthing, verification and delineation assessment was undertaken to scrutinise the results of the desktop assessment as well as to identify any potentially overlooked wetlands or other surface water resources in the field for the study site. The delineation results are displayed in **Figure 7** to **Figure 9**.

Ultimately, it was found that there are two (2) artificial depression wetlands, one (1) drainage line within the study site, as well as one natural depression wetland within the proposed power line corridors. None of the field identified natural wetland, drainage line and artificial features were evident in the database information sets consulted at a desktop level. The only feature that could be correlated included the Leeudoringspruit which is not located on the study site. The biophysical characteristics of the various indicators for each artificial and natural depression wetlands, and the drainage line are provided in more detail in the sub-sections below.

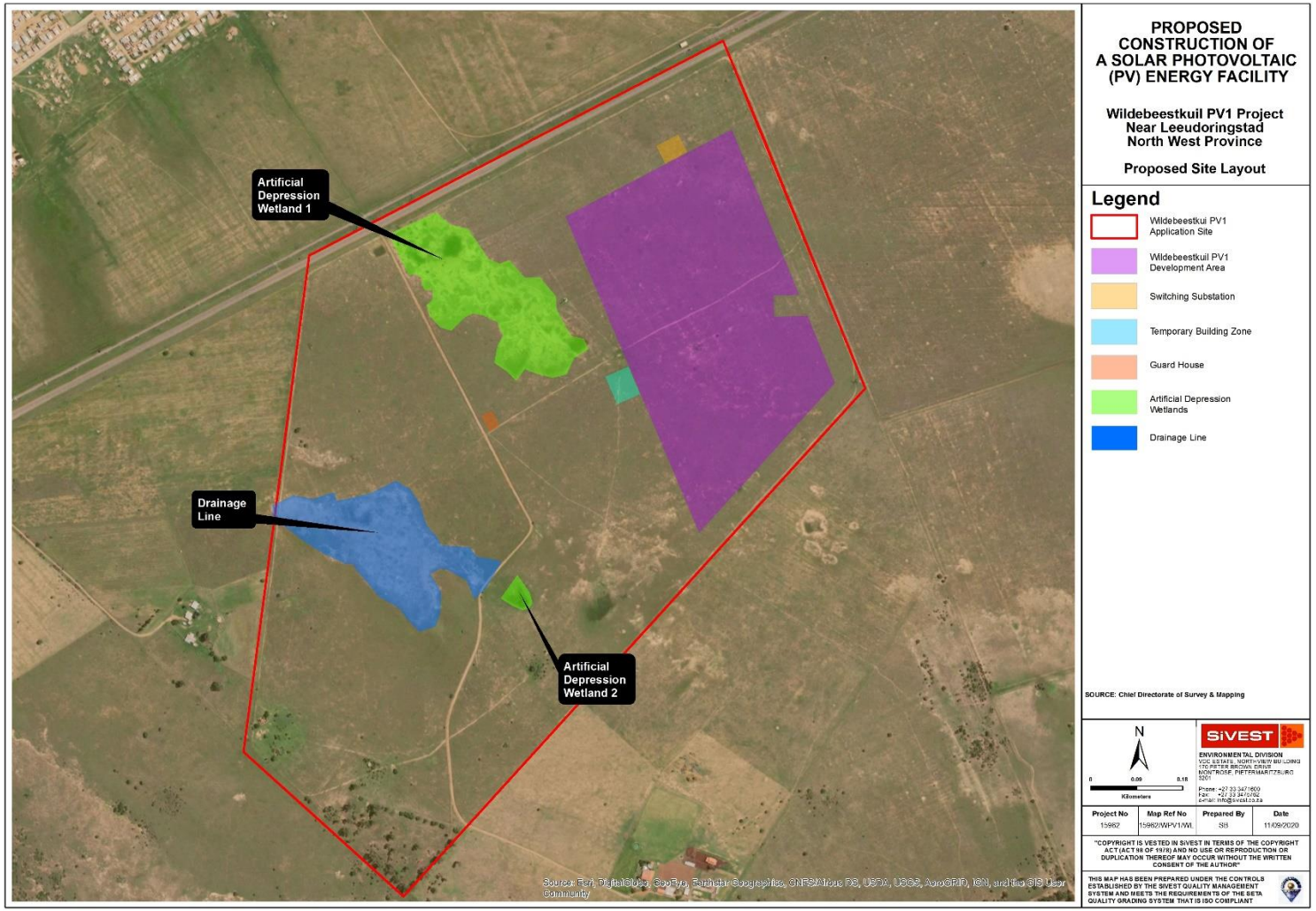

Figure 7: Surface Water Delineation Map for the Wildebeestkuil 1 Solar PV Plant Layout

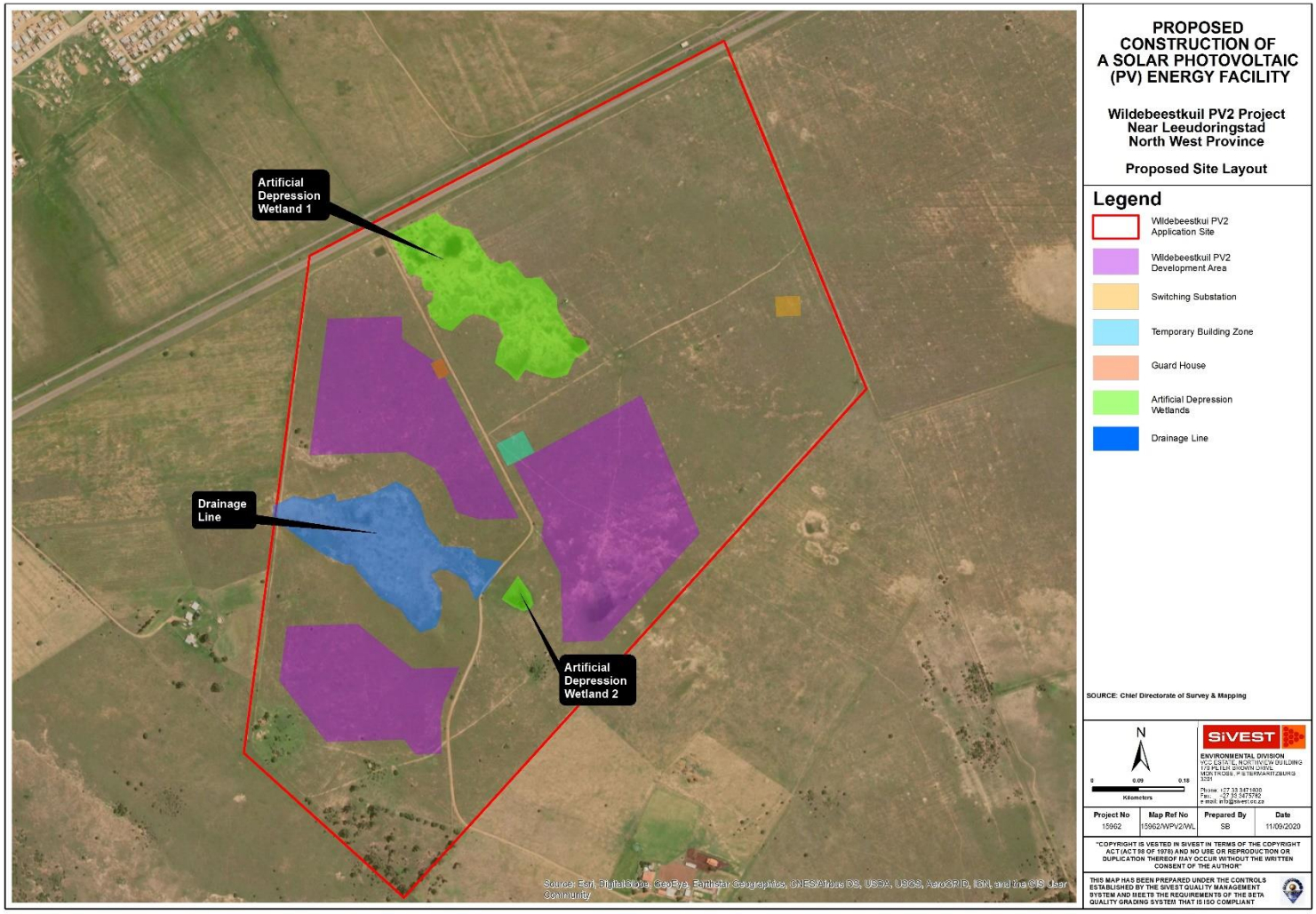

Figure 8: Surface Water Delineation Map for the Wildebeestkuil 2 Solar PV Plant Layout

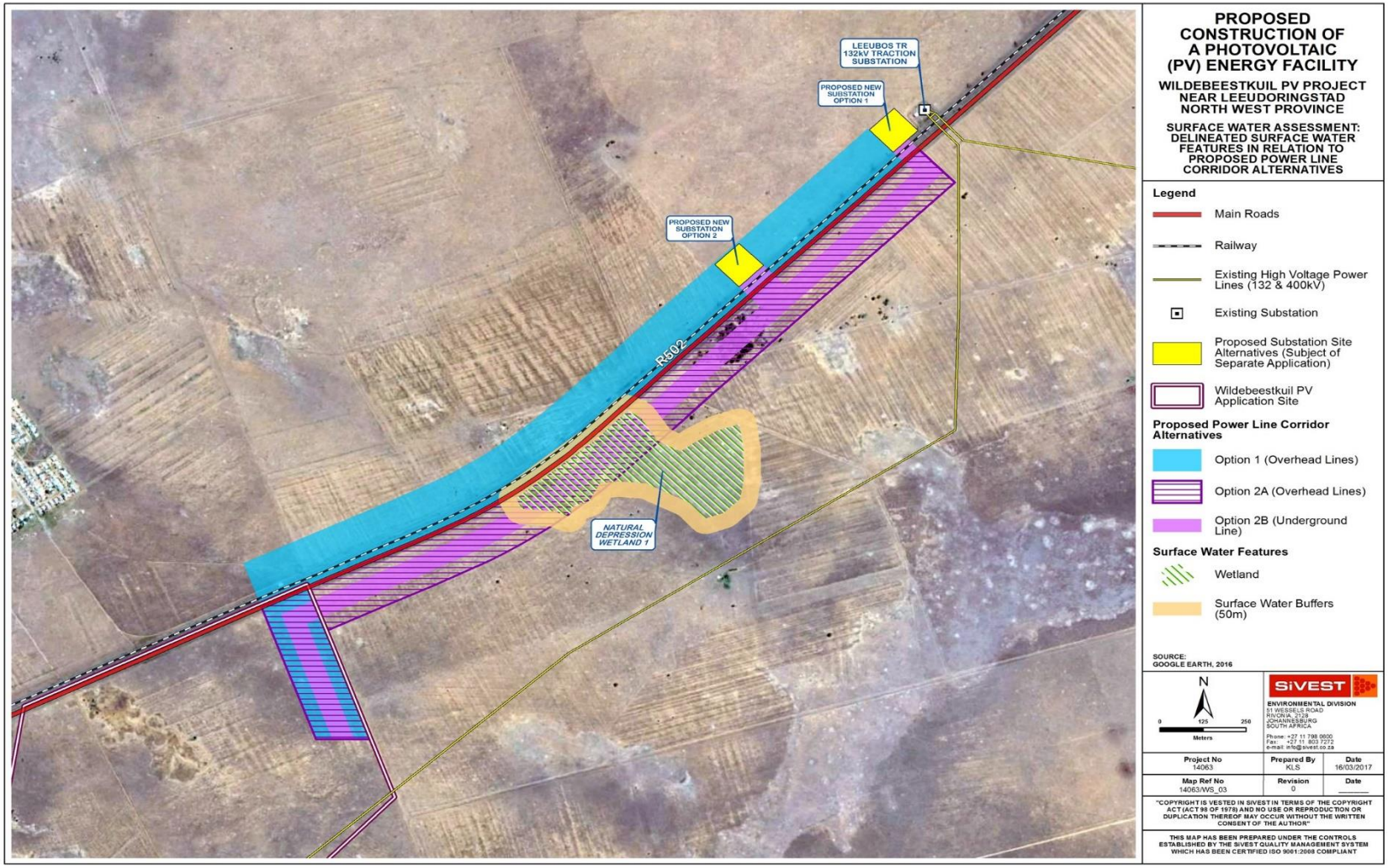

Figure 9: Surface Water Delineation Map for the Grid Connection Corridor Alternatives (Wildebeestkuil 1 and Wildebeestkuil 2)

5.2.1 Natural Depression Wetland 1

5.2.1.1 Terrain and Soil Characteristics

Natural Depression Wetland 1 (approximately 5.7ha) is found within the power line corridor approximately 650m to the north east of the PV project site. The landscape characteristics are predominantly flat in this area. However, any shallowed out basins in the terrain provide a suitable template for endorheic (closed systems that are in-ward draining) depression wetlands to form. In this instance, a natural depression wetland has formed **(Figure 10**) in the localized depression in the landscape. However, excavation activities have taken place within the wetland, presumably in an attempt to provide additional surface water for cattle to drink.

Figure 10. Natural Depression Wetland 1

In terms of soil characteristics, an Orthic A horizon overlaying a Soft Plinthic B horizon was observed. Excavations within the wetland make the wetland artificially deeper than would otherwise naturally be the case. A limited amount of surface water was therefore evident in the deeper excavated areas within the wetland. Nonetheless, the sub-soils were found to comprise a mixture of sandy/loamy/clay particles within the soil matrix. The soils were a dark brown colour with mottling signatures present in the form of orange, red and black mottles. Grey soil particles indicating reduction processes taking place in the wetland sub-soils were also evident. Accordingly, with the combination of the two soil horizon types, the Westleigh Soil Form could be attributed to the soils

in Natural Depression Wetland 1. The soil characteristics in Natural Depression Wetland 1 indicate that soil saturation is likely to be temporary.

Figure 11. Sub-soil Sample drawn from within Natural Depression Wetland 1 showing Orange Mottling and Grey Reduced Soil Particles

5.2.1.2 Vegetation

Vegetation observed in Natural Depression Wetland 1 varied from hydrophytic species within the open surface water pools in the excavated areas to graminoid species which dominated the majority of the wetland. Of the hydrophytic species observed, these included *Juncus* sp. (ow), *Marsilea* sp. (ow) and *Persicaria* sp. (ow - weed). Graminoid species in the wetter core areas of the wetland consisted of mainly *Eragrostis plana* (fw), whilst *Themeda triandra* and *Hypparhenia hirta* were also observed.

Figure 12. Hydrophytic Vegetation of Depression Wetland 3

Existing impacts include dirt and tar road fragmenting the wetland. Grazing impacts are also currently affecting the wetland as well as old excavation pits.

5.2.2 Artificial Depression Wetland 1

5.2.2.1 Terrain and Wetland Soil Characteristics

The terrain of the landscape is flat. Past excavation activities in the northern region of the study site, presumably for road and / or rail transportation, have resulted in a collection of hollowed out basins (**Figure 13**) within the greater excavation pit (approximately 5.5 hectares). The excavation pit situated in the flatter landscape which now acts as a sink for sediments in the surrounding catchment. Drainage does not flow in from or out of any particular hydrological system, but rather as diffuse flow from the surrounding catchment. The system can therefore be considered endorheic (a closed system that is in-ward draining).

Figure 13. Hollowed out Basin in the Old Excavation Pit

In terms of geomorphology, the influx of silt and clay due to inward depositional processes results in the accumulation of sediment. This accumulated sediment forms a layer (normally containing appreciable amounts of clay) that is relatively impermeable and is found near the surface in the subsoil of the old excavation pit. However, soil composition (for example, degree of sand, silt and clay) varies across the numerous localized smaller depressions within the excavation pit with a higher composition of clays in the lowest points of the excavated pockets within the excavation pit. Soil deposition near the surface was representative of an Orthic A horizon. In general, bedrock was found close to the surface (approximately 10-50cm). The sub-soils were therefore relatively thin in most areas. However, it was noticed that the soils presumably undergo regular but temporary wet and dry phases to the extent that hydric soils are able to form. The characteristics of a Soft Plinthic B horizon are evident in the sub-soils with brown soils comprising a loamy / clay fraction, expressing mottling signatures in the form of orange coloured accumulations (mottles) as well as grey reduced particles (**Figure 14**). Ultimately, the combination of the Orthic A and Soft Plinthic B soil horizons are attributable to the Westleigh Soil Form, a common wetland soil form which can be indicative of temporary saturation cycles.

Figure 14. Cracking Clays (left) and Soil Sample showing Orange Mottling (right) in the Soil Matrix

Overall, soil indicators akin to wetlands were observed within the excavation pit. The excavation pit was therefore classified as an artificial depression wetland.

5.2.2.2 Wetland Vegetation

A community of small herbaceous shrubs and small trees were found in the north western region of the artificial depression wetland. Notable species include *Acacia karroo*, *Searsia lancea* and Zi*ziphus mucronata*. Aside from these vegetation species, hydrophytic vegetation was observed in the form of *Juncus* sp. (ow) at the lowest points within several of the depression pockets within the excavation pit. Otherwise, vegetation cover was sparse. The occurrence of the *Juncus* sp. species provides further evidence of wetland conditions suitable for hydrophytic vegetation species currently exhibited by the artificial depression wetland.

Figure 15. *Juncus* sp. observed in Artificial Depression Wetland 1

Aside from the excavation impacts, other existing impacts currently affecting the artificial wetland that were noted include grazing by cattle thereby creating a moderate level of disturbance.

5.2.3 Artificial Depression Wetland 2

5.2.3.1 Terrain and Soil Characteristics

Anthropogenic modification in the form of a berm was observed near the south central parts of the study site. Whilst the study site is predominantly flat, the berm presumably acts as a barrier in order to contain water draining through the property seemingly in a south easterly direction. Water therefore accumulates behind the berm. The feature is approximately 0.24ha in extent (**Figure 16**).

Figure 16. Artificial Depression Wetland 2

Sediments contained in the run-off settle behind the berm forming a layer that is relatively impermeable, similar to artificial depression wetland 1. As a result, the layer contains a loamy clay mixture which appears to retain saturation relatively well enough for hydric soils to develop near the surface. The A horizon could be attributed to an Orthic A horizon, whilst the B horizon was similar to the sub-soils observed in Artificial Depression Wetland 1 revealing a predominantly brown soil matrix intermixed with mottling signatures in the form of orange and red iron accumulations and grey reductions. Again, the Westleigh Soil Form could be attributed to the soils in the feature. Given the soil characteristics, the feature was classified as an Artificial Depression Wetland 2. The soils signatures for Artificial Depression Wetland 2 indicate temporary soil saturation.

5.2.4 Drainage Line 1

5.2.4.1 Topography Associated With a Watercourse

Despite the study site being flat, it seems that surface water run-off follows a south easterly trajectory in the mid regions of the PV study site. A distinct area where soil and vegetation characteristics change from that of the surrounding landscape, form a drainage pathway area (**Figure 17**). This particular area was defined as Drainage Line 1. Drainage Line 1 is approximately 5.6 hectares in extent.

Figure 17. Terrain Characteristics of Drainage Line 1

5.2.4.2 Alluvial Soils and Deposited Materials

Soils samples within Drainage Line 1 did not show any characteristics that are indicative of hydric soils. As such, the area was not classified as a wetland. However, a higher amount of clay particles were visibly evident by comparison to the adjacent terrestrial area. Given the context of the landscape, the higher degree of clay particles in the sub-soils may be indicative illuviation (downward movement of soil particles by percolating water – **McVicar *et al*., 1991**) taking place in the landscape following rainfall events.

5.2.4.3 Vegetation

The vegetation observed within Drainage Line 1 was a mixture of graminoid, small herbacoues and scrub vegetation species (**Figure 18**). The condition of the vegetation appeared considerably disturbed at the time of the assessment. Bare patches of soil were exposed at the surface, presumably in part a result of surface water movement through the area after rains. However, no specific hydrophytic vegetation species were noted during the fieldwork.

Figure 18. Encroachment of Herbaceous Vegetation Species in Drainage Line 1

5.3 Wetland Present Ecological Status (PES)

The overall PES for the Natural Depression Wetland 1 was determined. The PES was not however determined for the artificial wetlands (See **Section 1.3**). This includes the integration of the hydrological and vegetation PES components for Natural Depression Wetland 1. The summarised results are shown in **Table 5**. Ultimately, the PES of Natural Depression Wetland 1 was categorised to have an overall PES – D (Largely Modified). A description of the factors and corresponding component PES scores influencing the overall PES score for the wetland is explained in more detail below.

Table 5. Overall PES for Natural Depression Wetland 1

Wetland Name	Module	Impact Score	Category	Change Score	Change Description	Health Class
Natural Depression Wetland 1	Hydrology	5	D	-1,00	Deteriorate Slightly	D (Largely Modified)
	Geomorphology					
	Vegetation	5,1	D	0,00	Remain Stable	D (Largely Modified)
	Overall Health Score for entire wetland	5,04	D	-0,5	Deteriorate Slightly	D (Largely Modified)

With respect to the hydrological integrity of the wetland, the most significant factors to have scored a negative impact on the systems includes the change in surface roughness and impeding features (dirt and tar roads in / nearby the wetland). The change in surface roughness and the presence of dirt and tar roads act to change the distribution and retention of water within the wetland by increasing flood peaks after rainfall events. Limited cover therefore can also act as an erosive force contributing to additional sediment inputs into the wetland. A further factor affecting the state of the wetland are the excavation impacts. Here the excavation areas leave the wetland exposed when not inundated. Fortunately, due to the shallow nature of the wetlands and the presence of bedrock, accumulated sediment above the impermeable layer seems to assist in preventing erosion as no active erosion was evident. The excavations therefore did not impact to a significant degree on the overall health category. Accordingly, the overall hydrological component was assessed to be classed a D (Largely Modified).

The vegetation component for the wetland was assessed to have mainly been affected by the presence of roads and grazing by cattle. The lack of surface roughness was assessed to influence the scoring of vegetation disturbance in the wetland. The vegetation disturbance was assessed to be moderate in terms of this impact. Again however, the excavation impacts were an additional impact affecting Natural Depression Wetland 1, resulting in an increased impact to the wetland. The magnitude of existing impacts was assessed to score a health category of D (Largely modified).

5.4 Wetland Ecosystem Services

The in-field findings, as described above, were used to inform aspects of the wetland ecosystem services assessment in the sub-sections below.

5.4.1 Natural Depression Wetland 1

The potential wetland ecosystem services provided by Natural Depression Wetland 1 which scored highest includes sediment trapping. The sediment trapping function of this wetland can be said to be one of the primary functions of an endorheic wetland. Other potential wetland ecosystem services provided at a slightly lower degree include phosphate trapping and erosion control. This

is closely followed by toxicant control and nitrate removal. Other potential wetland ecosystem services which could potentially be provided, which scored to a lesser degree, include flood attenuation, education and research, tourism and recreation, natural resources and maintenance of biodiversity (**Figure 20**). The ecosystem services scores in general are not very high due to the relatively limited extent (5.7 hectares) of the wetland, the degree of disturbance as well as the general limitations to basic functions that can be performed by endorheic wetlands. However, the main functions and services provided are arguably most significant in terms of sedimentological functions such sediment trapping.

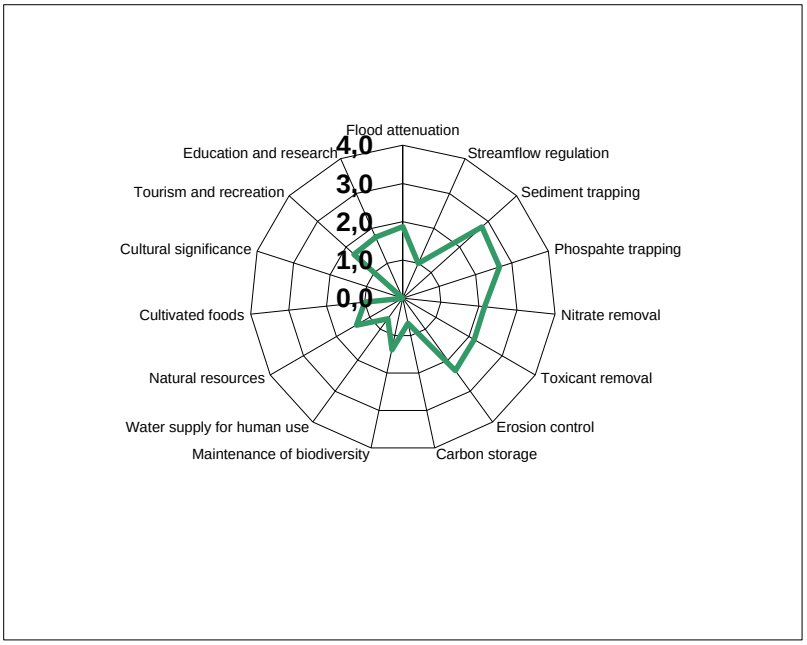

Figure 19. Natural Depression Wetland 1 Ecosystem Services

5.4.2 Artificial Depression Wetland 1

The potential ecosystem services provided by Artificial Depression Wetland 1 which scored highest was in terms of sediment trapping followed closely by phosphate trapping, erosion control and flood attenuation. Other potential wetland ecosystem services which could potentially be provided which scored to a lesser degree included toxicant control, nitrate removal, maintenance of biodiversity, natural resources and, tourism and recreation (**Figure 20**). The ecosystem services are not very high in consideration that the wetland system is artificial in nature and would not occur in the location it is naturally. Aside from this main factor, the level of potential wetland ecosystem services is not very high due to the existing impacts from past excavation activities and current grazing impacts.

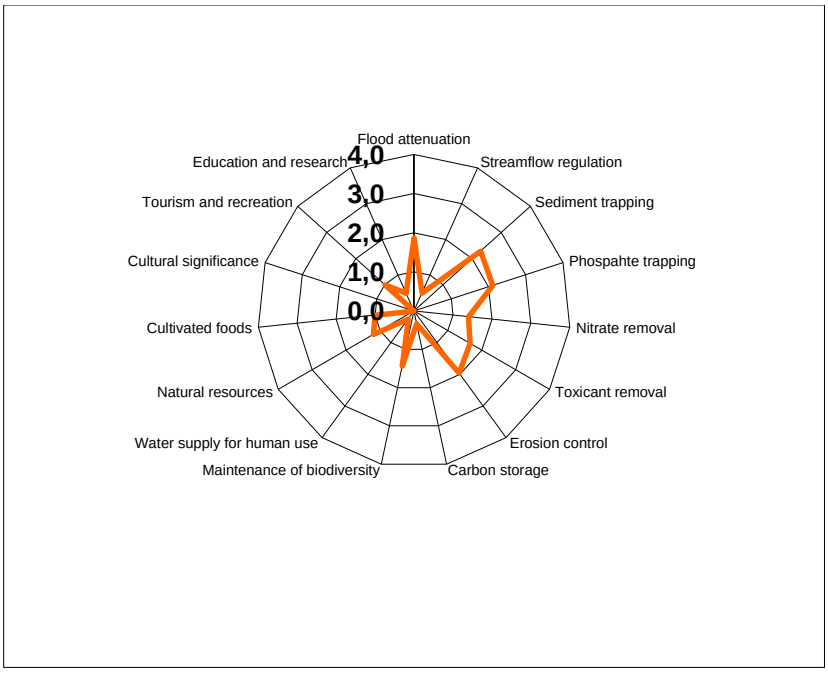

Figure 20. Artificial Depression Wetland 1 Ecosystem Services

5.4.3 Artificial Depression Wetland 2

The potential wetland ecosystem services offered by Artificial Depression Wetland 2 scored highest in terms of erosion control. The other potential wetland ecosystem services provided at a slightly lower degree include sediment trapping, phosphate trapping, flood attenuation, maintenance of biodiversity and toxicant removal. Additionally, other potential wetland ecosystem services which could potentially be provided but which scored to a lesser degree include maintenance and biodiversity, education and research, tourism and recreation and natural resources (**Figure 21**). The remaining potential wetland ecosystem services offered scored negligible levels. Artificial Depression Wetland 2 is very limited extent and so the potential wetland ecosystem services offered are generally not to s significant degree. Additionally, once more, the existing impacts detract slightly from those services that are potentially offered to a degree.

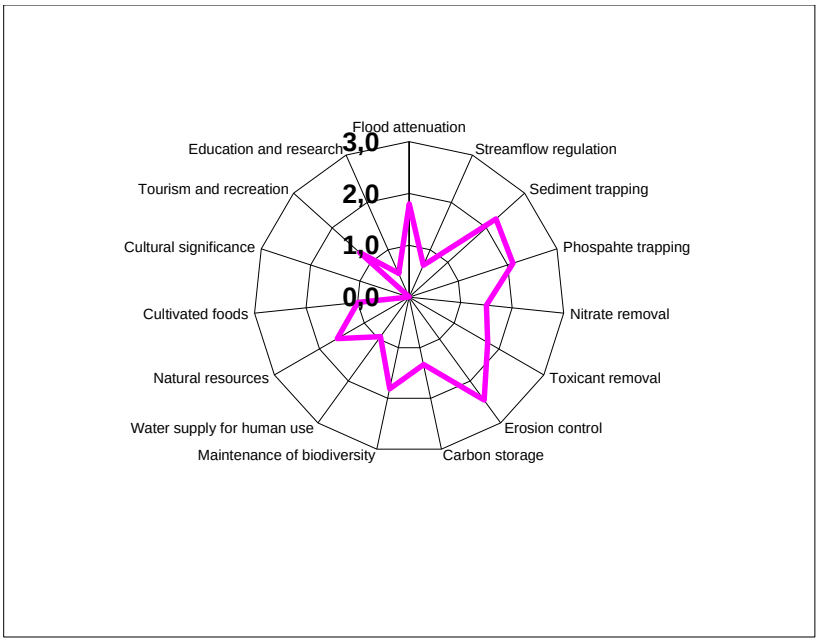

Figure 21. Artificial Depression Wetland 2 Ecosystem Services

5.5 Wetland Ecological Importance and Sensitivity Categorisation

During the site visit, the only faunal activity observed included ground squirrels and mongoose in the nearby surrounding area outside the wetlands. However, whilst limited activity was observed at the time the fieldwork was undertaken, avifaunal and amphibian species may well frequent the wetland at various stages of the day and seasonally in the year when surface water is present. This is especially so for the man-made impoundment were water supply will be of a more regular occurrence than the surrounding features in the landscape which rely directly on rainfall. Therefore, the limitations of this short term once off study must not detract from the possibility of faunal activity in the area throughout the year. Overall, taking the above into account as well as the wetland ecosystem services results, the EISC are as follows:

- Natural Depression Wetland 1 was categorised as a Class C (Moderate);
- Artificial Depression Wetland 1 was categorised as a Class C (Moderate);
- Artificial Depression Wetland 2 was categorised as a Class B (High).

A detailed description of the scoring of the EISC results for the wetland are displayed in **Table 6** below.

Table 6. Environmental Importance and Sensitivity Category for the Biotic and Habitat Determinants of the Identified Wetlands

Wetland Name	**Natural Depression Wetland 1**		**Reason**	**Artificial Depression Wetland 1**		**Reason**	**Artificial Depression Wetland 2**		**Reason**
Determinant	**Score**	**Confidence**		**Score**	**Confidence**		**Score**	**Confidence**	
Primary Determinants									
1. Rare & Endangered Species	1	3	No specific wetland dependent fauna and flora species of conservation importance associated with this wetland were identified during the field assessment.	1	3	No specific wetland dependent fauna and / or flora species of conservation importance associated with this wetland were identified during the field assessment.	1	3	No specific wetland dependent fauna and / or flora species of conservation importance associated with this wetland were identified during the field assessment.
2. Populations of Unique Species	2	3	Greater density of *Juncus* sp. and *Marsilea* sp. identified within the core of the wetland.	1	3	Very small isolated communities of *Juncus* sp identified within the wetland.	2	3	Small community of *Juncus* sp. identified within the core of the wetland.

3. Species/taxon Richness	2	3	Species and taxon richness slightly more diverse and dense by comparison to Depression Wetland 1 in terms of hydrophytic vegetation species. However, the observed faunal species richness was similarly limited to terrestrial mammals.	1	3	Species and taxon richness not particularly diverse nor rich in terms of hydrophytic vegetation species. Similarly, observed faunal species richness limited to terrestrial mammals.	2	3	Species and taxon richness slightly more diverse and rich by comparison to Artificial Depression Wetland 1 in terms of hydrophytic vegetation species. However, the observed faunal species richness was similarly limited to terrestrial mammals.
4. Diversity of Habitat Types or Features	3	3	Fair degree of diversity of habitat types between aquatic vegetation and terrestrial vegetation (despite being of limited extent).	1	3	No particularly significant diversity of habitat types between aquatic vegetation and terrestrial vegetation.	2	3	Fair degree of diversity of habitat types between aquatic vegetation and terrestrial vegetation (despite being of limited extent).
5. Migration route/breeding and feeding site for wetland species	2	3	Depression wetland may serve as a breeding site for amphibian as well as feeding site for waterfowl despite no species being identified on the day of the wetland assessment.	1	3	Depression wetland may serve as a breeding site for amphibian as well as feeding site for waterfowl despite no species being identified on the day of the wetland assessment.	2	3	Depression wetland may serve as a breeding site for amphibian as well as feeding site for waterfowl despite no species being identified on the day of the wetland assessment.

6. Sensitivity to Changes in the Natural Hydrological Regime	2	3	The seasonal to temporary hydrological regime of the depression wetland means that it will be fairly sensitive to reductions and changes in the natural hydrological regime. This is especially applicable to the hydrophytic dependent species observed (*Juncus* sp. & *Marsilea* sp.).	2	3	The seasonal to temporary hydrological regime of the depression wetland means that it will be fairly sensitive to reductions and changes in the natural hydrological regime. This is especially applicable to the hydrophytic dependent species observed (*Juncus* sp.).	2	3	The seasonal to temporary hydrological regime of the depression wetland means that it will be fairly sensitive to reductions and changes in the natural hydrological regime. This is especially applicable to the hydrophytic dependent species observed (*Juncus* sp.).

7. Sensitivity to Water Quality Changes	2	3	The hydrophytic vegetation species identified are known to be salt tolerant to a degree. The vegetation species within the depression wetland will therefore be somewhat resistant to changes in water quality. The depression wetland would be fairly tolerant to increased sediment inputs. However, the depression wetland would be sensitive to substantial sediment inputs.	1	3	The hydrophytic vegetation species identified are known to be salt tolerant to a degree. The vegetation species within the depression wetland will therefore be somewhat resistant to changes in water quality. The depression wetland would be fairly tolerant to increased sediment inputs.	3	3	The hydrophytic vegetation species identified are known to be salt tolerant to a degree. The vegetation species within the depression wetland will therefore be somewhat resistant to changes in water quality. Given the limited extent the depression wetland would be fairly tolerant to minor increased sediment inputs. However, substantial sediment inputs could have significant impacts.
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	3	3	One of the main potential functions of the depression wetland is the ability of the wetland to perform a functional role in terms of attenuation of storm water, energy dissipation and particulate removal for the study site. In this	1	3	One of the main current functions of the artificial depression wetland is to perform a functional role in terms of attenuation of run-off, energy dissipation and	2	3	One of the main current functions of the artificial depression wetland is to perform a functional role in terms of attenuation of run-off, energy dissipation and particulate removal for the study site. In this regard, the

			regard, the depression wetland is significant in terms of the role it performs in the greater landscape.			particulate removal for the study site. In this regard, the depression wetland is somewhat significant in terms of the role it performs in the greater landscape.			depression wetland is somewhat significant in terms of the role it performs in the greater landscape.
Modifying Determinants									
9. Protected Status	0	4	No protected status	2	4	Inside a Critical Biodiversity Area (CBA)	2	4	Inside a Critical Biodiversity Area (CBA)
10. Ecological Integrity	1	4	The PES was assessed to be in a Largely modified state.	2	4	Moderate disturbance is currently compromising the ecological integrity of the artificial wetland system.	3	4	Limited disturbance is currently compromising the ecological integrity of the artificial wetland system.
TOTAL	18	32		13	32		21	32	
MEDIAN	1,8	3,2		1,3	3,2		2,1	3,2	
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE	**C**			**C**			**B**		

5.6 Surface Water Buffer Zones

For the surface water resources, the primary threat related to the PV developments and the associated power lines during the construction phase, are increased run-off and additional sediment inputs as well as increased turbidity. These impacts commonly take place mainly during vegetation clearing for the PV arrays and excavation of pits for the foundations of the individual PV panels as well as electricity towers. These areas are left vulnerable to surface run-off, consequent erosion and sedimentation. Given the relatively flat terrain, these impacts are highly likely given the wetland types and proximity of the proposed PV fields. However, these potential impacts can be easily mitigated with relatively simple management measures in place. Therefore, the buffer zones can be of limited size in order to address potential impacts adequately.

For the operation phase, run-off from the PV fields and adjacent services roads (including service roads for the power lines) can contribute to increased run-off and sediment inputs, as well as turbidity in the wetlands. Again, the terrain and climate factors will have a bearing on potential impacts. However, with the implementation of mitigation measures, potential impacts can be avoided.

Based on the above, buffer zones were determined for the identified natural and artificial depression wetlands and the drainage line. As such, a buffer zone of 50m was applied to the natural and artificial depression wetlands, and drainage line to provide sufficient buffer from the PV array fields and associated power lines (including towers). The above assigned buffer zones were guided by the rationale behind the establishment of suitable buffer zones for surface water resources according to the **GDARD Requirements for Biodiversity Assessments (2014)**, which are equally deemed applicable in the North West Province, as well as using professional judgement based on the biophysical characteristics and findings in the field.

6 ALTERNATIVES COMPARATIVE ASSESSMENT

It should be noted that no layout alternatives for the proposed PV arrays were identified or comparatively assessed as the buildable areas for the proposed developments (and ultimately the layouts of the proposed respective solar PV plants and 132kV power lines) were determined by taking the identified environmentally sensitive and/or “no-go” areas into consideration. These areas were subsequently used to inform the area for the potential erection of PV panels and associated infrastructure within the application site (referred to as the proposed PV buildable areas). These were also used to inform the route for the proposed power line corridors. No location, layout or design alternatives for the associated infrastructure have been considered and assessed as part of the current BA process either as these locations have also been informed by the identified

environmentally sensitive and/or “no-go” areas. Specialist studies were originally undertaken in 2016 and all current layouts being proposed were selected based on the environmental sensitivities and/or “no-go” areas identified as part of these studies in 2016. All specialist studies which were undertaken in 2016 were however updated in 2020 (including ground-truthing, where required) to focus on the impacts of the layouts being proposed as part of the current BA process. The results of the updated specialist assessments have informed the layouts being proposed as part of the BA process. The proposed layouts have therefore been informed by the identified environmental sensitive and/or “no-go” areas.

As previously mentioned, three (3) power line corridor route alternatives have been investigated for each of the proposed solar PV plant developments (**Figure 22** to **Figure 24**). The power line corridor route alternatives were informed by the identified environmental sensitive and/or “no-go” areas. These alternatives have been comparatively assessed in order to determine the preferred alternatives from a surface water perspective.

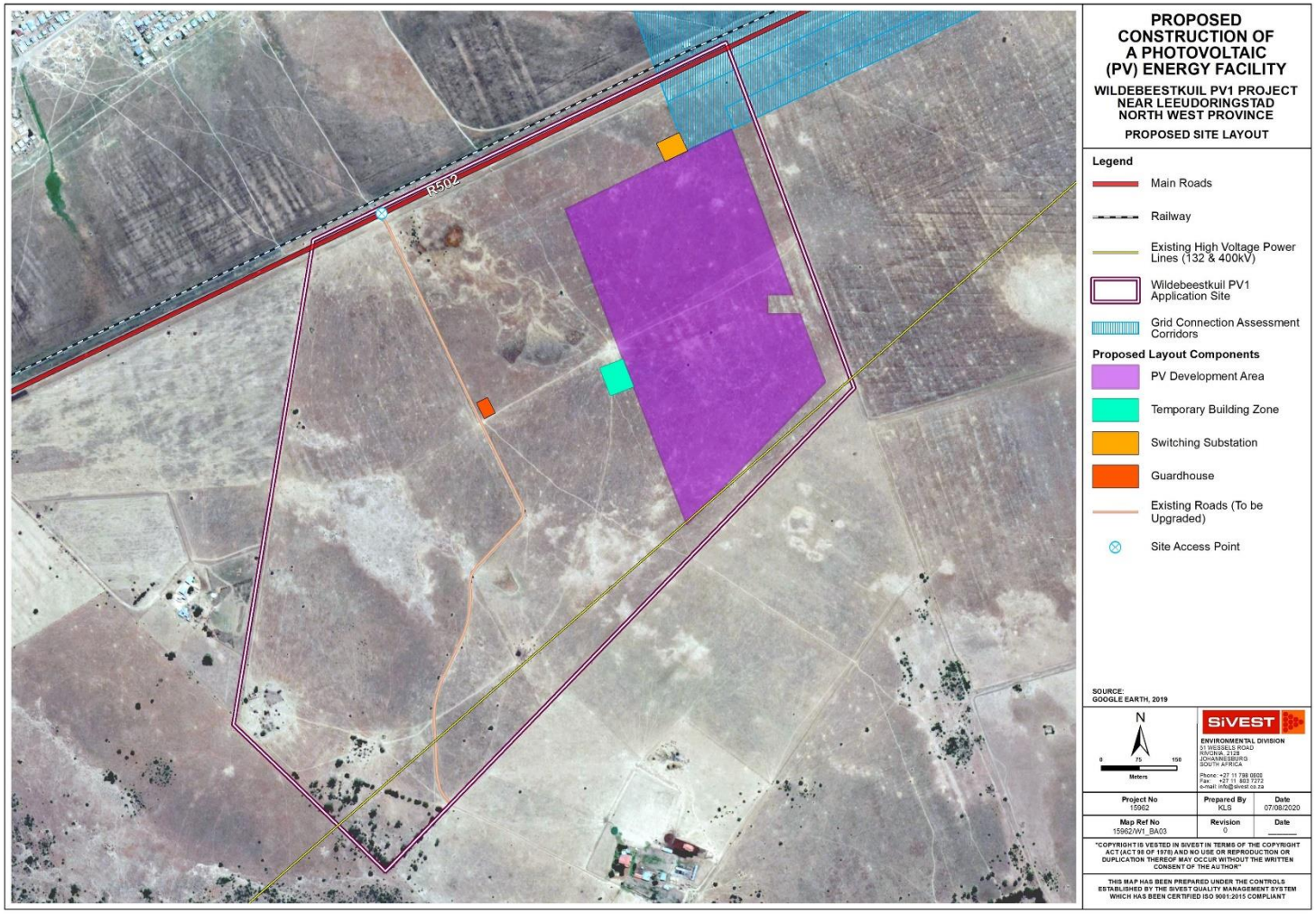

Figure 22. Wildebeestkuil 1 Solar PV Plant Layout

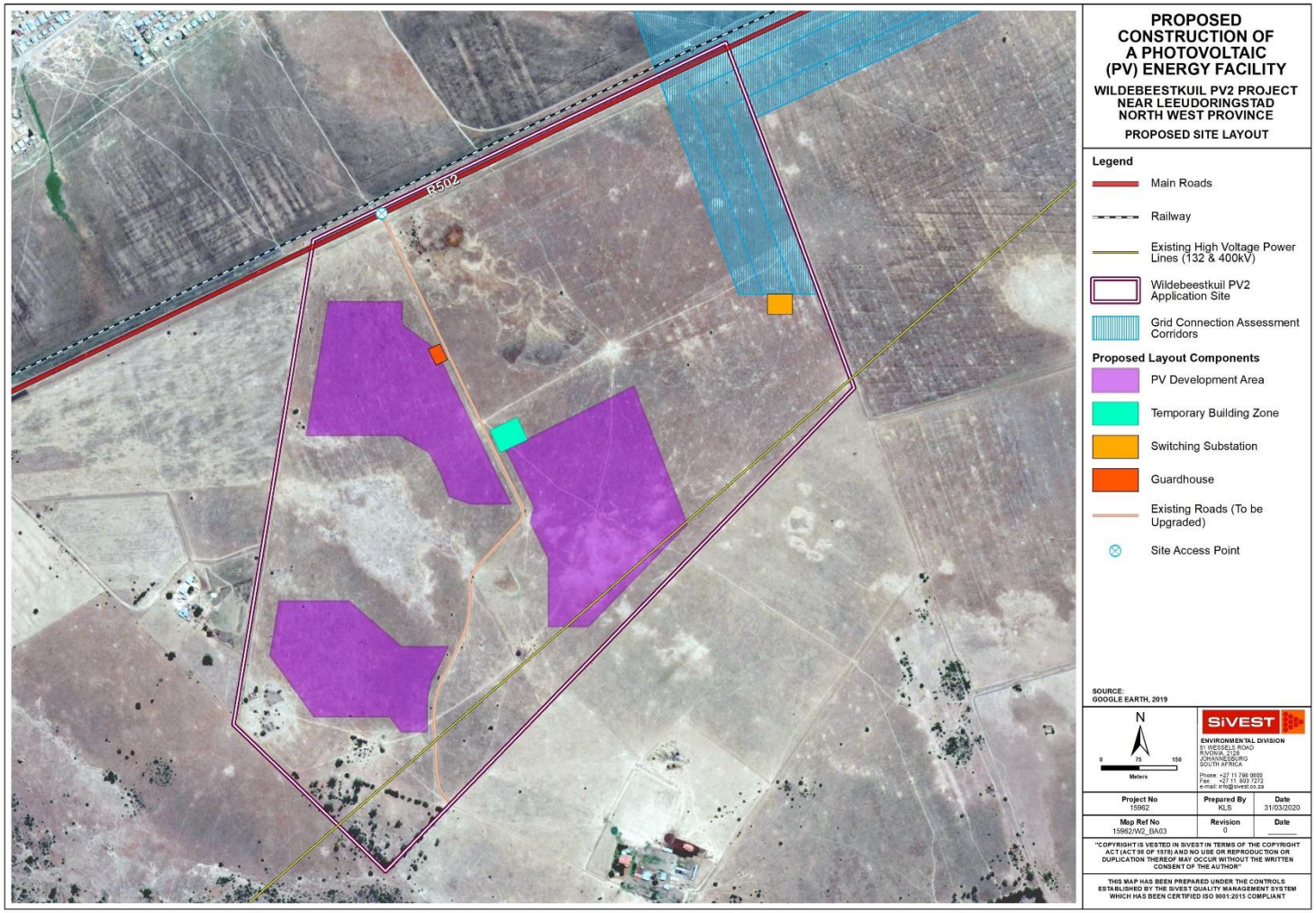

Figure 23. Wildebeestkuil 2 Solar PV Plant Layout

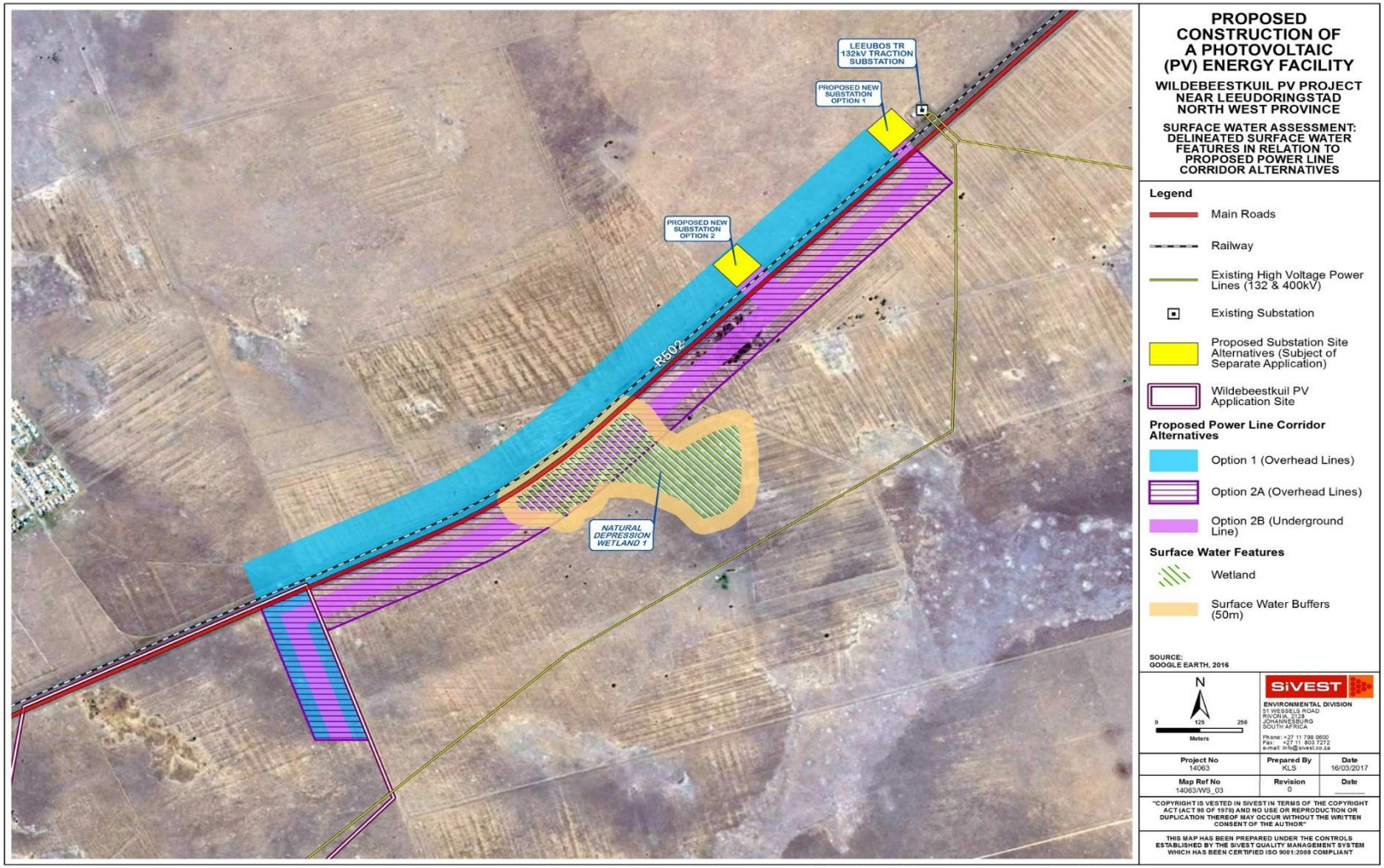

Figure 24. Wildebeestkuil 132kV Power Line Corridor Alternatives (Wildebeestkuil 1 and Wildebeestkuil 2) - Options 1, 2A and 2B

The following factors were taken into account when comparatively evaluating the proposed alternatives:

- Size and number of potentially impacted surface water resource(s) in the proposed alternatives;
- Proximity to the nearest surface water resource(s);
- The location of any surface water resources present and the ability of the proposed developments to be constructed out of, around or away from any nearby surface water resources;
- Number of sub-catchments affected; and
- Existing impact factors (such as existing infrastructure, roads and impacted land).

In terms of the first criteria, the size and number of surface water resources within an alternative area was relevant. The more surface water resources that are present and the greater the area each occupies, it is likely that the impact of the proposed development will be greater.

The second criteria to consider is proximity of the proposed developments' positioning to any nearby surface water resources. The type of surface water resource and the distance of the proposed developments to it will have a bearing on whether there may be direct or indirect impacts that could affect it.

The third criteria focuses on whether the proposed developments may be able to be constructed with surface water resources present. It may be possible for the proposed developments to be constructed if there are few surface water resources present and the facility components or infrastructure are repositioned to avoid the surface water feature. In this instance, manoeuvrability of the site layouts may only also be possible should any surface water resources be located on the boundary of the proposed development areas under consideration.

The fourth criteria includes sub-catchment areas that will be affected by the proposed developments. The sub-catchments include the wetland specific catchment areas for the endorheic systems as well as the general catchment areas containing several wetland features. Where more sub-catchment areas are affected (both directly / indirectly), more potential contamination pathways exist thereby influencing the extent and severity of an impact.

The final criteria of significance, when selecting the most suitable alternatives, is existing infrastructure (power lines, roads, railway etc.) and impacted land (agricultural fields, urban areas etc.). Disturbance to an existing impacted area will be less than if undisturbed, or where less impacted land is affected.

The preference ratings for the power line corridor alternatives are provided in **Table 7** below. The alternatives are rated as being either preferred (the alternative will result in a low surface water impact / reduce the surface water impact), not-preferred (the alternative will result in relatively high

surface water impact / increase the surface water impact), favourable (the surface water impact will be relatively insignificant) or no preference (the alternative will result in equal impacts). This is shown in the key below.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 7. Alternative Assessment for the proposed power line corridors (Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildbeestkuil 2 Solar PV Plant and 132kV Power Line) summarising the impacts, highlighting issues/concerns and indicating the preference associated with each proposed alternative[9]

Alternative	Preference	Concerns / Impact Summary	Fatal Flaws
Wildebeestkuil Overhead Power Line Corridor Option 1 (Wildebeestkuil 1 and Wildebeestkuil 2)	**Preferred**	▪ No wetlands or any other surface water resources will be directly affected by the proposed power line in this corridor. The nearest wetland is Natural Depression Wetland 1 located to the south on the opposite side of the R50 and the existing railway. The tar road and existing railway acts as a physical barrier that will assist in buffering potential indirect impacts as a result of the construction process. Minimal mitigation measures can be adopted to minmise potential indirect impacts during the construction phase.	No
Wildebeestkuil Overhead Power Line Corridor Option 2A (Wildebeestkuil 1 and Wildebeestkuil 2)	**Not Preferred**	▪ Natural Depression Wetland 1 will be directly affected as the power lines will be unable to span the narrowest crossing point which is approximately 365m. As such, a minimum of one tower will need to be placed within the wetland resulting in direct impacts. This however will not be a fatal flaw and construction can technically take place with the relevant approvals for a water use license and environmental authorisation. This power line corridor alternative is therefore not preferred.	No
Wildebeestkuil Underground Power Line Corridor option 2B (Wildebeestkuil 1 and Wildebeestkuil 2)	**Not Preferred**	▪ Natural Depression Wetland 1 will be directly affected. In order to install the underground cable, trenching will be required and direct impact to the wetland will result. This however will not be a fatal flaw and construction can technically take place with the relevant approvals for a water use license and environmental authorisation. This power line corridor alternative is therefore not preferred.	No

From the above, the preferred power line corridor route alternative for both proposed Wildebesstkuil solar PV plants (Wildebeestkuil 1 and Wildebeestkuil 2) is **Wildebeestkuil Overhead Power Line Corridor Option 1[9]**.

[9] Due to the fact that the power line corridor alternatives for both proposed solar PV plant and power line developments are almost identical in nature and traverse the same properties, a combined comparative assessment of alternatives has been undertaken. The results of the comparative assessment of alternatives are thus applicable to both proposed development (i.e. same power line corridor alternative chosen as "preferred" from a surface water perspective both proposed developments)

7 LEGISLATIVE IMPLICATIONS

In the context of the proposed development impacting on surface water resources, the environmental and water related legislation listed in the sub-sections below are identified to be relevant. The triggered legislation listed is based on the scenarios presented below. It should be noted that both proposed solar PV plant and 132kV power line developments are expected to trigger the same environmental and water related legislation, due to the fact that the proposed developments are identical in nature. Where different environmental and water related legislation is triggered by a specific development, this has been indicated in the sub-sections below.

7.1 National Environmental Management Act, 1998 (No. 107 of 1998) & Environmental Impact Assessment Regulations (2014)

7.1.1 Environmental Impact Assessment Regulations 2014 (as amended), Listing Notice 1, GN. 983, Activity 12

The development of-

(xii) *infrastructure or structures with a physical footprint of 100 m2 or more;*

where such development occurs-

(a) within a watercourse;

(c) if no development setback exists, within 32 m of a watercourse, measured from the edge of a watercourse; -

This activity is only applicable for two (2) of the power line corridor alternatives. Should **Wildebeestkuil Overhead Power Line Corridor Option 2A** and/or **Wildebeestkuil Underground Power Line Corridor Option 2B** be selected as preferred, this activity will be triggered as the power line servitude width of 32m and a minimum length of 365m will need to be established through Natural Depression Wetland 1. This will result in a minimum disturbance footprint of 11 680m².

7.1.2 Environmental Impact Assessment Regulations 2014 (as amended), Listing Notice 1, GN. 983, Activity 19

The infilling or depositing of any material of more than 5 m³ into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 m³ from-

(i) a watercourse;

This activity is only applicable for two (2) of the power line corridor alternatives. Should **Wildebeestkuil Overhead Power Line Corridor Option 2A** and/or **Wildebeestkuil Underground Power Line Corridor Option 2B** be selected as preferred, this activity will be triggered as the power line servitude width of 32m and a minimum length of 365m will need to be established through Natural Depression Wetland 1. This will result in a minimum disturbance footprint of 11 680m². Additionally, the placement of at least one (1) power line tower inside the wetland for **Wildebeestkuil Overhead Power Line Corridor Option 2A** is likely to result in the excavation, removal or moving of soil or rock of more than 5m³ from the wetland. In terms of **Wildebeestkuil Underground Power Line Corridor Option 2B**, trenching through the wetland for the width of the underground cable will result in the excavation, removal or moving of soil or rock of more than 5m³ from the wetland.

7.1.3 Environmental Impact Assessment Regulations 2014 (as amended), Listing Notice 3, GN. 985, Activity 14

The development of –
(xii) infrastructure or structures with a physical footprint of 10 square metres or more;

Where such development occurs –

(a) within a watercourse;

(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of the watercourse;

(e) In North West:
i. Outside urban areas, in:
ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority;

This activity is only applicable for two (2) of the power line corridor alternatives. Should **Wildebeestkuil Overhead Power Line Corridor Option 2A** and/or **Wildebeestkuil Underground Power Line Corridor Option 2B** be selected as preferred, this activity will be triggered as the power line servitude width of 32m and a minimum length of 365m will need to be established through the Natural Depression Wetland 1. This will result in a minimum disturbance footprint of 11 680m².

7.2 National Water Act, 1998 (Act No. 36 of 1998)

As previously mentioned, according to Section 21 of the NWA, the following are considered "water uses" and will require licensing in the form of a water use license application:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in stream flow reduction activity contemplated in Section 36 of the NWA;
e) Engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38(1) of the NWA;
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
h) Disposing of waste in a manner of water which contains waste from, or which has been heated in any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

In terms of the proposed developments, at a minimum water uses c) and i) will be triggered for two (2) of the power line corridor options. Should **Wildebeestkuil Overhead Power Line Corridor Option 2A** and/or **Wildebeestkuil Underground Power Line Corridor Option 2B** be selected as preferred, a water use license application will need to be undertaken as Natural Depression Wetland 1 will be directly affected. Additionally, the site access roads are to be upgraded. The existing access road is likely to be used. The existing access road however routes through Drainage Line 1. As such, upgrade activities in the wetland will trigger water uses c) and i) as well.

Alternatively, should **Wildebeestkuil Overhead Power Line Corridor Option 1** be selected thereby avoiding Natural Depression Wetland 1, and where the access roads are diverted away outside of Drainage Line 1, it may be possible to register for General Authorisation under Government Notice 509 of August 2016 (Notice No. 40229). As per **Section 8**, where the outcome of the assessment of the Risk Assessment Protocol shows that the proposed developments will have a Low Risk it will be possible to register for a General Authorisation. Importantly, these details will need to be confirmed in consultation with the Department of Water and Sanitation (DWS) through a water use license pre-application meeting and site visit.

8 NATURE OF THE POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED DEVELOPMENTS

From a surface water perspective, this section will identify and contextualise each of the potential impacts within the context of the proposed developments and the identified surface water resources. This section will rate these impacts according to an impact rating system (see **Appendix A** for a full methodology and description of the impact rating system), determine the effect of the environmental impact, and provide recommendations towards mitigating the anticipated impact. The identification and rating of impacts will be undertaken for the pre-construction, construction, operation and de-commissioning phase of the proposed developments.

The impacts associated with the two (2) proposed solar PV plants and 132kV power lines are identified and assessed below. It should be noted that due to the fact that the proposed solar PV plants and 132kV power lines are located on the same properties and are identical in nature, the same impacts have been identified for both proposed developments. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants and 132kV power lines. Where impacts and/or mitigation measures are project specific, this has been indicated.

8.1 Pre-construction Phase Potential Impacts

8.1.1 Impacts associated with the Temporary Building Zones

A temporary building zone will be required for the proposed development. The location of the construction lay-down area alternative are within 55m of Artificial Depression Wetland 1. Placing the lay-down area in either alternative location is to result in indirect negative impacts respectively. Indirectly, potential downstream contamination and pollution impacts from stored oils, fuels, and other hazardous substances or materials being transported via run-off are a possibility. Where site clearing for the lay-down area may be required near surface water resources, clearance/removal of vegetation at the surface can leave the downstream surface water resources vulnerable to increased run-off and consequent erosion and sedimentation impacts.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 8** on **page 68**.

8.2 Construction Phase Potential Impacts

8.2.1 Vehicle and Machinery Degradation Impacts

Construction vehicles (heavy and light) will require access to the proposed PV array construction areas as well as tower locations for the proposed power lines or the underground power cable trench. Potential negative impacts can include the need to travel through the delineated surface water resources, thereby resulting in increased and additional physical degradation respectively. Physical degradation in the form of compaction / excavation of soils, potential erosion, consequent sedimentation and general disturbance from vehicle movement is likely. Additionally, drainage into the surface water resources directly or from run-off containing oils, fluids and/or fuels either leaking or spilling from vehicles and machinery is a possibility. Moreover, drainage into the surface water as a result of run-off containing oils, fluids and/or fuels leaked during re-fuelling or servicing in or near the surface water resources is also probability. Should any leakage or spillage occur in and/or near the surface water resources, potential soil/water contamination/intoxication of amphibians, avi-fauna or other organisms frequenting the surface water resources can result. Fuels and oils also pose a fire risk not only to the surface water resources, but also neighbouring grazing lands or nearby settlement areas.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 8** on **page 68**.

8.2.2 Human Degradation of Flora and Fauna associated with the Surface Water Resources

The possibility of human degradation to surface water resources is likely to occur during the construction phase, since construction activities will take place in relative close proximity and directly within (in terms of access roads) to the surface water resources. Human degradation can take the form of physical / direct degradation such as lighting fires (purposefully or accidentally) in or near to the surface water resources. Usage of the surface water resources for sanitation purposes may take place when inundated, resulting in pollution of the surface water resources. The surface water resources may also be utilised as a source of water for domestic use, building and general cleaning purposes.

Fauna associated with surface water resources are often hunted, trapped, killed or eaten. This impact must be prevented. Finally, flora associated with wetlands may need to be cleared or removed for building storage purposes which can result in a loss of resources.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 8** on **page 68**.

8.2.3 Degradation and Removal of Soils and Vegetation associated with the Surface Water Resources

The proposed development may need to take place either directly within the identified and delineated surface water resources as well as within the associated buffer zones. Where removal and/or infill of wetland soils will take place, functionality may be affected in terms of hydrogeomorphic functionality. Moreover, the excavation of any foundations will result in a relatively permanent structure, meaning that the area occupied by the foundation will ultimately result in a degree of permanent habitat and soil loss for the affected surface water resources.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 8** on **page 68**.

8.2.4 Increased Run-off, Erosion and Sedimentation Impacts

Vegetation clearing will need to take place for the construction process. Excessive or complete vegetation clearance in the highly sensitive and nearby surrounding areas is likely to result in exposing the soil and leaving the ground susceptible to wind and water erosion, particularly during and after rainfall events. Due to the climate of the study area and sudden sporadic rainfall, general soil erosion, as a consequence of the proposed development, is a distinct possibility. A further impact due to erosion and storm water run-off impacts is increased sedimentation to the surface water resources. Deposited sediments can smother vegetation and change flow paths and dynamics making affected areas susceptible to alien plant invasion leading to further degradation.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 8** on **page 68**.

8.3 Operation Phase Potential Impacts

8.3.1 Vehicle Damage to the Surface Water Resources

Access roads to the proposed PV fields as well as the proposed power lines during the operation and maintenance phase can physically affect the identified surface water resources. Therefore, it is important that roads are not planned and constructed within any of the surface water resources and/or associated buffer zones. However, where it is not possible to avoid this, the surface water resources will be susceptible to compaction and erosion impacts for the lifecycle of the proposed development leading to long term impacts. Regular vehicle movement in the affected surface water

resources can compact the soil affecting the hydrology of the system. Similarly, regular movement from vehicles can flatten the ground surface making it a preferential flow path for storm water, thereby becoming susceptible to accelerated run-off which may result in progressive erosion. Compaction from vehicles can also create incisions which may induce donga erosion over time.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 8** on **page 68**.

8.3.2 Stormwater Run-off Impacts to Surface Water Resources

The impact of stormwater run-off is primarily related to the types of structures and surfaces that will need to be established for the proposed development. Hard impermeable surfaces and foundations are to be laid for PV arrays, buildings and associated infrastructure. Additionally, where regular movement from vehicles flatten the ground surface making it a preferential flow path for storm water, sediment transportation from hardened gravel surfaces via run-off along internal access and power line service roads can result in increased run-off and sedimentation. In general, flat and hard surfaces aid with the acceleration and generation of run-off which can impact on nearby surface water resources through the onset of erosion due to increased run-off, as well as through the generation of increased sedimentation.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 8** on **page 68**.

8.4 Decommissioning Phase Potential Impacts

8.4.1 Decommissioning Impacts

Should the proposed developments need to be decommissioned, the same impacts as identified for the construction phase of the proposed developments can be anticipated. Similar potential impacts are therefore expected to occur and the stipulated mitigation measures (where relevant) must be employed as appropriate to minimise impacts.

Assessment of the potential negative impacts associated with the decommissioning phase and mitigation measures thereto are provided in **Table 8** on **page 68** below.

Table 8. Rating of Surface Water Impacts for Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildebeestkuil 2 Solar PV Plant and 132kV Power Line (all phases)

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Pre-Construction Phase																				
Artificial Wetland 1 Impacts associated with the Temporary Building Zones	Impacts associated with the Temporary Building Zone within 55m to Artificial Wetland 1	1	3	2	2	2	2	20	-	Low	**Preventing Indirect Erosion, Sedimentation and Run-off Impacts** – In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets can be used to around the lay-down area to prevent run-off flowing into the surrounding area and possibly, any nearby surface water resources. This will additionally assist with preventing consequent erosion and sedimentation in susceptible surrounding areas. **Preventing Water Quality and Soil Contamination Impacts** – All fuels, oils and any other hazardous substances or liquids must be	1	3	1	1	1	1	7	-	Low

											contained in bunded areas of 110% capacity to prevent fuels, oils and any other hazardous substances or liquids contamination in run-off affecting any surface water resources on the study site. Additionally, any fueling and re-fueling activities must also take place over a bunded area of 110% capacity to prevent contamination in run-off entering surface water resources on the study site. Drainage in bunded areas must be removed or drained to capture sumps, grit / oil separators and/or sand filter traps. All vehicles and equipment must be regularly maintained to avoid any oil, fuel or hazardous leaks or spills. Spillage clean up kits must be readily available on site should an incident occur. All leaks and spillages must be cleared as soon as practically possible. A spill contingency plan must be compiled and implemented. All staff must be made aware of this protocol. In addition, soil contingency measures must be provided e.g. oil spill kits and fire extinguishers. Temporary chemical toilets must be provided and must be serviced on a regular basis.								

											Solid waste must be removed on a regular basis as soon as practically possible. **Preventing Fire Risks** – Operational fire extinguishers are to be available in the case of a fire emergency. Given the dry seasons and strong winds that the region experiences, it is recommended that a fire management and emergency plan is compiled. A suitably qualified health and safety officer must compile the fire management and emergency plan for proposed development.									
Construction Phase																				
Natural Depression Wetland 1, Artificial Depression Wetlands 1 & 2 and Drainage Line 1 - Vehicle and Machinery Degradation Impacts	Vehicle and machinery degradation	1	3	2	2	3	3	33	-	Medium	**Preventing Physical Degradation of the Surface Water Resources** – No construction is to take place within 50m nor directly within any of the identified and delineated surface water resources unless absolutely necessary. The delineated surface water resources and associated buffer zones are to be clearly demarcated as highly sensitive, and no access into these areas is to be allowed unless being authorized / licensed to do so. **Limiting Physical Degradation to Surface Water Resources** – Where construction directly within and / or in close proximity (50m) to surface water resources is absolutely required, the relevant environmental authorization	1	2	2	2	3	3	30	-	Medium

										and water licenses must be obtained before construction is allowed to commence. Where obtained, the stipulated conditions and any further mitigation measures are to be adhered to accordingly. Should an Environmental Authorization and / or WUL permit be issued, a single access route or "Right of Way" (RoW) is to be established through or in the desired construction area in the surface water resource(s). The environmentally authorized and water use license permitted construction area is to be demarcated and made clearly visible in conjunction to the RoW. The width of the RoW must be limited to the width of the vehicles required to enter the surface water resources (no more than a 3m width). An area around the locations of the proposed construction area(s) and / or structures (including associated infrastructure) will be required in order for construction vehicles and machinery to operate / maneuver where required. This too must be limited to the smallest possible area and made clearly visible by means of demarcation. Ideally, vegetation should not be cleared across the entire RoW. Rather, only the vehicle tracks should be cleared. Remaining vegetation can be kept trimmed to								

											below 30cm but not lower than 5cm height. As the wetlands can be seasonal, gravel running tracks can be used for stability. The gravel tracks will however need to be removed as soon as construction is complete. No tracks may be crossed in any surface water resource either during or directly after a rainfall event. The affected areas will need to be rehabilitated. A wetland rehabilitation plan will be required. This must be compiled by a suitably qualified wetland specialist. The rehabilitation plan must also be approved by the relevant environmental and water authorities. **Preventing Soil Contamination** – No vehicles are to be allowed in the highly sensitive areas unless authorised. Should vehicles be authorised in highly sensitive areas, all vehicles and machinery are to be checked for oil, fuel or any other fluid leaks before entering the required construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fueling, re-fueling, vehicle and machinery servicing or maintenance is to take place in the highly sensitive areas. The construction site is to contain sufficient spill contingency measures throughout the construction								

											process. These include, but are not limited to, oil spill kits to be available, fire extinguishers, fuel, oil or hazardous substances storage areas must be bunded to prevent oil or fuel contamination of the ground and / or nearby surface water resources or the associated buffer zone.									
Natural Depression Wetland 1, Artificial Depression Wetlands 1 & 2 and Drainage Line 1- Human Degradation of Flora and Fauna associated with the Surface Water Resources	Human degradation to fauna and flora associated with the surface water resources	1	3	1	2	2	2	18	-	Low	**<u>Minimising Human Physical Degradation of Surface Water Resources</u>** – Construction workers are only allowed in the designated construction areas and not into the surrounding surface water resources. Highly sensitive areas are to be clearly demarcated and made clearly visible prior to the commencement of construction and no access beyond these areas is to be allowed to construction workers unless in RoW areas. In general, no animals on the construction site or surrounding areas are to be hunted, captured, trapped, removed, injured, killed or eaten. Should any party be found guilty of such an offence, stringent penalties should be imposed. However, where animals (including snakes and reptiles) pose a threat to the safety of workers, the appointed environmental control officer (ECO) is to be contacted for removal thereof. No animals that are removed are allowed to be killed.	1	1	1	1	1	1	5	-	Low

											Removed animals must be relocated a safe distance from the RoW in close proximity to where they were found. No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must not be placed within any surface water resource and / or the associated buffer zone. Temporary sanitation facilities must rather be placed at least 100m from the surface water resources where these are required. Temporary chemical sanitation facilities must regularly cleaned and adequately maintained (checked for leaks) to prevent pollution impacts. No water is to be abstracted unless a water use license is granted for specific quantities for a specific water resource or abstraction is within Schedule 1 water uses in terms of the NWA. No hazardous or building materials are to be stored or brought into the highly sensitive areas. Should a designated storage area be required, the storage area must be placed at the furthest location from the highly sensitive area. Appropriate safety measures as stipulated above must be implemented.								

											No cement mixing is to take place directly in the surface water resources or the associated buffer zones. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Importantly, no mixing of cement directly on the surface is allowed in the highly sensitive areas.									
Natural Depression Wetland 1, Artificial Depression Wetlands 1 & 2 and Drainage Line 1 - Degradation and Removal of Soils and Vegetation associated with the Surface Water Resources	Degradation and removal of soils and vegetation associated with the surface water resources	1	3	3	2	3	3	36	-	Medium	**<u>Avoiding Direct Impacts to Surface Water Resources</u>** – The preferred power line corridor alternatives should be selected as the preferred alternatives for the environmental authorisation process in order to avoid direct impacts to the relevant surface water resources. Should the preferred corridor alternatives not be selected as preferred and construction will be required directly within surface water resources the necessary Environmental Authorization and / or WUL permit must be obtained prior to construction. Accordingly, in this scenario, the permitted construction area is to be established as a RoW area, as described in **Sections 8.2.1** and **8.2.2**. **<u>Preservation of Surface Water Resources as a Result of Powerline Construction</u>** – For **Wildebeestkuil**	1	2	3	2	3	2	22	-	Low

											Overhead Power Line Corridor Option 2A, excavations for power line towers (where authorised and permitted) must be undertaken by hand as far as practically possible to limit vehicles inside of the surface water resources. Where any soils are to be removed from surface water resource areas, these are to be stockpiled. Top soil must be stockpiled separately from the sub-soil types. All soil stockpiles from general construction activities in or within 50metres from the delineated surface water resource must be adequately bunded by suitable materials. Bunding materials can include a brick layer (three bricks in height) boundary around the soil stockpile. Alternatively, wooden planks approximately 40-50cm high fixed with pegs can be used. Sand bags may also potentially be used. This will prevent soil run-off and potential sedimentation pollution (environmental incident) impacting on the surface water resource. For **Wildebeestkuil Underground Power Line Corridor Option 2B, Limiting Removal of Excavated Soils** – Where the underground cable is to be constructed in the within Natural Depression Wetland 1 and the associated buffer zone, excavated topsoils should be stockpiled								

											separately from subsoils so that it can be backfilled in the correct soil horizon order for rehabilitation purposes. Wetland soils must not be removed unless there is a surplus. The soils are therefore to be re-used when back filling. Should there be a surplus of soils after backfilling has taken place, these should be taken to a registered landfill site that has sufficient capacity to assimilate the spoil. The topsoil is to be used for rehabilitation purposes and must not be removed from the site. It is critical that when the soils are reinstated, the subsoils are to be backfilled first followed by the topsoil. Topsoils (first 300mm of soil) will therefore need to be stockpiled separately from sub-soils. The topsoil contains a natural seedbank from which the affected wetlands, riparian habitat and buffer zone can naturally rehabilitate. Where the soils are excavated from the sensitive areas, it is preferable for them to be stockpiled adjacent to the excavation trench to limit worker/vehicle and any other movement activities around the excavation areas. From a safety perspective, potential mud slides can occur during construction activities in wet weather which must be avoided. The stockpiled soils adjacent the								

											trench will however require bunding of suitable materials to prevent erosion and sedimentation into the wetland itself. It is recommended that sand bags of sufficient height are pegged at the foot of the stockpiles to perform the dual role of preventing sedimentation and act as a supporting structure. Stockpiles are not to exceed 1.2m to prevent collapse potential. **Rehabilitation of RoW Areas** – Ideally, the affected RoW zones in the sensitive areas must be re-instated with the soils removed from the surface water resource(s), and the affected areas must be levelled, or appropriately sloped and scarified to loosen the soil and allow seeds contained in the natural seed bank to re-establish. However, given the aridity of the study area, it is likely that vegetation recovery will be slow. Rehabilitation areas will need to be monitored for erosion and invasion of alien vegetation species until re-growth can establish where prevalent.									
Natural Depression Wetland 1, Artificial Depression Wetlands 1 & 2 and Drainage Line 1 - Increased Run-off, Erosion and	Increased storm water run-off, erosion and increased sedimentation impacting on the surface water resources	1	3	2	3	2	3	33	-	Medium	**Preventing Increased Run-off and Sedimentation Impacts** – Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future.	1	4	1	2	1	1	9	-	Low

Sedimentation Impacts											An appropriate storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas. In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets can be used to prevent erosion in susceptible construction areas. All impacted areas are to be adequately sloped to prevent the onset of erosion. Importantly, special attention must be given and implemented at the recommendation of the ECO for site specific erosion, sedimentation and run-off mitigation measures at the edge of the buffer zones of the surface water resources if and where required.									
Operational Phase																				
Natural Depression Wetland 1, Artificial Depression Wetlands 1 & 2 and Drainage Line 1 -	Vehicle damage to the surface water resources	1	3	2	2	3	3	33	-	Medium	**Minimising Vehicle Damage to Surface Water Resources** – Potential impacts can be completely avoided by the routing of access and service roads outside of and away from the	1	1	1	1	3	1	7	-	Low

Vehicle Damage to the Surface Water Resources											surface water resources and the associated buffer zones. The existing road on the study site will therefore need to be re-aligned as it currently routes through Drainage Line 1 and is within the buffer zone of Artificial Depression Wetland 1. However, where access through the surface water resources are unavoidable and absolutely required, it is recommended that any road plan and associated structures be submitted to the relevant environmental and water departments for approval prior to implementation. The access roads that are environmentally authorised and have been permitted in terms of water use licensing in the surface water resources will have to be regularly monitored and checked for erosion. Monitoring should be conducted once every month in the rainy season (October to March). Additionally, after short or long periods of heavy rainfall or after long periods of sustained rainfall, the roads will need to be checked on an *ad hoc* basis for erosion. Rehabilitation measures will need to be employed should erosion be identified.									

											Where erosion begins to take place, this must be dealt with immediately to prevent significant erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required. Input, reporting and recommendations from a suitably qualified wetland/surface water specialist must be obtained in this respect.									
Natural Depression Wetland 1, Artificial Depression Wetlands 1 & 2 and Drainage Line 1 - Stormwater Run-off Impacts to Surface Water Resources	Impermeable and hardened surfaces creating accelerated run-off, consequent erosion and sedimentation	1	3	2	2	3	3	33	-	Medium	Any hardstand area or building within 50m proximity to a surface water resource must have energy dissipating structures in an appropriate location to prevent increased run-off and sediments contained in the run-off entering adjacent areas or surface water resources. This can be in the form of hard concrete structures or soft engineering structures (such as grass blocks for example). Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off and sediment entering adjacent areas or surface water resources.	1	2	2	2	3	1	10	-	Low
Decommissioning Phase																				
Should the proposed developments need to be decommissioned, the same impacts as identified for the construction phase of the proposed developments can be anticipated. Similar potential impacts are therefore expected to occur and the stipulated mitigation measures (where relevant) must be employed as appropriate to minimise impacts.																				

8.5 Cumulative impacts

The area has seen a notable interest from developers of various renewable energy projects, which could be associated with the solar energy resource potential found in the region, proximity to the existing sub-station and its evacuation capacity, as well as other factors. Such developments, whether already approved or only proposed, need to be considered as they have the potential to create numerous cumulative impacts, whether positive or negative, if implemented. **Table 9** lists the projects that will need to be considered when examining the cumulative impacts.

Table 9: Proposed Renewable Energy Projects in the Area

Proposed Development	Reference Number	Current Status of BA / EIA	Proponent	Proposed Capacity	Farm Details
Leeuwbosch 1 Solar PV Plant Project	TBA	BA ongoing	Leeuwbosch PV Generation (Pty) Ltd	9.9MW	Farm Leeuwbosch 44
Leeuwbosch 2 Solar PV Plant Project	TBA	BA ongoing	Leeuwbosch PV Generation (Pty) Ltd	9.9MW	Farm Leeuwbosch 44
Wildebeestkuil 1 Solar PV Plant Project	TBA	BA ongoing	Wildebeestkuil PV Generation (Pty) Ltd	9.9MW	Farm Wildebeestkuil 59
Wildebeestkuil 2 Solar PV Plant Project	TBA	BA ongoing	Wildebeestkuil PV Generation (Pty) Ltd	9.9MW	Farm Wildebeestkuil 59
Bokamoso Solar Energy Facility	14/12/16/3/3/2/559	Project has received environmental authorisation	SunEdison	75MW	A portion of the farm Matjesspruit 145,

Although it is important to assess the site specific surface water impacts of the proposed solar PV plants, 132kV power lines and the associated components, it is equally important to assess the potential cumulative surface water resources impact that could materialise in the area should other renewable energy facilities be constructed. Cumulative impacts are the impacts, which combine from different developments / facilities and result in significant impacts that may be larger than the sum of all the impacts combined.

In the context of the proposed developments, surrounding renewable energy projects include a number of developments to the east and west of the site (**Figure 25** and **Figure 26**). No other renewable energy developments are known to be in the surrounding area.

With the other Solar Energy Facilities located a relatively considerable distance from the proposed developments' study site, direct and indirect surface water impacts will be negligible. No wetlands will be lost as a result of the renewable energy projects proposed. The cumulative loss of wetlands is therefore negligible.

In consideration of the nearby Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant (part of separate respective BA processes), indirect impacts in terms of increased run-off, sedimentation and erosion may potentially be expected. However, none of the surface water resources appear to be hydrologically connected. Downstream impacts are therefore unlikely. Additionally, aside from the distance (approximately 1km) which separates the two renewable energy developments, the R502 and existing railway line acts as a barrier between the two project sites.

In light of the above, it is not expected that the cumulative impacts will be significant in so far as the mitigation measures are implemented, and the surface water resources are not affected, degraded or lost.

Thus no impact assessment has been undertaken, as no cumulative impact is likely.

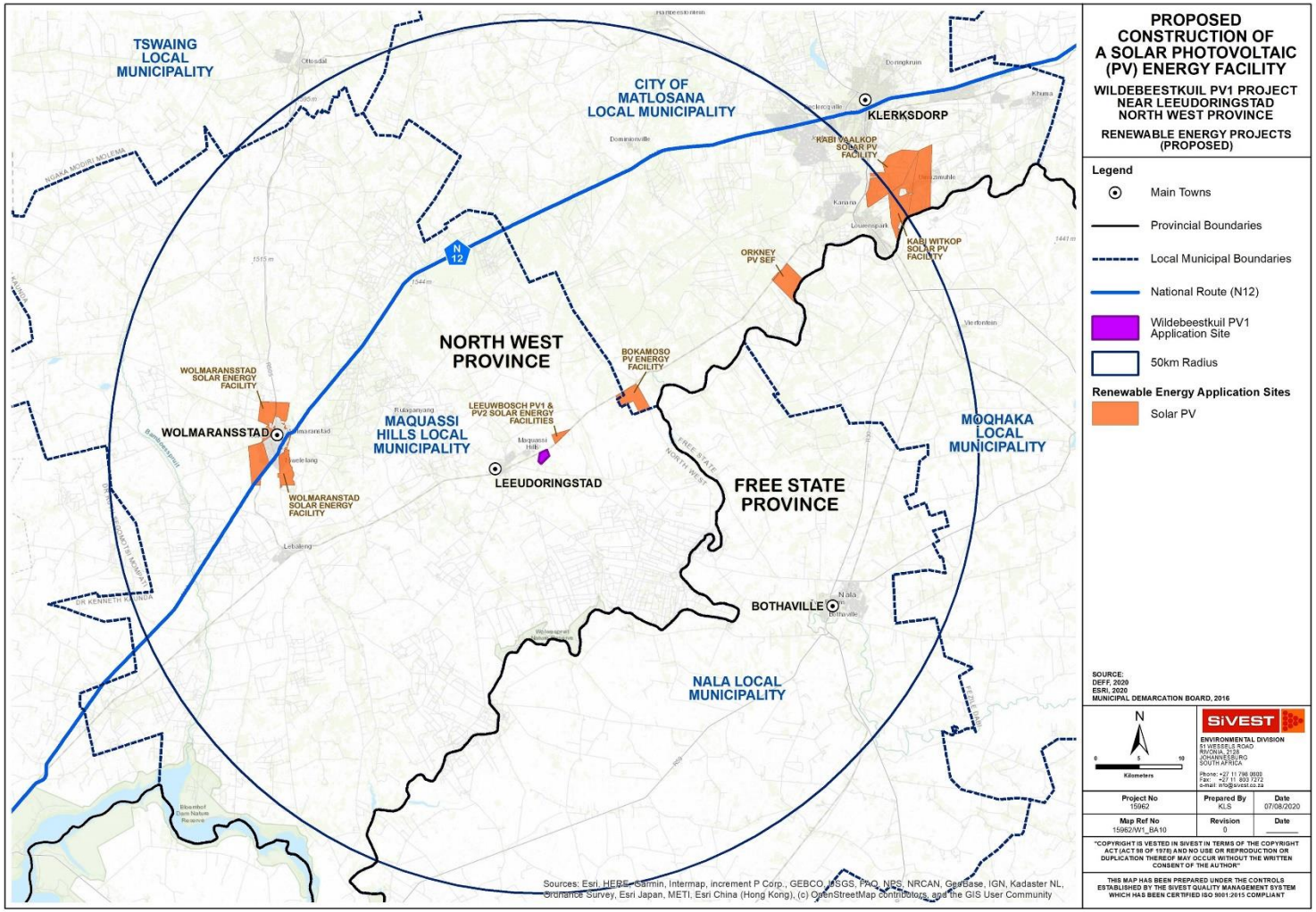

Figure 25: Surrounding Renewable Energy Projects Map – Wildebeestkuil 1 Solar PV Plant and 132kV Power Line

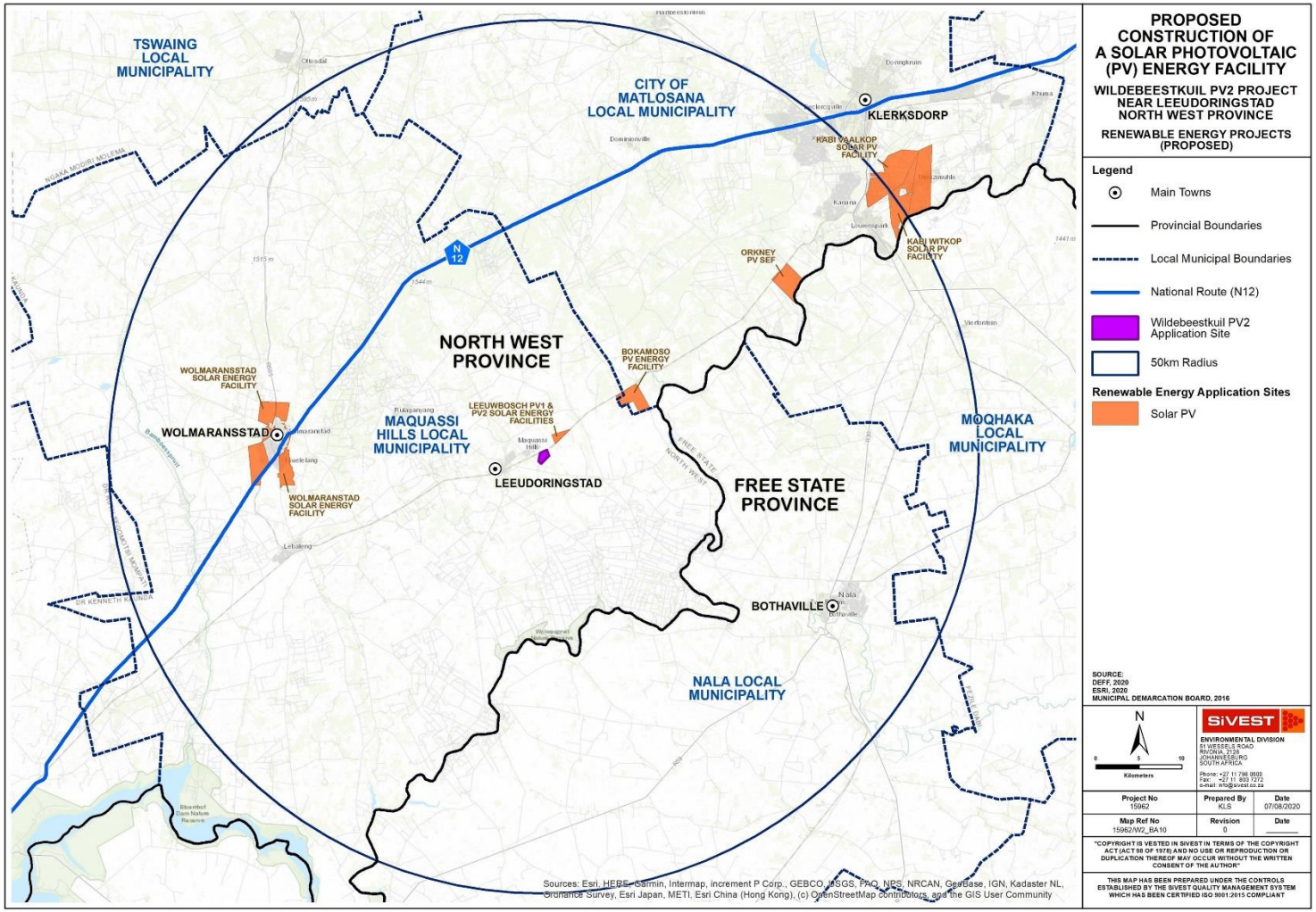

Figure 26: Surrounding Renewable Energy Projects Map - Wildebeestkuil 2 Solar PV Plant and 132kV Power Line

9 SPECIALIST RECOMMENDATIONS AND RISK ASSESSMENT

It is recommended that both the proposed Wildebeestkuil 1 Solar PV Plant and 132kV Power Line & Wildbeestkuil 2 Solar PV Plant and 132kV Power Line be granted environmental authorization. Mitigation measures stipulated (where applicable) will need to be implemented where the necessary environmental authorization and water use license is obtained.

It is strongly recommended that the preferred power line options (namely Option 1) are presented as the preferred alternatives for the environmental authorization process. Where this is not possible, the more intensive mitigation measures stipulated will need to be implemented where the necessary environmental authorization and water use license is obtained.

The existing site access roads currently routes through Drainage Line 1 and is in the buffer zone of Artificial Depression Wetland 1 on the study site. It is highly recommended that the access route is re-aligned outside of all the delineated surface water resources as well as the associated buffer zones where possible. Should this not be possible, the more intensive mitigation measures stipulated will need to be implemented where the necessary environmental authorization and water use license are obtained.

All the identified triggered activities and water uses identified in **Section 7** should be confirmed with the relevant government authoritative departments.

The risk assessment matrix is attached as **Appendix D**, and notes that all risks are considered Low, and appropriate mitigation measures have been proposed.

10 CONCLUSIONS

A surface water delineation and impact assessment is provided in this report for the proposed solar PV developments. Findings were based on a method for delineating wetlands and riparian habitats as per the **Department of Water Affairs and Forestry 2005** guidelines. Ultimately, it was found that there are two (2) Artificial Depression Wetlands, one (1) Drainage Line and one (1) Natural Depression Wetland within the study site and the proposed power line corridors[10].

[10] It should be noted that a combined report has been compiled for both the proposed Wildbeestkuil 1 Solar PV Plant & 132kV Power Line and Wildebeestkuil 2 Solar PV Plant & 132kV Power Line. This is due to the fact that the proposed solar PV plants and 132kV power line corridors are located on the same properties, are identical in nature and have the same associated impacts and recommended mitigation measures. Where certain findings and/or mitigation measures are project specific, this has been indicated in the relevant section of this report.

A present ecological status (PES) determination was undertaken for Natural Depression Wetland 1. Accordingly, the PES of Natural Depression Wetland 1 was categorised to have an overall PES – D (Largely Modified).

The wetland ecosystem services and environmental sensitivity and importance were assessed and provided for Artificial Depression Wetlands 1 and 2 as well as Natural Depression Wetland 1. These assessments were undertaken to determine their functionality and sensitivity. With regards to the potential wetland ecosystems services provided by each wetland, Artificial Depression Wetland 1 scored highest was in terms of sediment trapping followed closely by phosphate trapping, erosion control and flood attenuation. Artificial Depression Wetland 2 scored highest in terms of erosion control, with other potential wetland ecosystem services provided at a slightly lower degree including sediment trapping, phosphate trapping, flood attenuation, maintenance of biodiversity and toxicant removal. For Natural Depression Wetland 1, the potential wetland ecosystem service provided which scored highest includes sediment trapping. The sediment trapping function of this wetland can be said to be one of the primary functions of an endorheic wetland. Other potential wetland ecosystem services provided at a slightly lower degree include phosphate trapping and erosion control. This is closely followed by toxicant control and nitrate removal. Other potential wetland ecosystem services which could potentially be provided, which scored to a lesser degree, include flood attenuation, education and research, tourism and recreation, natural resources and maintenance of biodiversity.

The EISC for the surface water resources were determined. The results were as follows:

- Natural Depression Wetland 1 was categorised as a Class C (Moderate);
- Artificial Depression Wetland 1 was categorised as a Class C (Moderate); and
- Artificial Depression Wetland 2 was categorised as a Class B (High).

The **Department Of Water Affairs (2014)** database shows that the nearby Leeudoringspruit is classified as having a PES: B (Largely natural), EI: Moderate and ES: Moderate. This watercourse will not be directly impacted by the proposed developments as is it located approximately 150m from the study site.

The functional assessments undertaken were used to inform a 50m buffer zone that was applied to the identified surface water resources.

In terms of potentially applicable environmental and water related legislation, several listed activities and water uses have been identified that are likely to be applicable to the proposed developments. Accordingly, in terms of National Environmental Management Act (1998) and the EIA Regulations (2014), Activities 12 and 19 of Government Notice 983, and Activity 14 of Government Notice 985 have been identified as being applicable based on the scenarios presented in the sub-section. With respect to the National Water Act (1998), water uses (c) and (i) are also

applicable where stipulated. The aforementioned identified environmental listed activities and water uses should however be confirmed in consultation with the relevant government departments.

Foreseen potential negative impacts in terms of the pre-construction, construction, operation and decommissioning phases of the proposed developments were identified and assessed. Mitigation measures have been stipulated and must be included and implemented as part of the respective Environmental Management Programmes (EMPrs) for the proposed developments. Due to the fact that the proposed solar PV plants and power line corridors are located on the same properties and are identical in nature, the same impacts have been identified for both proposed solar PV plants and 132kV power lines. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants and 132kV power lines. The impacts for each phase of the proposed developments are summarised as follows:

PRE-CONSTRUCTION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**
Temporary Building Zone	- 20 (low negative)	- 7 (low negative)
CONSTRUCTION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**
Vehicle and Machinery Degradation	- 33 (medium negative)	- 30 (medium negative)
Human Degradation of Flora and Fauna associated with the Surface Water Resources	- 18 (low negative)	- 5 (low negative)
Degradation and Removal of Soils and Vegetation associated with the Surface Water Resources	- 36 (medium negative)	- 22 (low negative)
Increased Run-off and Sedimentation	- 33 (medium negative)	- 9 (low negative)
OPERATION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**
Vehicle Damage to the Surface Water Resources	- 33 (medium negative)	- 7 (low negative)
Stormwater Run-off Impacts to Surface Water Resources	- 33 (medium negative)	- 10 (low negative)

It is not anticipated that the proposed developments will need to be decommissioned. However, should this need to take place, all relevant identified potential construction impacts will be applicable

and the relevant mitigation measures must be implemented as far as practically possible and where applicable.

For cumulative potential impacts, surrounding renewable energy projects are located a relatively considerable distance from the proposed developments' study site and direct and indirect surface water impacts will be negligible. In consideration of the nearby Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant (part of separate respective BA processes), indirect impacts in terms of increased run-off, sedimentation and erosion may potentially be expected. However, none of the surface water resources appear to be hydrologically connected. Downstream impacts are therefore unlikely. Additionally, aside from the distance (approximately 1km) which separates the two renewable energy developments, the R502 and existing railway line acts as a barrier between the two project sites. In light of the above, it is not expected that the cumulative impacts will be significant in so far as the mitigation measures are implemented, and the surface water resources are not affected, degraded or lost.

Finally, in terms of final specialist recommendations, it is strongly recommended that the preferred power line option (namely Option 1) is presented as the preferred alternatives for the environmental authorization process. Where this is not possible, the more intensive mitigation measures stipulated will need to be implemented where the necessary environmental authorization and water use license is obtained.

The existing site access roads currently routes through Drainage Line 1 and is in the buffer zone of Artificial Depression Wetland 1 on the study site. It is highly recommended that the access route is re-aligned outside of all the delineated surface water resources as well as the associated buffer zones where possible. Should this not be possible, the more intensive mitigation measures stipulated will need to be implemented where the necessary environmental authorization and water use license are obtained. Please note that the crossing of the wetland by the road is not a fatal flaw.

The risk assessment matrix is attached as **Appendix D**, and notes that all risks are considered Low, and appropriate mitigation measures have been proposed.

Finally, all the identified triggered activities and water uses identified should be confirmed with the relevant government authoritative departments.

Based on the findings above, with the implementation of the control and mitigation measures stipulated herein, it is the opinion of the specialist that the proposed development may proceed.

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Appendix A:

Impact Rating Methodology

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 1**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		

1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.**		

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report. The excel spreadsheet template can be used to complete the Impact Assessment.

Table 2: Rating of impacts template and example

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Vegetation and protected plant species	Vegetation clearing for access roads, turbines and their service areas and other infrastructure will impact on vegetation and protected plant species.	2	4	2	2	3	3	39	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	4	2	1	3	2	24	-	Low

Operational Phase																				
Fauna	Fauna will be negatively affected by the operation of the wind farm due to the human disturbance, the presence of vehicles on the site and possibly by noise generated by the wind turbines as well.	2	3	2	1	4	3	36	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	2	2	1	4	2	22	-	Low
Decommissioning Phase																				
Fauna	Fauna will be negatively affected by the decommissioning of the wind farm due to the human disturbance, the presence and operation of vehicles and heavy machinery on the site and the noise generated.	2	3	2	1	2	3	30	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	2	2	1	2	2	18	-	Low

Cumulative																				
Broad-scale ecological processes	Transformation and presence of the facility will contribute to cumulative habitat loss and impacts on broad-scale ecological processes such as fragmentation.	2	4	2	2	3	2	26	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	3	2	1	3	2	22	-	Low

CURRICULUM VITAE

Name	Stephen Burton
Profession	Environmental Scientist
Name of Firm	SiVEST SA (Pty) Ltd
Present Appointment	Environmental Scientist: Environmental Division
Years with Firm	12 Years
Date of Birth	12 January 1979
ID Number	7901125138083
Nationality	South African

Education

- Matric Exemption (Natal Education Department)
- Maritzburg College, PMB, KZN (1991 – 1996)

Professional Qualifications

- B.Sc. (Zoology 2002), University of Natal PMB, KZN
- B.Sc. Honours (Zoology 2003), University of Natal PMB, KZN
- M.Sc. (Zoology 2006), University of KwaZulu-Natal PMB, KZN
- Pr.Sci.Nat. Registration No. 117474

Membership to Professional Societies

International Association for Impact Assessment South Africa (IAIAsa)
South African Council for Natural Scientific Professions (SACNASP) Pr. Sci. Nat. Reg No. 117474

Employment Record

April 2008 – present	SiVEST SA (Pty) Ltd: Environmental Division - Environmental Scientist
May 2007 – March 2008	UDIDI Project Development Company: Environmental Planner

Language Proficiency

LANGUAGE	SPEAK	READ	WRITE
English	Fluent	Fluent	Fluent
Afrikaans	Good	Good	Good

Years of Experience: 13 Years

Fields of Specialisation

- Environmental Science
- Zoology (specifically Ornithology and Mammology)
- Entomology and Wetland Ecology.

CURRICULUM VITAE

Stephen Burton

Skills

- Evaluation of Biodiversity
- Management Recommendations
- Scoping Reports and Environmental Impact Assessments
- Bird Identification
- Grass Identification
- Tree Identification
- Mammal Identification
- Wetland Ecology
- Wetland Delineation
- Wetland Functionality Assessments
- Wetland Rehabilitation Plans
- GIS Package Skills, particularly ESRI products
- Statistical Package Skills, particularly STATISTICA, PDAP and R-Statistics.

Overview

Stephen has completed a Bachelor of Science Degree with a Zoology Major (University of Natal, PMB), as well as a Bachelor of Science (Honours) in Zoology (University of Natal, PMB). Stephen has also completed a Master of Science Degree in Zoology (University of KwaZulu-Natal, PMB). This post-graduate degree was fieldwork and lab based and provided practical experience in conceptualising, planning, modelling and executing of a project.

Stephen has been involved in consulting since May 2007, which included scoping reports, environmental management plans, integrated management plans, rezoning applications, development facilitation act applications, basic assessment reports, environmental impact reports and strategic environmental assessments. He has been involved in a number of faunal assessments for developments ranging from power lines and water pipelines, to housing developments and light industrial developments. In addition, Stephen has undertaken a number of wetland assessments, and wetland rehabilitation plans, for developments ranging from pipelines through housing and industrial developments.

Since Joining SiVEST Environmental Division in April 2008, Stephen has been involved in a number of projects ranging from Environmental Management Planning for Eskom Power lines to the writing up of scoping reports and environmental impact reports for various projects, and the auditing of Eskom Power lines, district roads and Umgeni Water pipelines and dams. In addition, he has developed specialist skills in faunal and wetland assessments for a range of development types.

Projects Experience

April 2008 – present

WETLAND ASSESSMENTS AND REHABILITATION PLANS

- Hendrina Wind Energy Farm Wetland Assessment
- Umgeni Water Waste Water Treatment Works Offset study
- Leeuwberg Wind Energy Farm Wetland Assessment
- Signal Hill Housing Wetland Assessment
- Umsobomvu Solar Energy Wetland Assessment
- Shayamoya Housing Wetland Assessment
- Rockdale Wetland Assessment
- Tooverberg Wind Energy Farm
- Sibaya Node 5 Development
- Transnet Wetland Functionality and Biodiversity Assessment for Port of Richards Bay

- Cornubia Rem 68 Development
- Dube Tradeport State of the Environment Report
- Eshowe SSA1 Bulk Water Supply Scheme
- Umgeni Water Waste Water Treatment Plant Offsets
- Osizweni Industrial Development
- Bishopstowe Strategic Environmental Assessment
- Ezaheni D Housing Development
- Izinga Phase 3 Residential Development Amendment
- Dannhauser Bulk Water Supply
- Transnet Richards Bay Port Wetland Assessment
- Raisethorpe Canal Phase 2
- Mimosadale Bulk Water Supply
- Greater Edendale EMF
- Shemula Phases 2-6 Pipeline
- Sumitomo New Rubber Plant
- Riverside Cemetery Development
- DTP Support Zone 2 Development
- Wosiyane/Swayimane Pipeline
- IRPTN Corridor 4 Development
- Sibaya Development
- Cornubia North Development
- Tinley Manor North Development
- Izinga Phase 3 Development
- Nonoti-Zinkwazi Development
- Zimbali Estate Properties
- Mthandeni Irrigation Scheme
- Strode Property Development
- Ethekwini Integrated Rapid Public Transport Network Corridor 9
- D1562 Road Upgrade
- Cornubia Phase 2 Development
- Compensation Flats Development
- Zimbali Estate Development
- Mandeni Cemetery
- Fairmont Hotel
- Tinley Manor South Development
- Maidstone Mill Development
- Mnambithi Substation and Powerline
- Nquthu Town Erf 16 & 17 Development
- Goswell Platform Development - Cato Ridge
- Driefontein Pipeline Route - Ladysmith
- Blaaubosch Housing Development - Newcastle
- Madadeni Housing Development - Newcastle
- Hyde Park Country Estate
- Newcastle Municipality New Cemetery Sites

FAUNAL ASSESSMENTS

- Umlaas Gate Faunal Assessment
- Ntunjambili Bulk Water Supply Scheme
- In-depth specialist studies (including faunal) for Port of Richards Bay
- Kassier Road North Mixed Use Development
- Transnet Richards Bay Port Faunal Assessment
- Greater Edendale EMF

- Shemula Phase 2-6 Pipeline
- Milky Way Shopping Centre Development
- Dudley Pringle Development
- Lindokuhle Housing Development
- Shongweni Bulk Water Pipeline
- Ethekwini Integrated Rapid Public Transport Network Corridor 1
- Ethekwini Integrated Rapid Public Transport Network Corridor 3
- Ethekwini Integrated Rapid Public Transport Network Corridor 9
- Newcastle Municipality New Cemetery Sites
- Shongweni Mixed-Use Development
- Nonoti Beach Tourism Development
- Proposed Shoprite & Checkers Distribution Centre Development, Marianhill
- Proposed Cornubia Development, Umhlanga
- Lower Tugela Bulk Water Supply Scheme Extension
- Proposed Redcliffe Housing Development in Ethekwini Municipality

AVI- FAUNAL ASSESSMENTS

- Proposed High Voltage Powerline to Cygnus Substation, Empangeni
- Proposed High Voltage Powerline between Corinth and Lamington Substations, Underberg
- Proposed High Voltage Powerline between Corinth and Mzongwana Substations

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

Basic Assessments (BAs) for the Proposed Development of the 9.9MW Wildebeestkuil 1 and Wildebeestkuil 2 Solar Photovoltaic (PV) Plants, 132kV Power lines and associated infrastructure near Leeudoringstad in the North West Province, Maquassi Hills Local Municipality in the Dr Kenneth Kaunda District Municipality.

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:	SiVEST SA			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)		Percentage Procurement recognition	
Specialist name:	Stephen Burton			
Specialist Qualifications:	BSc, BSc Hons, MSc			
Professional affiliation/registration:	Pr.Sci.Nat. (reg No. 117474)			
Physical address:	170 Peter Brown Drive, Montrose, 3201			
Postal address:				
Postal code:	3201	Cell:	083 795 2804	
Telephone:	033 347 1600	Fax:	033 347 5762	
E-mail:	stephenburtonza@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Stephen Burton, 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

SiVEST SA (Pty) Ltd

Name of Company:

26 February 2021

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Stephen Burton, 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

SiVEST SA (Pty) Ltd

Name of Company

26 February 2021

Date

28/02/2021

Signature of the Commissioner of Oaths

Date

CERTIFIED A TRUE COPY OF THE ORIGINAL

.....

GUSTAF SWART
PROFESSIONAL LAND SURVEYOR PLS 1444
COMMISSIONER OF OATHS
UNIT 9 101 OCEAN DRIVE
SHAKA'S ROCK. DOLPHIN COAST 4399
TEL: 082 828 2198

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Drainage Lines
Risk Matrix (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)
Project Name: 15962 Leeudoringstad PV Arrays and Infrastructure
Name and Registration No. of SACNASP Professional Member: Stephen Burton Registration number - 117474

					Severity																	
No.	**Phases**	**Activity**	**Aspect**	**Impact**	**Flow Regime**	**Physico-Chemical (Water Quality)**	**Habitat (Geomorphology+ Vegetation)**	**Biota**	**Severity**	**Spatial Scale**	**Duration**	**Consequence**	**Frequency of Activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance Risk Rating**	**Confidence Level**	**Control Measures**	**Borderline LOW MODERATE Rating Classes**	**PES and EIS of Watercourse**
1	**Construction Phase**	**Clearance of Vegetation and Levelling in the Local Catchment for PV array, Operation and Maintenance Buildings:** Limited clearance of vegetation on the study site will affect catchment level roughness and increased storm water run-off rates and volumes.	Water Quality	Sedimentation during construction.	1.5	2	2	1	1.625	2	2	5.625	2	2	1	2	7	39.375	High	- Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not additional areas where construction will only take place in the future. - Adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the PV array bases are to be used where necessary to prevent run-off containing sediment entering the watercourse as well as potential erosion in susceptible areas near to the watercourse and the associated buffer zone. - An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
			Watercourse Hydrology	Change in flow rate during construction. Change to hydrology of the watercourse during construction.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the PV array bases can be used where necessary to prevent run-off containing sediment entering the watercourses as well as potential erosion in susceptible areas near to the watercourses and the associated buffer zones.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
2		**Possible Leakage, Spills of Fuel, Oil and other Hazardous Substances:** Fuel, oils and other hazardous substances entering the downstream watercourse via storm water run-off.	Water Quality	Vehicles and machinery my leak oil which can accumulate in storm water run-off generated on the construction site and enter the watercourse downstream. Additionally, stored fuels, oils and other hazardous substances may leak from storage areas and enter the downstream watercourse via storm water run-off.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	Medium	-All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourses and the associated buffer zones, unless such storage is unavoidable and approved by the ECO. Where these items are stored within 100m from the full extent of the watercourse, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. -All vehicles and machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourses and the associated buffer zones. -The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited to) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. -No cement mixing is to take place in the watercourse or the associated buffer zones. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in readymix vehicles. Importantly, no mixing of cement or concrete directly within the watercourse and associated buffer zone.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
3	**Operation Phase**	**Increased Hardened Surfaces in the Local Catchment due to PV array bases:** With the development of the PV array and Associated Infrastructure, there will an increase in hard impermeable surfaces which will affect catchment level dynamics including surface roughness and increased storm water run-off rates and volumes.	Water Quality	Sedimentation during operation.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures, where required, must be put into place to deal with increased/accelerated run-off and associated sediment volumes. The use of energy dissipating structures where required to prevent increased run-off and sediments contained in the run-off entering the watercourse can be used. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
			Watercourse Hydrology	Change in flow rate during operation. Change to hydrology of the watercourse during operation.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures, where required, must be put into place to deal with increased/accelerated run-off and associated sediment volumes. The use of energy dissipating structures where required (preferably surrounding the PV array bases and access roads) to prevent increased run-off and sediments contained in the run-off entering the watercourse can be used. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)

Drainage Lines
Risk Matrix (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)
Project Name: 15962 Leeudoringstad Grid Connections
Name and Registration No. of SACNASP Professional Member: Stephen Burton Registration number - 117474

					Severity																	
No.	**Phases**	**Activity**	**Aspect**	**Impact**	**Flow Regime**	**Physico-Chemical (Water Quality)**	**Habitat (Geomorphology+ Vegetation)**	**Biota**	**Severity**	**Spatial Scale**	**Duration**	**Consequence**	**Frequency of Activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance Risk Rating**	**Confidence Level**	**Control Measures**	**Borderline LOW MODERATE Rating Classes**	**PES and EIS of Watercourse**
1	**Construction Phase**	**Stringing of Power lines in the extent of the Watercourse:** Disturbance to the soils and vegetation will take place where stringing of the power lines is undertaken within the extent of the watercourse.	Water Quality	Physical disturbance to the soils and vegetation within the servitude of the power lines in the extent of the watercourse.	1	1	2	2	1.5	2	2	5.5	1	1	1	3	6	33	High	--Stringing of the power line (pilot line) is to be undertaken by hand and walked through the extent of the watercourse within the servitude of the power line. No disturbance or entry by workers outside of the servitude in the extent of the watercourse is allowed. -Alternatively, the pilot line can be pulled around the extent of the watercourse by vehicle if the pilot line does not damage any vegetation within the extent of the watercourse. Importantly, no vehicle movement is allowed within the extent of the watercourse. -The extent of the servitude must be demarcated and visible to workers when undertaking the stringing of the power lines through the extent of the watercourse to prevent prohibited entry into the extent of the watercourse.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
2		**Clearance of Vegetation and Levelling in the Local Catchment for the Substation and pylons:** Limited clearance of vegetation on the study site will affect catchment level roughness and increased storm water run-off rates and volumes.	Water Quality	Sedimentation during construction.	1.5	2	2	1	1.625	2	2	5.625	2	2	1	2	7	39.375	High	- Vegetation clearing must take place in a phased manner, only clearing areas where construction will take place and not additional areas where construction will only take place in the future. - Adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the substation and pylons are to be used where necessary to prevent run-off containing sediment entering the watercourse as well as potential erosion in susceptible areas near to the watercourse and the associated buffer zone. - An appropriate construction storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
			Watercourse Hydrology	Change in flow rate during construction. Change to hydrology of the watercourse during construction.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets or other appropriate measures along the boundaries of the pylon foundations can be used where necessary to prevent run-off containing sediment entering the watercourses as well as potential erosion in susceptible areas near to the watercourses and the associated buffer zones.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
3		**Possible Leakage, Spills of Fuel, Oil and other Hazardous Substances:** Fuel, oils and other hazardous substances entering the downstream watercourse via storm water run-off.	Water Quality	Vehicles and machinery my leak oil which can accumulate in storm water run-off generated on the construction site and enter the watercourse downstream. Additionally, stored fuels, oils and other hazardous substances may leak from storage areas and enter the downstream watercourse via storm water run-off.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	Medium	-All oils, fuels and hazardous substances or liquids must not be stored within 100m from the full extent of the watercourses and the associated buffer zones, unless such storage is unavoidable and approved by the ECO. Where these items are stored within 100m from the full extent of the watercourse, the storage area must be adequately bunded to contain any spillage from containers. Emergency spill kits must be available to clean up and remove spills. -All vehicles and machinery operating on the study site are to be checked for oil, fuel or any other fluid leaks before entering the construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place within 100m of the watercourses and the associated buffer zones. -The study site is to contain sufficient safety measures throughout the construction process. Safety measures include (but are not limited to) oil spill kits and the availability of fire extinguishers. Additionally, fuel, oil or hazardous substances storage areas must be bunded to 110% capacity to prevent oil or fuel contamination of the ground and / or nearby watercourses and the associated buffer zones. -No cement mixing is to take place in the watercourse or the associated buffer zones. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Cement / concrete can also be trucked in readymix vehicles. Importantly, no mixing of cement or concrete directly within the watercourse and associated buffer zone.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
4	**Operation Phase**	**Increased Hardened Surfaces in the Local Catchment due to substation and access road:** With the development of the Substation and Associated Infrastructure, there will an increase in hard impermeable surfaces which will affect catchment level dynamics including surface roughness and increased storm water run-off rates and volumes.	Water Quality	Sedimentation during operation.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures, where required, must be put into place to deal with increased/accelerated run-off and associated sediment volumes. The use of energy dissipating structures where required to prevent increased run-off and sediments contained in the run-off entering the watercourse can be used. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site. -Additionally, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off and sediment entering the wetland thereby, also preventing possible associated erosion impacts.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)
			Watercourse Hydrology	Change in flow rate during operation. Change to hydrology of the watercourse during operation.	2	2	3	1	2	2	2	6	1	2	5	1	9	54	High	- Adequate structures, where required, must be put into place to deal with increased/accelerated run-off and associated sediment volumes. The use of energy dissipating structures where required (preferably surrounding the substation and access roads) to prevent increased run-off and sediments contained in the run-off entering the watercourse can be used. - An appropriate operational storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with sedimentation and increased run-off on site.	No applicable.	Ecological Condition C (Moderately Modified) / EISC Class B (High)

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