LEEUWBOSCH PV GENERATION (PTY) LTD

Proposed Construction of Leeuwbosch Solar Photovoltaic (PV) Plants (Leeuwbosch 1 Solar PV Plant & Leeuwbosch 2 Solar PV Plant) on Portion 37 of the Farm Leeuwbosch No. 44 near Leeudoringstad, North West Province

Surface Water Delineation and Assessment Report

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Confidentiality Statement

LEEUWBOSCH PV GENERATION (PTY) LTD

PROPOSED CONSTRUCTION OF LEEUWBOSCH SOLAR PHOTOVOLTAIC (PV) PLANTS ON PORTION 37 OF THE FARM LEEUWBOSCH 44 NEAR LEEUDORINGSTAD, NORTH WEST PROVINCE

SURFACE WATER DELINEATION AND ASSESSMENT REPORT

EXECUTIVE SUMMARY

A wetland delineation and impact assessment is provided in this report for the proposed solar PV developments. Findings were based on a method for delineating wetlands as per the **Department of Water Affairs & Forestry 2005** guidelines. Ultimately, two (2) depression wetlands were delineated within the PV project site and one (1) additional depression wetland located to the south west approximately 125m from the study site[1].

The wetland present ecological status (PES), wetland ecosystem services, and environmental sensitivity and importance category (EISC) for the identified depression wetlands were assessed and provided for each depression wetland to determine their functionality and sensitivity. Accordingly, the PES of Depression Wetlands 1 and 2 were categorised to have an overall PES – C Moderately Modified, whilst Depression Wetland 3 was categorised with a PES – D Largely Modified.

With regards to the potential wetland ecosystems services provided by each depression wetland, all were found to score highest in terms of sediment trapping. Other relatively significant potential wetland ecosystem services provided (but at a slightly lower degree) include erosion control, phosphate trapping, toxicant control, nitrate removal and flood attenuation. For the artificial stormwater seeps, the potential ecosystem services provided which scored highest were in terms of phosphate trapping, nitrate removal, sediment trapping and erosion control. This is unsurprising since the seeps manage flows containing nutrients from the settlement areas. The stormwater flows also contain sediments which deposit into the seeps. The erosion control function is also important in this regard. Finally, the man-made impoundment scored highest in terms of the tourism and recreational opportunities it provides. Equally, the erosion control functions scored just as high. Other wetland ecosystem service functions however scored relatively low mainly due to the fact that the artificial system is controlled.

With regards to the EISC for the surface water resources, the results were as follows:

- Depression Wetland 1 was categorised as a Class C (Moderate);

[1] It should be noted that a combined report has been compiled for both the proposed Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant. This is due to the fact that the proposed solar PV plants are located on the same property (Portion 37 of the Farm Leeuwbosch 44), 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.

- Depression Wetland 2 was categorised as a Class C (Moderate); and
- Depression Wetland 3 was categorised as a Class C (Moderate).

The functional assessments undertaken, as well as potential impacts anticipated, were used to inform a 50m buffer zone to be implemented for the identified depression wetlands.

In terms of potentially applicable environmental and water related legislation, several listed activities and water uses have been identified that will be applicable to the proposed developments based on the scenarios presented. 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 only for the upgrading of the existing road routing through Depression Wetland 2.

With respect to the National Water Act (1998), at a minimum water uses c) and i) will be triggered specifically for the site access road routing through Depression Wetland 2 that is to be upgraded. However, should it be possible to re-align the existing road outside of the wetland, it may be possible to register for General Authorisation under Government Notice 509 of August 2016 (Notice No. 40229). As per Section 9 of this report, the outcome of the Risk Assessment Protocol shows that the proposed developments will have a Low Risk, and thus it should be possible to register for a General Authorisation. The General Authorisation may be applicable to the entire proposed developments where the road is re-aligned out of the wetland as the proposed development falls within the 500m regulated area in terms of Government Notice 509 of August 2016 (Notice No. 40229). 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.

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 are located on the same property (Portion 37 of the Farm Leeuwbosch 44) and are identical in nature, the same impacts have been identified for both proposed solar PV plants. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants. 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 Alternatives	- 20 (low negative)	- 7 (low negative)
CONSTRUCTION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**

Vehicle and Machinery Degradation Impacts to Wetlands	- 33 (medium negative)	- 20 (low negative)
Human Degradation of Flora and Fauna associated with the Wetlands	- 18 (low negative)	- 5 (low negative)
Degradation and Removal of Soils and Vegetation associated with Wetlands	- 33 (medium negative)	- 22 (low negative)
Increased Run-off, Erosion and Sedimentation Impacts	- 20 (low negative)	- 5 (low negative)
OPERATION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**
Vehicle Damage to the Wetland	- 33 (medium negative)	- 33 (medium negative)
Stormwater Run-off Impacts to Wetlands	- 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, direct and indirect surface water impacts will be negligible. In consideration of the nearby Wildbeestkuil 1 Solar PV Plant and Wildebeestkuil 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 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.

The existing site access roads currently routes through Depression Wetland 2 and associated buffer zone on the study site. It is therefore highly recommended that the access route is re-aligned outside of all the delineated wetlands as well as the associated buffer zones. 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 - Leeuwbosch 1 Solar PV Plant & Leeuwbosch 2 Solar PV Plant 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 - Leeuwbosch 1 Solar PV Plant & Leeuwbosch 2 Solar PV Plant 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 - Leeuwbosch 1 Solar PV Plant & Leeuwbosch 2 Solar PV Plant Projects near Leeudoringstad, North West Province of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
j) a Proposed Construction of the Leeudoringstad Solar Photovoltaic (PV) Energy Facility - Leeuwbosch 1 Solar PV Plant & Leeuwbosch 2 Solar PV Plant 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 - Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant 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 ASSESSMENT AND DELINEATION REPORT

1 INTRODUCTION

Leeuwbosch PV Generation (Pty) Ltd (hereafter referred to as "Leeuwbosch PV Generation") is proposing to construct two (2) Solar Photovoltaic (PV) Power Plants with export capacities of up to 9.9 megawatt (MW) each (namely the Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant) as well as associated infrastructure on Portion 37 of the Farm Leeuwbosch No. 44, approximately 15km east of the town of Leeudoringstad, North West Province. The proposed PV Plants are located within the Maquassi Hills Local Municipality. The overall objective of the proposed solar PV plants is to generate electricity to feed into the national electricity grid. This study is specifically related to the proposed construction of two power plants (namely the Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant), each of which will have an export capacity of up to 9.9MW, and associated infrastructure on Portion 37 of Farm Leeuwbosch No. 44 near Leeudoringstad, North West Province (hereafter referred to as, "the proposed developments").

In order to determine the potential impacts of the proposed developments 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 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 development 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

[2] It should be noted that a combined report has been compiled for both the proposed Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant. This is due to the fact that the proposed solar PV plants are located on the same property (Portion 37 of the Farm Leeuwbosch 44), 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.

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:

- 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

[3] Due to the fact that the proposed solar PV plants are located on the same property (Portion 37 of the Farm Leeuwbosch 44) and are identical in nature, the same impacts have been identified for both proposed solar PV plants. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants.

- 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 (*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.

Lastly, 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.

Where any activities are to take place in or "near" 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. The above applies to both wetlands and watercourses (amongst others) which are both regarded as surface water resources (see **Section 1.2**). In terms of wetlands specifically, 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 potentially applicable to where activities take place within the regulated area (within 500m radius) of 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

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 land that is periodically covered with shallow water, and land which 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.

1.2.1 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.

1.2.2 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 (including riparian habitats and drainage lines) identified.

Groundwater, hydrology, aquatic studies of fish, invertebrates, amphibians etc. have also 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 in 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 Leeuwbosch solar PV plants (Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant) 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 will be developed under a Special Purpose Vehicle (SPV). The SPV, Leeuwbosch PV Generation, is currently owned by Upgrade Energy South Africa (Pty) Ltd. Once Commercial Operation Date (COD) is accomplished, 100% of the Leeuwbosch PV Generation shares will be transferred to the new owners of the proposed developments.

Additionally, the proposed solar PV Plants 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 Technical details

The proposed developments will entail the construction of two solar Photovoltaic (PV) plants (namely Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant) with voltage capacities of up to 9.9MW respectively on Portion 37 of the Farm Leeuwbosch No. 44 near Leeudoringstad, Maquassi Hills Local Municipality, North West Province.

The generated electricity will be purchased from Leeuwbosch 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

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

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

The proposed project property (Portion 37 of the Farm Leeuwbosch No. 44) is approximately 124.691 hectares (ha) in extent. The proposed Leeuwbosch 1 Solar PV Plant and associated infrastructure assessed as part of the BA is however expected to cover an area less than 30ha. The proposed Leeuwbosch 2 Solar PV Plant and associated infrastructure assessed as part of the BA is also expected to cover an area less than 30ha

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 power purchase agreement with the relevant off taker.

2.2 Project Location

The proposed 9.9 MW Leeuwbosch 1 Solar PV Plant and Leeuwboch 2 Solar PV Plant are located on Portion 37 of the farm Leeuwbosch No. 44, which lies approximately 5km from the town of Leeudoringstad, North West Province. The study site is shown in the locality map (Figure 1 **& 2**).

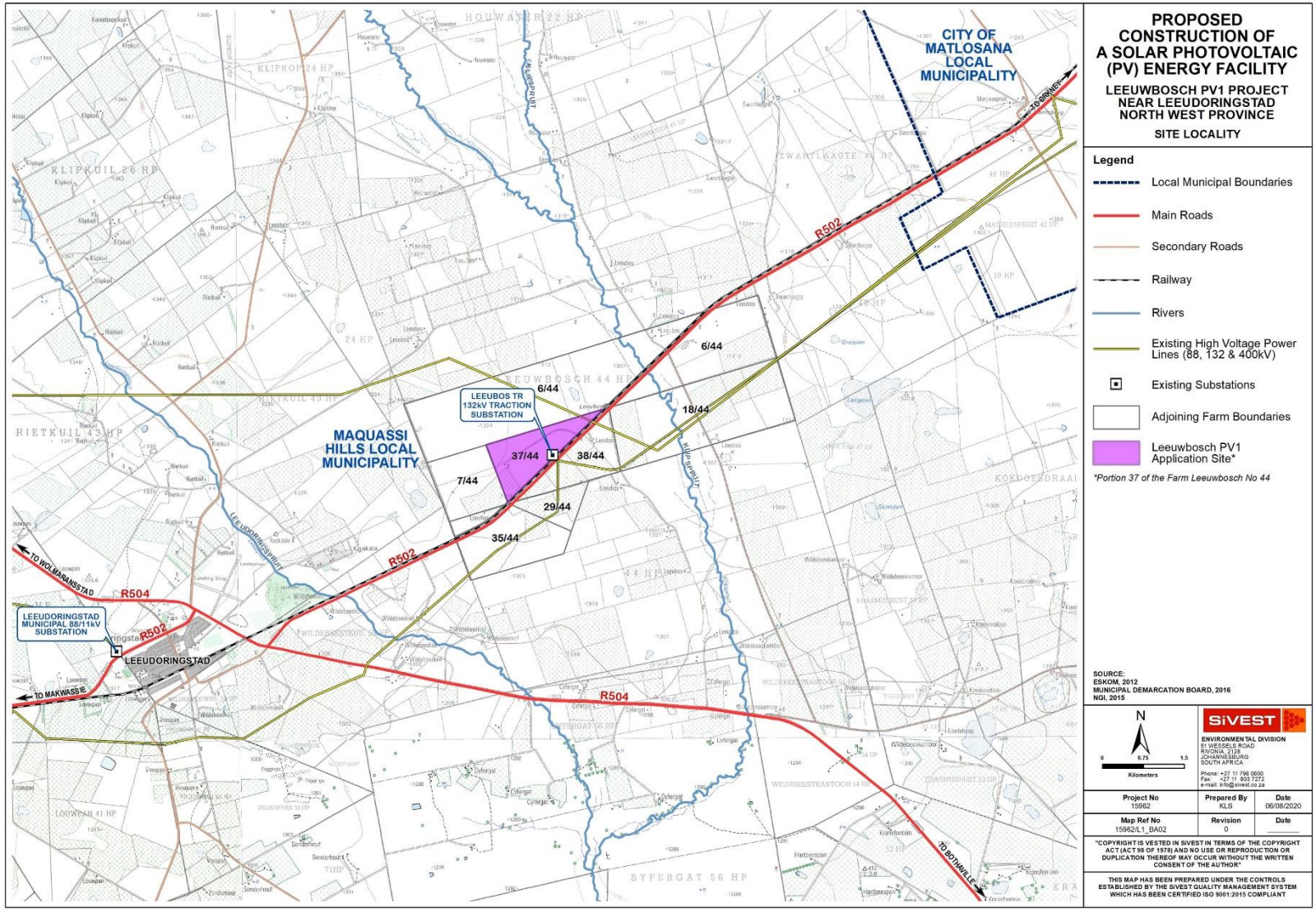

Figure 1. Locality Map for Leeuwbosch 1 Solar PV Plant

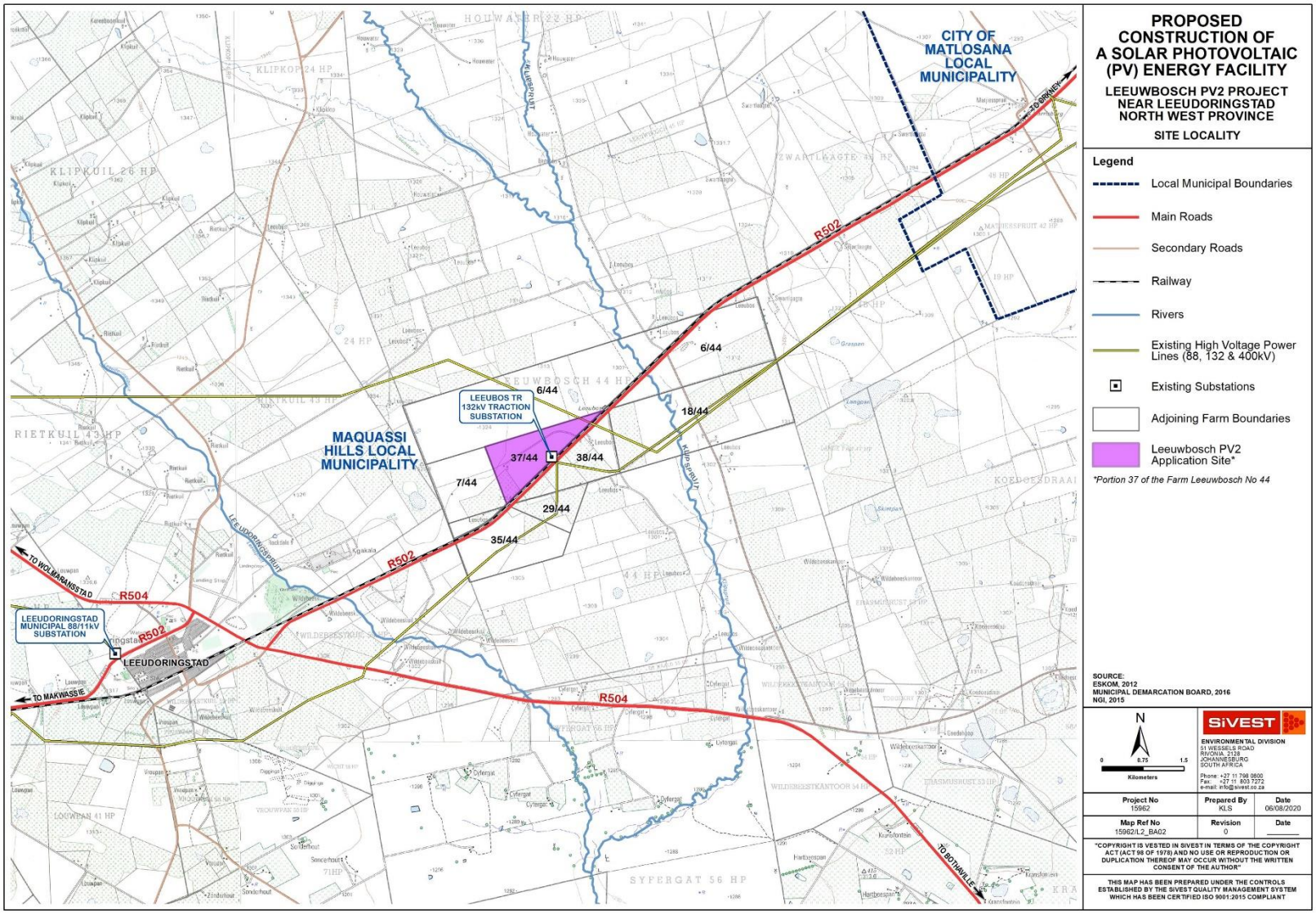

Figure 2. Locality Map for Leeuwbosch 2 Solat PV Plant

2.3 Location alternatives

No site alternatives for the proposed developments are being considered as the placement of solar PV installations 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, 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.

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, Switching Substations, Guard houses and Temporary Building Zones (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.

2.6 The operational aspects of the activity

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

2.7 'No-go' alternative

The 'no-go' alternative is the option of not fulfilling the proposed solar PV 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 Leeuwbosch 1 Solar PV Plant & Leeuwbosch 2 Solar PV Plant from contributing to the environmental, social and economic benefits associated with the development of the renewables sector.

3 METHODOLOGY

3.1 Desktop Delineation of Wetlands

The first step in the wetland assessment was to identify all wetlands 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, wetlands that were identified 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 wetlands, not contained within the above mentioned databases, to be identified and ground-truthed in the field work phase.

3.2 Field-based Wetland Delineation Techniques

Wetland delineations are based primarily on 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'. 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 Fe^{3+} 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 0-50cm 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 1.2m (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.

3.3 Wetland Present Ecological Status Determination

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 PES 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 Ecological 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 this study, the WET-Health (**Macfarlane *et al*., 2009**) Level 1 methodology was used for wetlands within 500m of the study site. The Level 2 methodology was used to determine the PES for any wetlands identified directly on the study site.

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)

<table>
<tr><td rowspan="11">Ecosystem services supplied by wetlands</td><td rowspan="8">Indirect benefits</td><td rowspan="7">Hydro-geochemical benefits</td><td colspan="2">Flood attenuation</td></tr>
<tr><td colspan="2">Streamflow regulation</td></tr>
<tr><td rowspan="5">Water quality enhancement benefits</td><td>Sediment trapping</td></tr>
<tr><td>Phosphate assimilation</td></tr>
<tr><td>Nitrate assimilation</td></tr>
<tr><td>Toxicant assimilation</td></tr>
<tr><td>Erosion control</td></tr>
<tr><td colspan="2">Carbon storage</td></tr>
<tr><td colspan="3">Biodiversity maintenance</td></tr>
<tr><td rowspan="6">Direct benefits</td><td colspan="3">Provision of water for human use</td></tr>
<tr><td colspan="3">Provision of harvestable resources[2]</td></tr>
<tr><td colspan="3">Provision of cultivated foods</td></tr>
<tr><td colspan="3">Cultural significance</td></tr>
<tr><td colspan="3">Tourism and recreation</td></tr>
<tr><td colspan="3">Education and research</td></tr>
</table>

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 [5]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.

[5] 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

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		
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)**[6]. This is addressed in **Section 9**.

4 GENERAL STUDY AREA

As previously mentioned, the two proposed 9.9 MW solar PV plants are located on Portion 37 of the farm Leeuwbosch No. 44 (study site) which lies approximately 5km from the town of Leeudoringstad situated in the Maquassi Hills Local Municipality, North West Province (**Figure 3**).

[6] Due to the fact that the proposed solar PV plants are located on the same property (Portion 37 of the Farm Leeuwbosch 44) and are identical in nature, the same impacts have been identified for both proposed solar PV plants. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants.

According to **Mucina and Rutherford (2006)**, the study site for the two (2) proposed solar PV plants 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.

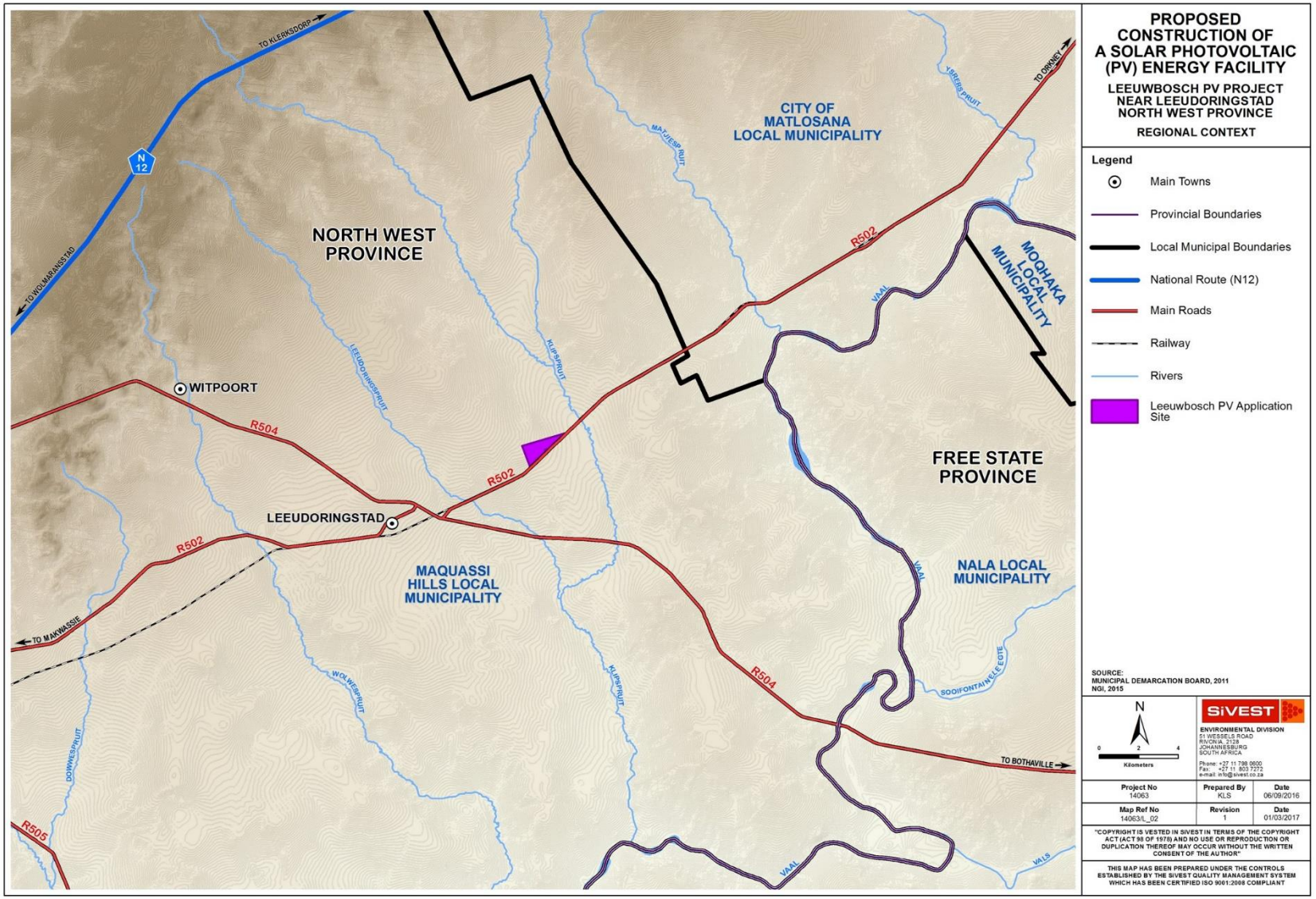

Figure 3. Regional Locality Map

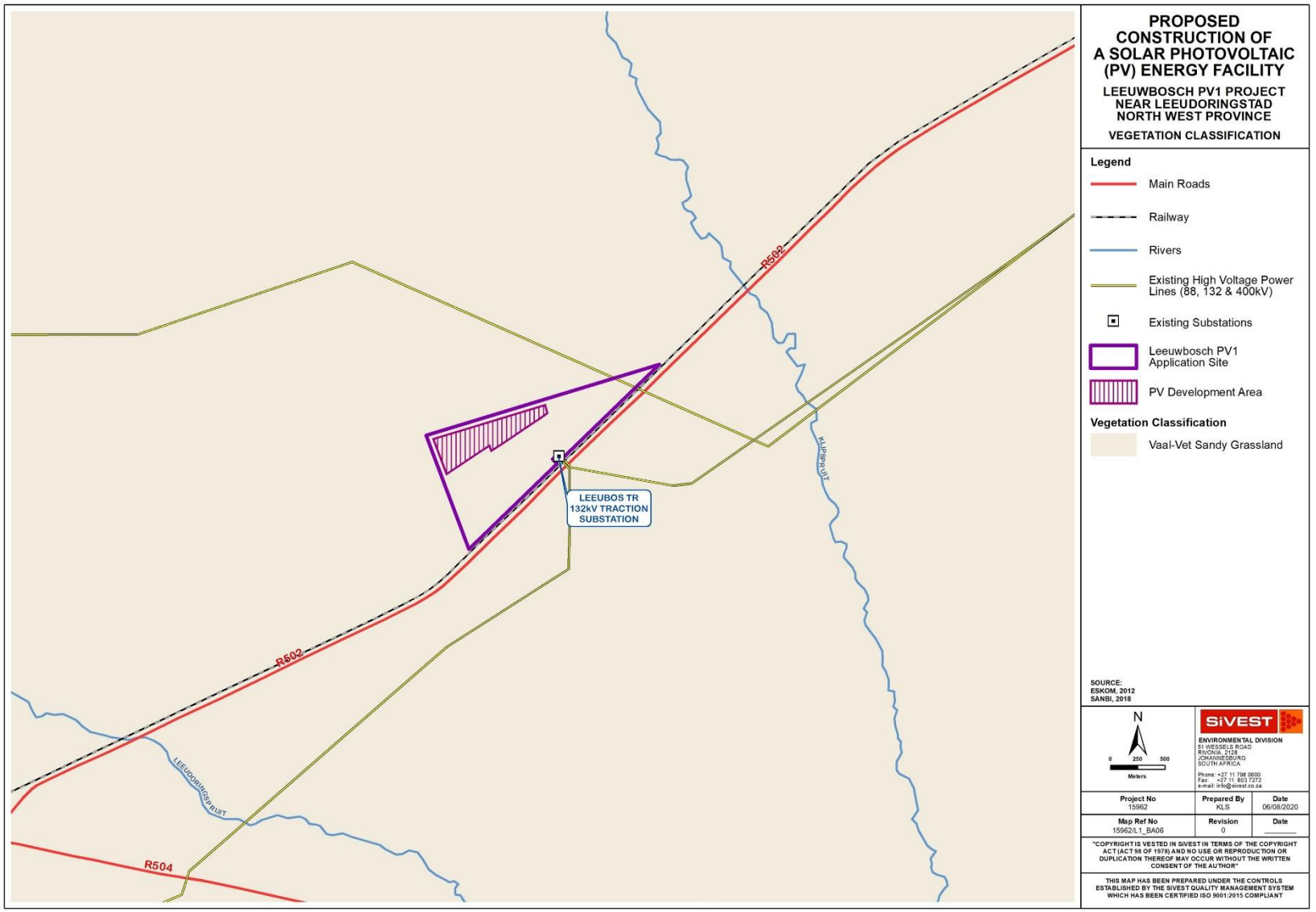

Figure 4. Vegetation Unit Map for Leeuwbosch 1 Solar PV Plant

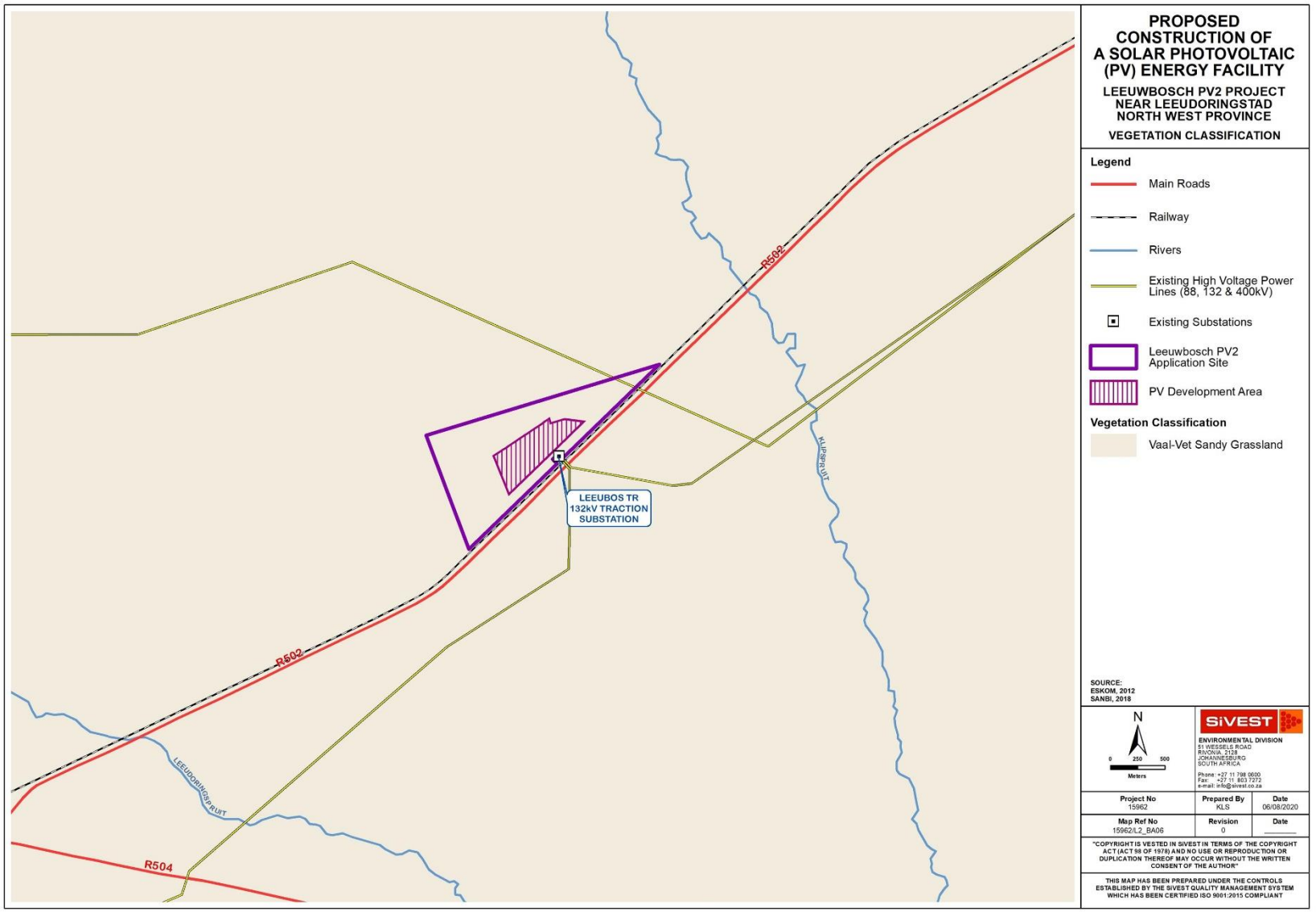

Figure 5. Vegetation Unit Map for Leeuwbosch 2 Solar PV Plant

4.1 Vaal-Vet Sandy Grassland

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.

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 Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant. This is due to the fact that the proposed solar PV plants are located on the same property (Portion 37 of the Farm Leeuwbosch 44) 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 could be identified directly within the study area. However, there is a natural un-channelled valley bottom wetland found within relative close proximity (approximately 300m) to the north east of the study site. This wetland is not considered a Wetland Freshwater Ecosystem Protection Area (Wetland FEPA). Wetland FEPAs are wetlands that are to stay in good condition to conserve freshwater ecosystems and protect water resources for human use. These are classified according to number of criteria some of which including existing protected areas and focus areas for protected area expansion identified in the National Protected

Expansion Strategy. As such, there is no ecological significance in terms of the nearby un-channelled valley bottom wetland.

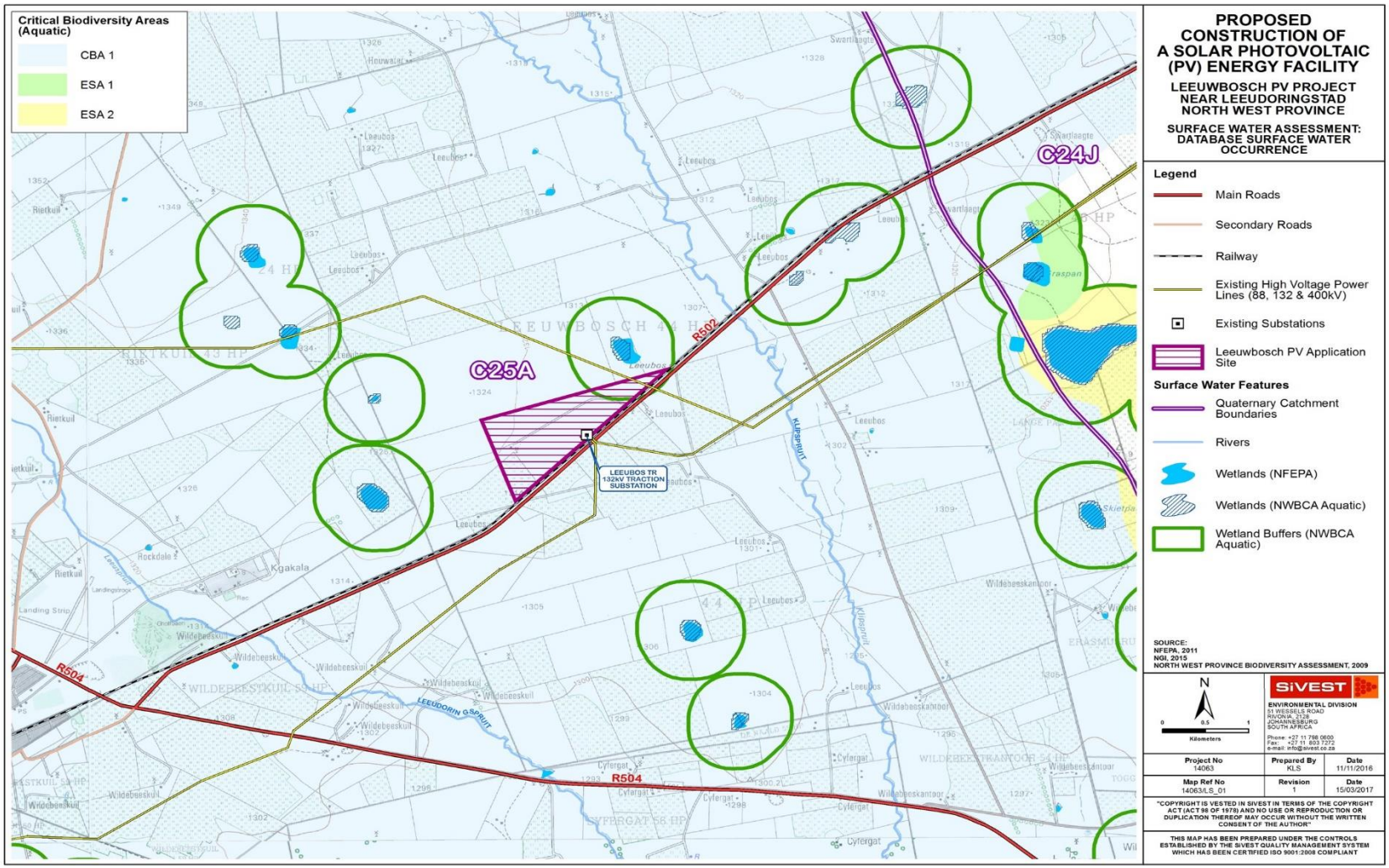

Figure 6. Database Wetland Occurrence Map

A Level 1 WET-Health assessment was undertaken to determine the state of the wetland from a desktop level. The Unchannelled Valley Bottom Wetland was attributed with a combined score of 0.8 whereby it was classified as having PES: A (Unmodified). The results are shown in **Table 5**.

Table 5. Level 1 WET-Health Scores for Unchannelled Valley Bottom Wetland 1

Wetland Name	Module	Impact Score	Category	Change Score	Change Description	Health Class
Unchannelled Valley Bottom Wetland 1	Hydrology	1	B	0.00	Remain Stable	B (Largely Natural)
	Geomorphology	0.1	A	0.00	Remain Stable	A (Unmodified/Natural)
	Vegetation	0.5	A	0.00	Remain Stable	A (Unmodified/Natural)
	Overall Health Score for entire wetland	0.8	A	0	Remain Stable	A (Unmodified/Natural)

The potential existing impacts identified which are likely to affect the PES (as identified from a desktop perspective using Google Earth) were from dirt roads that route into and through the wetland, as well as grazing by cattle which commonly takes place in the area. These existing potential impacts were identified to be relatively insignificant in terms of an increase in run-off as well as due to general grazing impacts consequentially resulting in a minimal reduction in surface roughness. These potential impacts would have knock on impacts from a geomorphological and vegetation point of view resulting in the given scores. Aside from these impacts, the wetland was assessed to be in a largely natural state.

The **North West Province Biodiversity Conservation Plan (2008)** database overlaps with the NFEPA (2011) natural un-channelled valley bottom wetland. A 500m aquatic buffer has been applied to the wetland which affects the northern corner of the study site.

5.2 Refinement of Desktop Findings Based on In-field Assessment and Delineations

The in-field wetland delineation assessment took place on the 13th September 2016, as well as the 19th August 2020. The fieldwork ground-truthing, verification and delineation assessment was undertaken to scrutinise the results of the desktop identified features 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** and **Figure 8**.

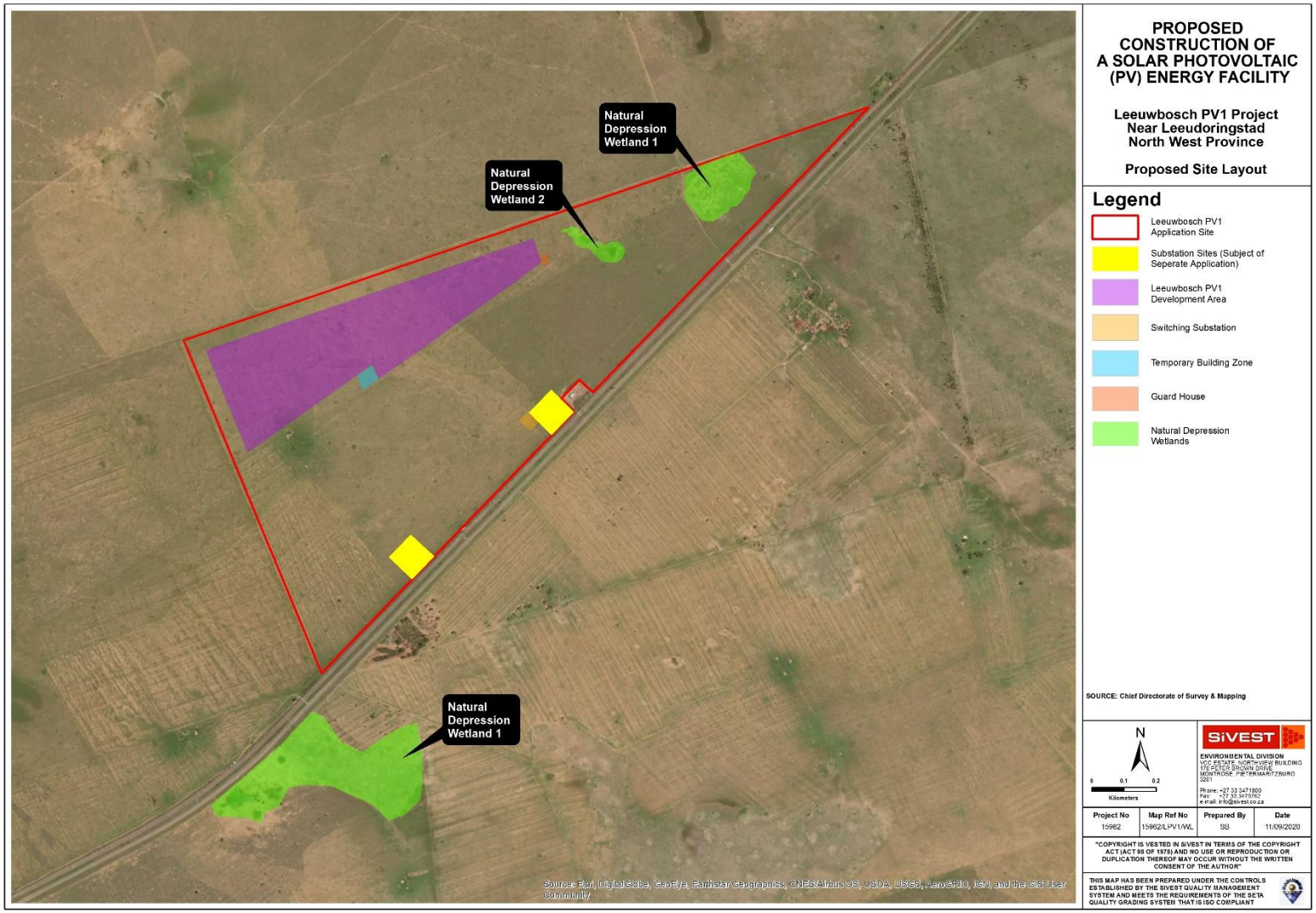

Figure 7. Surface Water Delineation Map for the Leeuwbosch 1 Solar PV Plant Layout

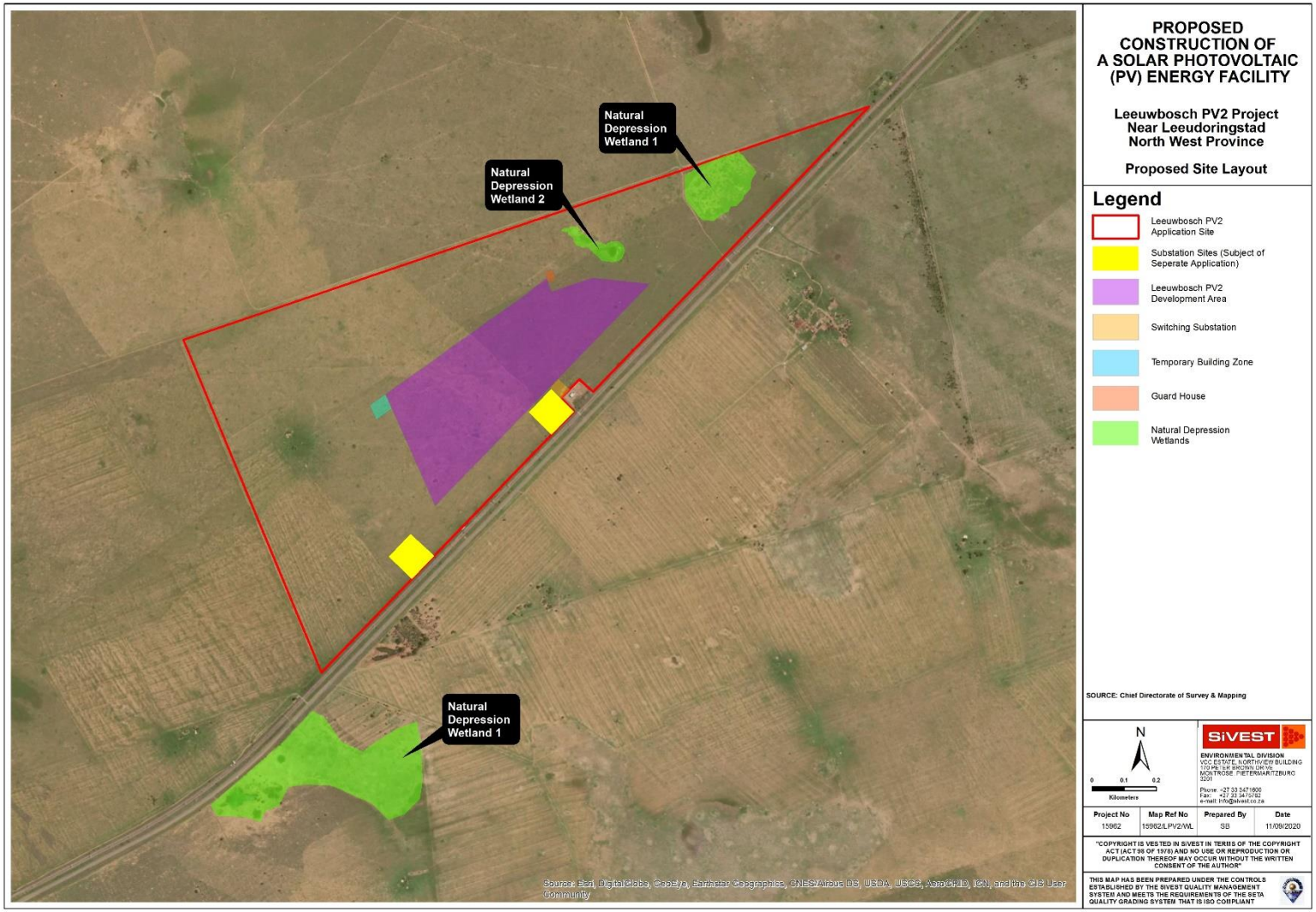

Figure 8. Surface Water Delineation Map for the Leeuwbosch 2 Solar PV Plant Layout

Ultimately, it was found that there are two (2) natural depression wetlands within the PV study site. The field identified depression wetlands were not evident on the database information consulted at a desktop level. Additionally, another natural depression wetland was identified approximately 125m from the southern boundary of the study site. This wetland is therefore within the 500m regulated area in accordance with Government Notice 509 of August 2016 (Notice No. 40229) and is included in this assessment. The boundaries of all the depression wetlands were based on in-field delineations. The physical characteristics of the various indicators for the identified wetlands are provided in more detail in the sub-sections below.

5.2.1 Depression Wetland 1

5.2.1.1 Terrain and Wetland Soil Characteristics

The terrain of the landscape is flat. Shallowed out basins within the flatter landscape areas form a suitable physical template for endorheic (closed systems that are in-ward draining) depression wetlands. As such, Depression Wetland 1 (approximately 3.2ha) was identified in the north eastern corner of the study site in the form of a shallow depression in a flat plain landscape (**Figure 9**).

Figure 9. Depression Wetland 1

In terms of depression wetland geomorphology, the influx of silt and clay due to inward depositional processes results in the accumulation of sediment. This sediment forms a layer that is relatively

impermeable and is found near the surface in the subsoil of the depression basin. However, soil composition (for example, degree of sand, silt and clay) is likely to vary somewhat from one depression wetland to the next in the same region. As previously mentioned, Depression Wetland 1 is a shallow depression in the landscape. Bedrock and a degree of calcrete in the southern areas of the wetland were found close to the surface (approximately 30-50cm). The sub-soils are therefore relatively thin. An Orthic A horizon characterizes the top soil layer, whilst the sub-soils are characteristic of a Soft Plinthic B horizon. The Soft Plinthic B horizon contains brown coloured sediments which are a mix of sand and clay particles. Intermixed within the soil matrix are orange coloured iron accumulations (mottles) as well as grey reduced particles (**Figure 10**). Some carbonaceous material is also found within the soil matrix near the southern boundary of the wetland where an extrusion of Calcrete (Hardpan Carbonate) was observed at the surface slightly beyond the depression wetland to the south, as previously mentioned. 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 indicates temporary to seasonal saturation cycles.

Figure 10. Soil Sample showing Orange Mottling and Carbonaceous Materials in the Soil Matrix

Overall, the depression wetland appeared to have been impacted by excavation activities which presumably expanded the size of the wetland from the natural condition. Other impacts currently affecting the wetland include grazing by cattle, overhead transmission power lines and dirt roads which can be found bordering the depression wetland to the west.

5.2.1.2 Wetland Vegetation

Depression wetland 1 was predominantly covered in graminoid species. Species observed include *C. pospischilii* (fd), *Polypogon monspeliensis* (fw) and *T. triandra* (fd). Small communities of hydrophytic vegetation were evident near the north eastern area of the depression wetland in the form of *Juncus* sp. (ow). The occurrence of the wetland species are indicative of wetland conditions.

Figure 11. *P. monospeliensis* (left) and *Juncus* sp. (right) observed in Depression Wetland 1

5.2.2 Depression Wetland 2

5.2.2.1 Terrain and Soil Characteristics

Depression Wetland 2 (approximately 0.8 hectares) is found approximately 240m to the south west of Depression Wetland 1. As such, the landscape characteristics are identical in that the landscape is flat. Again however, the shallowed out basin in the landscape provides the template where the wetland has formed (**Figure 12**).

Figure 12. Depression Wetland 2

In terms of soil characteristics, beneath the Orthic A horizon, the sub-soils (**Figure 13**) can likewise be described as a Soft Plinthic B horizon. However, the sub-soils were found to have a greater degree of clay particles within the soil matrix. Additionally, the soils were a darker brown colour. Moreover, the type of mottling observed was a deeper red form of iron accumulations. Nonetheless, the characteristics of the sub-soils still fall within the description of a Soft Plinthic B horizon. Accordingly, with the combination of the two soil horizon types, the Westleigh Soil Form could be attributed to the soils in Depression Wetland 2. With the higher degree of clay particles in Depression Wetland 2, it is expected that soil saturation is seasonal.

Figure 13. Sub-soil Sample drawn from within Depression Wetland 2 showing Red Mottling

5.2.2.2 Vegetation

The vegetation composition of Depression Wetland 2 differed from Depression Wetland 1. The higher density of hydrophytic species in the core of the wetland in comparison to the Graminoid dominated Depression wetland 1, as well as general species composition being the main differences. In the core of the wetland (at the lowest point), hydrophytic species including *Juncus* sp. (ow) and *P. monspeliensis* (fw) were the dominant species present. Towards the outer edges of the wetland, communities of *Eragrostis plana* (fw) were evident.

Figure 14. *Eragrostis plana* near the Outer Edges of Depression Wetland 2

Existing impacts similarly include a dirt road, which routes through the wetland fragmenting it somewhat at a superficial level. However, connectivity at a sub-surface level in terms of drainage appears to be impacted but functional. Grazing impacts are also currently affecting the wetland.

5.2.3 Depression Wetland 3

5.2.3.1 Terrain and Soil Characteristics

Depression Wetland 3 (approximately 5.7ha) is found approximately 125m to the south west of PV project study site. As such, the landscape characteristics are identical in that the landscape is flat. Once more, the shallowed out basin in the landscape provides the template where the wetland has formed (**Figure 15**). However, excavation activities have taken place within the wetland, presumably in an attempt to provide additional surface water for cattle to drink.

Figure 15. Depression Wetland 3

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 Depression Wetland 3. With the degree of clay particles in Depression Wetland 3, it is also expected that soil saturation is seasonal much like Depression Wetland 2.

Figure 16. Sub-soil Sample drawn from within Depression Wetland 3 showing Orange Mottling and Grey Reduced Soil Particles

5.2.3.2 Vegetation

Vegetation observed in Depression Wetland 3 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 *E. plana* (fw), whilst *T. triandra* and *H. hirta* were also observed.

Figure 17. 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.

5.3 Wetland Present Ecological Status (PES)

The overall PES for the natural depression wetlands were determined. The PES was not however determined for artificial wetlands (See **Section 1.3**). This includes the integration of the hydrological and vegetation PES components for the depression wetlands. The summarised results are shown in **Table 6**. A description of the factors and corresponding component PES scores influencing the overall PES score for the wetland type is explained in more detail in the sub-sections below. Ultimately, the PES of Depression Wetlands 1 and 2 were categorised to have an overall PES – C Moderately Modified, whilst Depression Wetland 3 was categorised to have an overall PES – D Largely Modified.

Table 6. Overall PES for the Three Depression Wetlands

Wetland Name	Module	Impact Score	Category	Change Score	Change Description	Health Class
Depression Wetland 1	Hydrology	3	C	0,00	Remain Stable	C (Moderately Modified)
	Geomorphology					
	Vegetation	4,5	D	0,00	Remain Stable	D (Largely Modified)
	Overall Health Score for entire wetland	3,6	C	0	Remain Stable	C (Moderately Modified)
Depression Wetland 2	Hydrology	3	C	0,00	Remain Stable	C (Moderately Modified)
	Geomorphology					
	Vegetation	3,9	C	0,00	Remain Stable	C (Moderately Modified)
	Overall Health Score for entire wetland	3,36	C	0	Remain Stable	C (Moderately Modified)
Depression Wetland 3	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)

All depression wetlands were found to be affected by similar existing impacts. With respect to the hydrological integrity of the wetlands, 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 wetlands). The change in surface roughness and the presence of dirt 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 wetlands. A further factor affecting the state of Depression Wetlands 1 and 3 specifically were the excavation impacts to the wetlands. 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, this hardened layer seems to assist in preventing erosion as no erosion was evident. The excavations therefore did not impact to a significant degree on the overall health category. Accordingly, the overall health category was the same for Depression Wetlands 1 and 2 being C – Moderately modified, with Depression Wetland 3 being classed D – Largely Modified.

The vegetation component for all wetlands were assessed to have mainly been affected by the presence of dirt roads and grazing by cattle. The lack of surface roughness was observed to influence the degree of vegetation disturbance noted in the wetlands. However, vegetation disturbance was assessed to be moderate in terms of these impacts. Again however, the excavation impacts were an additional impact affecting Depression Wetland 1 and 3 specifically which resulting in an increased impact to these wetlands (particularly Depression Wetland 3). The magnitude of existing impacts was assessed to have a moderate overall impact on the vegetation PES of the wetland for Depression Wetland 2, in which a health category of C – Moderately modified was attributed. For Depression Wetlands 1 and 3, as a result of additional impacts due to excavation, a health category of D – Largely modified was attributed.

5.4 Wetland Ecosystem Services

The PES, as assessed above, was used to inform aspects of the wetland ecosystem services assessment in the sub-sections below.

5.4.1 Depression Wetland 1

The potential ecosystem services provided by Depression Wetland 1 which scored highest was in terms of sediment trapping of which can be said to be the primary function of an endorheic wetland. Other potential wetland ecosystem services provided at a slightly lower degree include erosion control, phosphate trapping, toxicant control, nitrate removal and attenuation. Other potential wetland ecosystem services which could potentially be provided which scored to a lesser degree included maintenance and biodiversity, education and research, tourism and recreation and natural resources (**Figure 18**). The ecosystem services are not very high due to the relatively limited extent (3.2 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.

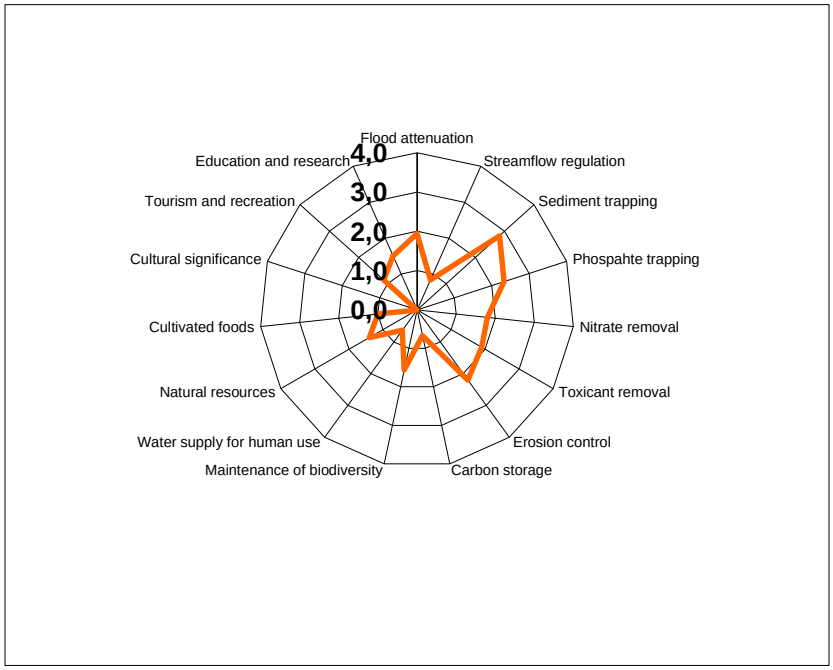

Figure 18. Depression Wetland 1 Ecosystem Services

5.4.2 Depression Wetland 2

Depression Wetland 2 was assessed to be highly similar in most respects to the potential wetland ecosystem services provided by Depression Wetland 1, in that the potential ecosystem services provided by Depression Wetland 2 also scored highest in terms of sediment trapping. Likewise, other potential wetland ecosystem services provided at a slightly lower degree include erosion control, phosphate trapping, toxicant control, nitrate removal and attenuation. Additionally, other potential wetland ecosystem services which could potentially be provided which scored to a lesser degree included maintenance and biodiversity, education and research, tourism and recreation and natural resources (**Figure 19**). The only real difference is that potential carbon storage ecosystem services provided were assessed to be offered at a higher degree than Depression Wetland 1. The even more limited extent of the wetland (0.8 hectares), the degree of disturbance as well as the general limitations to basic functions that can be performed by endorheic wetlands being the main factors affecting a higher level of wetland ecosystem service potential functionality provided by Depression Wetland 2.

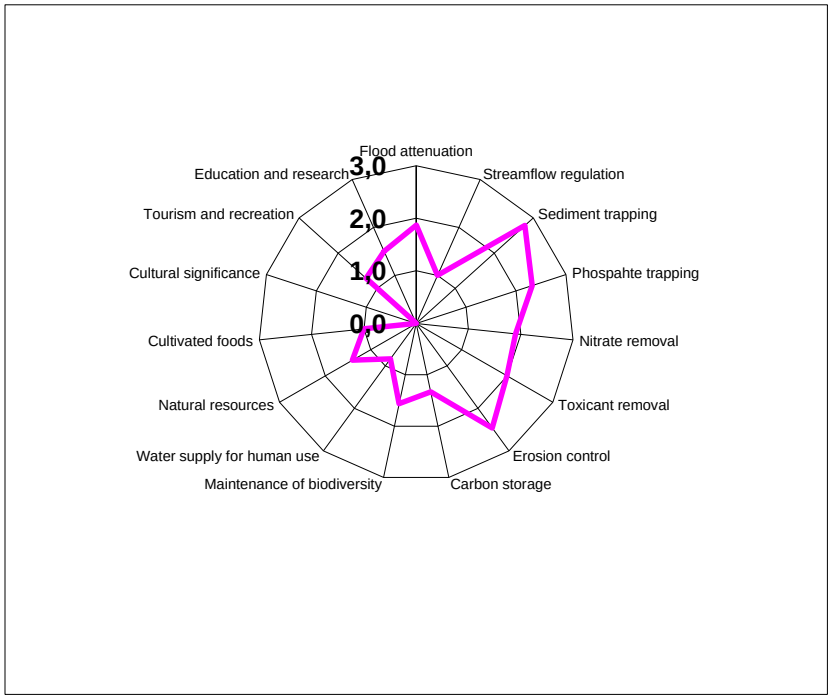

Figure 19. Depression Wetland 2 Ecosystem Services

5.4.3 Depression Wetland 3

Much like Depression Wetland 1, the potential ecosystem service provided by Depression Wetland 3 which scored highest was sediment trapping, which can be said to be the primary function of an endorheic wetland. Other potential wetland ecosystem services provided at a slightly lower degree include phosphate trapping and erosion control followed closely by toxicant control and nitrate removal. Other potential wetland ecosystem services which could potentially be provided, which scored to a lesser degree, included flood attenuation, education and research, tourism and recreation, natural resources and maintenance of biodiversity (**Figure 20**). The ecosystem services 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.

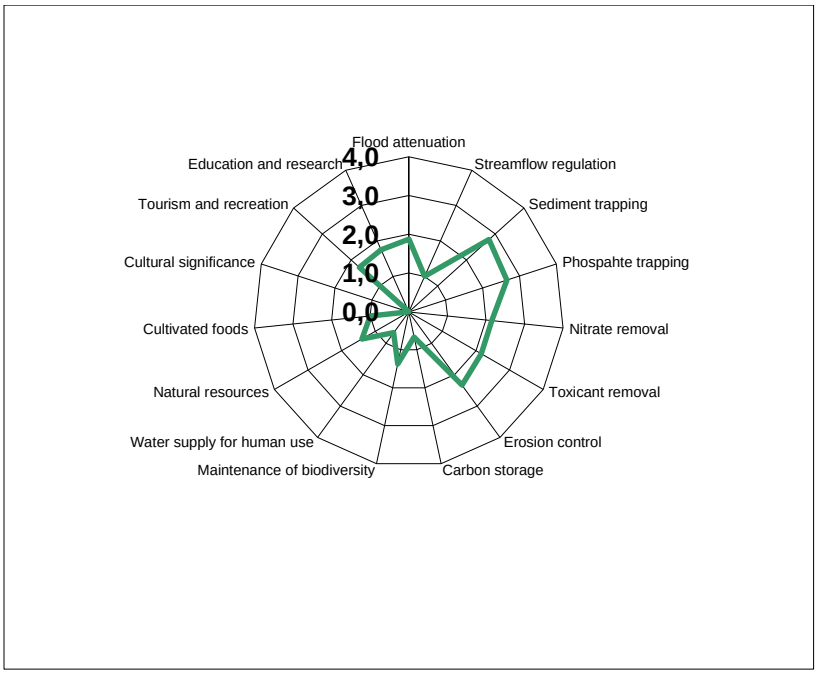

Figure 20. Depression Wetland 3 Ecosystem Services

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 where 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 PES / wetland ecosystem services results, the EISC are as follows:

- Depression wetlands 1, 2 and 3 were categorised as a Class C (Moderate);

A detailed description or the scoring of the EISC results for the wetland are displayed in **Table 7** below.

Table 7. Environmental Importance and Sensitivity Category for the Biotic and Habitat Determinants of the Identified Wetlands

Wetland Name	**Depression Wetland 1**		**Reason**	**Depression Wetland 2**		**Reason**	**Depression Wetland 3**		**Reason**
Determinant	**Score**	**Confidence**		**Score**	**Confidence**		**Score**	**Confidence**	
Primary Determinants									
1. Rare & Endangered Species	1	3	No specific wetland dependant fauna and flora species of conservation importance associated with this wetland were identified during the field assessment.	1	3	No specific wetland dependant fauna and flora species of conservation importance associated with this wetland were identified during the field assessment.	1	3	No specific wetland dependant fauna and flora species of conservation importance associated with this wetland were identified during the field assessment.
2. Populations of Unique Species	1	3	Very small isolated community of Juncus sp identified within the wetland.	2	3	Greater density of Juncus sp. identified within the core of the wetland.	2	3	Greater density of Juncus sp. and *Marsilea* sp. identified within the core of the wetland.
3. Species/taxon Richness	1	3	Species and taxon richness not particularly diverse nor dense 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 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.	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.

4. Diversity of Habitat Types or Features	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).	3	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.	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.	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.).	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. & *Marsilea* 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.	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.	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.
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 regard, the depression wetland is significant in terms of the role it performs in the greater landscape.	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 regard, the depression wetland is significant in terms of the role it performs in the greater landscape.	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 regard, the depression wetland is significant in terms of the role it performs in the greater landscape.
Modifying Determinants									
9. Protected Status	0	4	No protected status	0	4	No protected status	0	4	No protected status

10. Ecological Integrity	2	4	The PES was assessed to be in a Moderately modified state.	2	4	The PES was assessed to be in a Moderately modified state.	1	4	The PES was assessed to be in a Largely modified state.
TOTAL	15	32		18	32		18	32	
MEDIAN	1,5	3,2		1,8	3,2		1,8	3,2	
OVERALL ECOLOGICAL SENSITIVITY AND IMPORTANCE	**C**			**C**			**C**		

5.6 Surface Water Buffer Zones

For the surface water resources, the primary threat related to the PV developments and the associated infrastructure 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 associated infrastructure. 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 field. 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 field and adjacent services roads 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 depression wetlands. As such, a buffer zone of 50m was applied to the depression wetlands to provide sufficient buffer from the PV array fields. The above assigned buffer zones were guided by the rationale behind the establishment of suitable buffer zones for wetlands according to the **Gauteng Department of Agriculture and Rural Development (GDARD) Requirements for Biodiversity Assessments (2014)**, which are equally deemed applicable in the North West Province.

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) 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). 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 and/or positions for the solar PV plants associated infrastructure 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.

In light of the above, only one (1) proposed PV layout has been investigated for the each respective proposed solar PV plant development (**Figure 21** & **Figure 22**). These respective layouts are based on identified environmental sensitive and/or “no-go” areas.

The following factors were taken into account when evaluating the respective proposed layouts:

- Size and number of potentially impacted surface water resource(s) in the proposed layouts;
- 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).

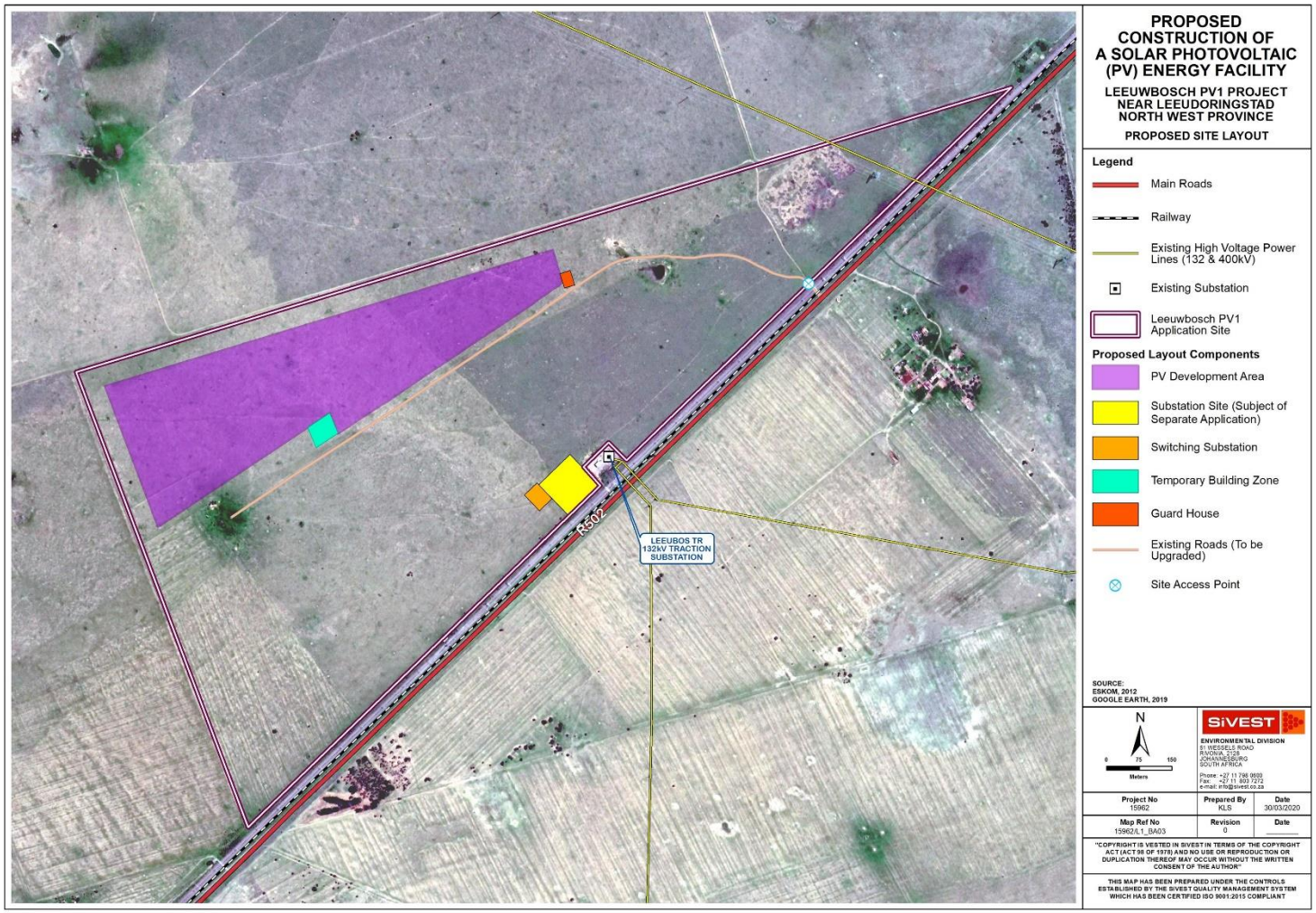

Figure 21. Leeuwbosch 1 Solar PV Plant Layout

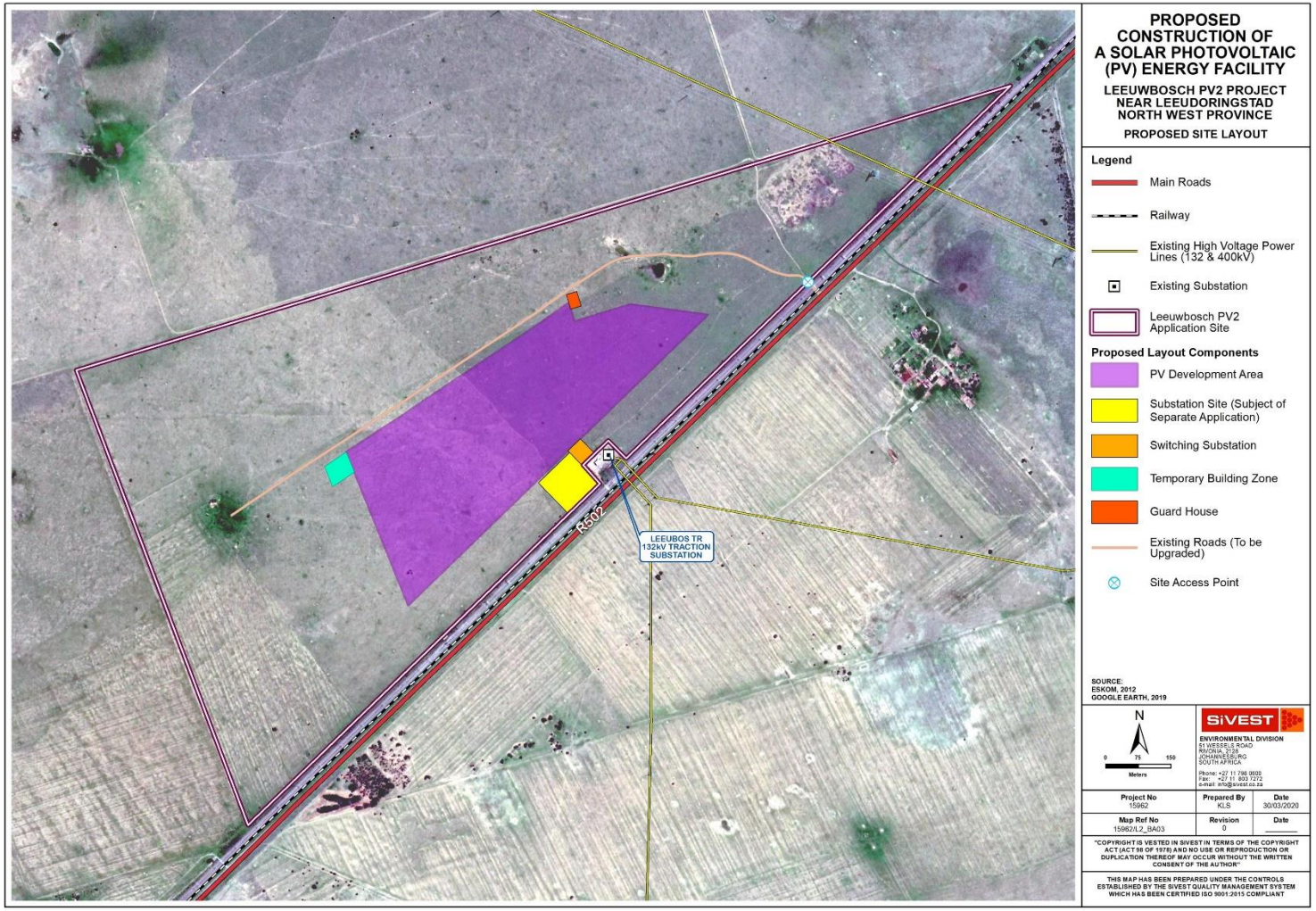

Figure 22. Leeuwbosch PV2 Facility Layout

In terms of the first criteria, the size and number of surface water resources within the areas 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 developments 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 PV plant component or infrastructure is 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 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.

Both of the current proposed layouts presented above are therefore being applied for via a Basic Assessment Process, and no comparative assessment of alternatives is presented here.

7 LEGISLATIVE IMPLICATIONS

In the context of the proposed developments 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 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 m^2 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 the upgrading of the existing road routing through Depression Wetland 2. Should this road be upgraded, this activity will be triggered for both proposed solar PV plant developments on Portion 37 of the Farm Leeuwbosch No. 44.

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 m^3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 m^3 from-

(i) a watercourse;

This activity is only applicable for the upgrading of the existing road routing through Depression Wetland 2. Should this road be upgraded, this activity will be triggered for both proposed solar PV plant developments on Portion 37 of the Farm Leeuwbosch No. 44.

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 the upgrading of the existing road routing through Depression Wetland 2. Should this road be upgraded, this activity will be triggered for both proposed solar PV plant developments on Portion 37 of the Farm Leeuwbosch No. 44.

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 the site access roads that are to be upgraded. The existing access road that routes through Depression Wetland 2 is likely to be used.

However, should it be possible to re-align the existing road outside of the wetland, 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. The General Authorisation may be applicable to the entire proposed developments where the road is re-aligned out of the wetland as the proposed developments fall within the 500m regulated area in terms of Government Notice 509 of August 2016 (Notice No. 40229). 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 resources perspective, this section will identify and contextualise each of the potential impacts within the context of the proposed developments and the identified depression wetlands. 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 on Portion 37 of the Farm Leeuwbosch 44 are identified and assessed below. It should be noted that due to the fact that the proposed solar PV plants are located on the same property and are identical in nature, the same impacts have been identified for both proposed solar PV plants. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants. 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 each of the respective proposed solar PV plant developments. Placing the lay-down areas near wetlands may result in indirect negative impacts. 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 areas 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 60**.

8.2 Construction Phase Potential Impacts

8.2.1 Vehicle and Machinery Degradation Impacts to Wetlands

Construction vehicles (heavy and light) will require access to the proposed PV arrays and other component construction areas. Potential negative impacts can include the need to travel through the delineated wetlands on the existing dirt road coursing through Depression Wetland 2 or possibly new roads to be constructed in the wetlands, thereby resulting in increased and additional physical degradation respectively. Physical degradation in the form of compaction of soils, potential erosion, consequent sedimentation and general disturbance from vehicle movement is likely. Additionally, inward drainage into the wetlands 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-fueling or servicing in or near the surface water resources is also probability. Should any leakage or spillage occur in and/or near the wetland, potential soil/water contamination/toxication of amphibians, avifauna or other organisms frequenting the wetlands can result. Fuels and oils also pose a fire risk not only to the wetlands but also neighbouring grazing lands or nearby farm houses / settlement areas.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 8** on **page 60**.

8.2.2 Human Degradation of Flora and Fauna associated with Wetlands

The possibility of human degradation to wetlands 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 wetlands. Human degradation can take the form of physical / direct degradation such as lighting fires (purposefully or accidentally) in or near to the wetlands. Usage of the wetlands for sanitation purposes may take place when inundated, resulting in pollution of the wetland. The wetlands may also be utilised as a source of water for domestic use, building and general cleaning purposes.

Fauna associated with wetlands 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 60**.

8.2.3 Degradation of Soils and Vegetation associated with the Wetlands

The proposed developments (internal access roads) 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.

Assessment of the above potential negative impacts and mitigation measures thereto are provided in **Table 8** on **page 60**.

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 developments, is a distinct possibility. A further impact due to erosion and storm water run-off impacts is increased sedimentation to the wetlands. 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 60**.

8.3 Operation Phase Potential Impacts

8.3.1 Vehicle Damage to the Wetlands

Access roads to the proposed PV fields during the operation and maintenance phase can physically affect the wetlands (mainly Depression Wetland 2). Therefore, it is important that roads are not planned and constructed within any wetlands and/or associated buffer zones. However, where it is not possible to avoid this, the wetlands will be susceptible to compaction and erosion impacts for the lifecycle of the proposed developments leading to long term impacts. Regular vehicle movement in the affected wetlands 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 60**.

8.3.2 Stormwater Run-off Impacts to Wetlands

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 developments. 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 60**.

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 60** below.

Table 8: Rating of Surface Water Impacts for Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant (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																				
Depression Wetland 2 – Impacts associated with the Temporary Building Zones	Indirect increased run-off and consequent erosion and sedimentation impacts as well as possible contamination impacts from stored fuels, oils and other hazardous substances and liquids to Depression Wetlands	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 contained in bunded areas of 110%	1	3	1	1	1	1	7	-	Low

											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. **<u>Preventing Fire Risks</u>** – 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																				
Depression Wetlands 1 and 2 - Vehicle and Machinery Degradation Impacts to Wetlands	Vehicle and machinery degradation	1	3	2	2	3	3	33	-	Medium	**<u>Preventing Physical Degradation of the Wetlands</u>** – Ideally, the existing road to be upgraded should be re-aligned outside of Depression Wetland 2. This is the most important mitigation measure in order to avoid direct impact to this wetland. Should this not be possible, the necessary environmental authorization and water use license will be required before construction can commence. In general, no construction is to take place within 50m nor directly within any of the identified and delineated wetlands unless absolutely necessary. The delineated wetlands and associated buffer zones are to be clearly demarcated as highly sensitive.	1	2	2	2	3	2	20	-	Low

											Demarcations are to be made visible and no access into these areas is to be allowed unless being authorized / licensed to do so. **<u>Limiting Physical Degradation to Wetlands</u>** – Should an Environmental Authorization and / or WUL permit be issued for construction in and near wetlands, a single access route or "Right of Way" (RoW) is to be established through or in the desired construction area in the wetland. 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 wetland (no more than a 3m width). 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 soils have been identified to be temporarily saturated, 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 governmental environmental and water authorities. **<u>Preventing Soil Contamination</u>** – 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 wetland or the associated buffer zone.								

Depression Wetlands 1 and 2 - Human Degradation of Flora and Fauna associated with Wetlands	Human degradation to fauna and flora associated with the wetlands	1	3	1	2	2	2	18	-	Low	**Minimising Human Physical Degradation of Sensitive Areas** – Construction workers are only allowed in the designated construction areas and not into the surrounding wetlands. Highly sensitive areas are to be 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 authorised 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. 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	1	1	1	1	1	1	5	-	Low

											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 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 area.									
Depression Wetlands 1 and 2 - Degradation of Soils and Vegetation associated with the Wetlands	Degradation and removal of soils and vegetation associated from wetlands	1	2	3	2	3	3	33	-	Medium	**<u>Preventing Physical Degradation of the Wetlands</u>** – The necessary Environmental Authorization and / or WUL permit must be obtained prior to construction. Accordingly, the permitted construction area is to be established as a RoW area, as described in **Sections 8.2.1** and **8.2.2**. **<u>Rehabilitation of RoW Areas</u>** – Ideally, the affected RoW zones in the sensitive areas must be re-instated with the soils removed (if any) from the wetlands, 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. Rehabilitation areas will need to be monitored for erosion and invasion of alien vegetation species until re-growth can establish where prevalent.	1	2	3	2	3	2	22	-	Low
Depression Wetlands 1, 2 and 3 - Increased Run-off, Erosion and Sedimentation Impacts	Increased storm water run-off, erosion and increased sedimentation impacting on wetlands	2	2	2	3	1	2	20	-	Low	**<u>Preventing Increased Run-off and Sedimentation Impacts</u>** – 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	1	1	1	1	1	5	-	Low

											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																				
Depression Wetlands 1 and 2 - Vehicle Damage to the Wetlands	Vehicle damage to the surface water resources	1	3	2	2	3	3	33	-	Medium	**<u>Minimising Vehicle Damage to the Wetlands</u>** – Where access through the wetland is unavoidable and absolutely required, it is recommended that any road plan and associated structures be	1	3	2	2	3	3	33	-	Medium

											submitted to the relevant governmental environment 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 highly sensitive area 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 wetland. 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.									
Depression Wetlands 1 and 2 - Stormwater Run-off Impacts to Wetlands	Impermeable and hardened surfaces creating accelerated run-off, consequent	2	2	2	2	3	3	33	-	Medium	Any hardstand area or building within 50m proximity to a wetland must have energy dissipating structures in an appropriate location to prevent	1	2	2	2	3	1	10	-	Low

	erosion and sedimentation										increased run-off and sediments contained in the run-off entering adjacent areas or wetlands. This can be in the form of hard concrete structures or soft engineering structures (such as grass blocks for example). A suitable operational storm water management design or plan is to be compiled and implemented that accounts for the use of appropriate structures or devices that will prevent increased run-off and sediment entering nearby wetlands.									
Decommissioning Phase																				
Should the proposed developments need to be decommissioned, the same impacts as identified for the construction phase of the proposed development 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 Potential Impacts

The broader study 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 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 23** and **Figure 24**). 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 Wildebeestkuil 1 Solar PV Plant and Wildebeestkuil 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.

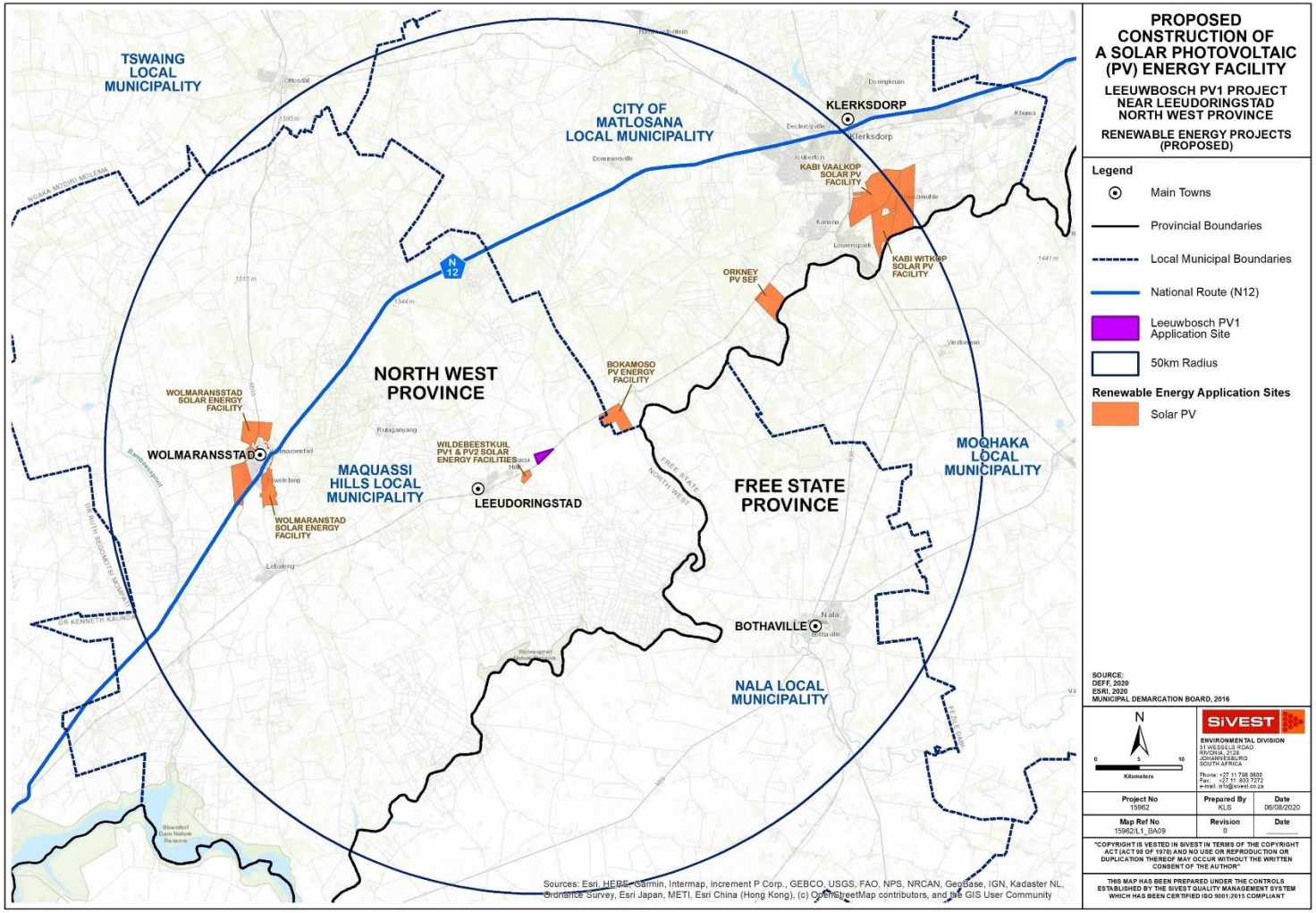

Figure 23: Surrounding Renewable Energy Projects Map – Leeuwbosch 1 Solar PV Plant

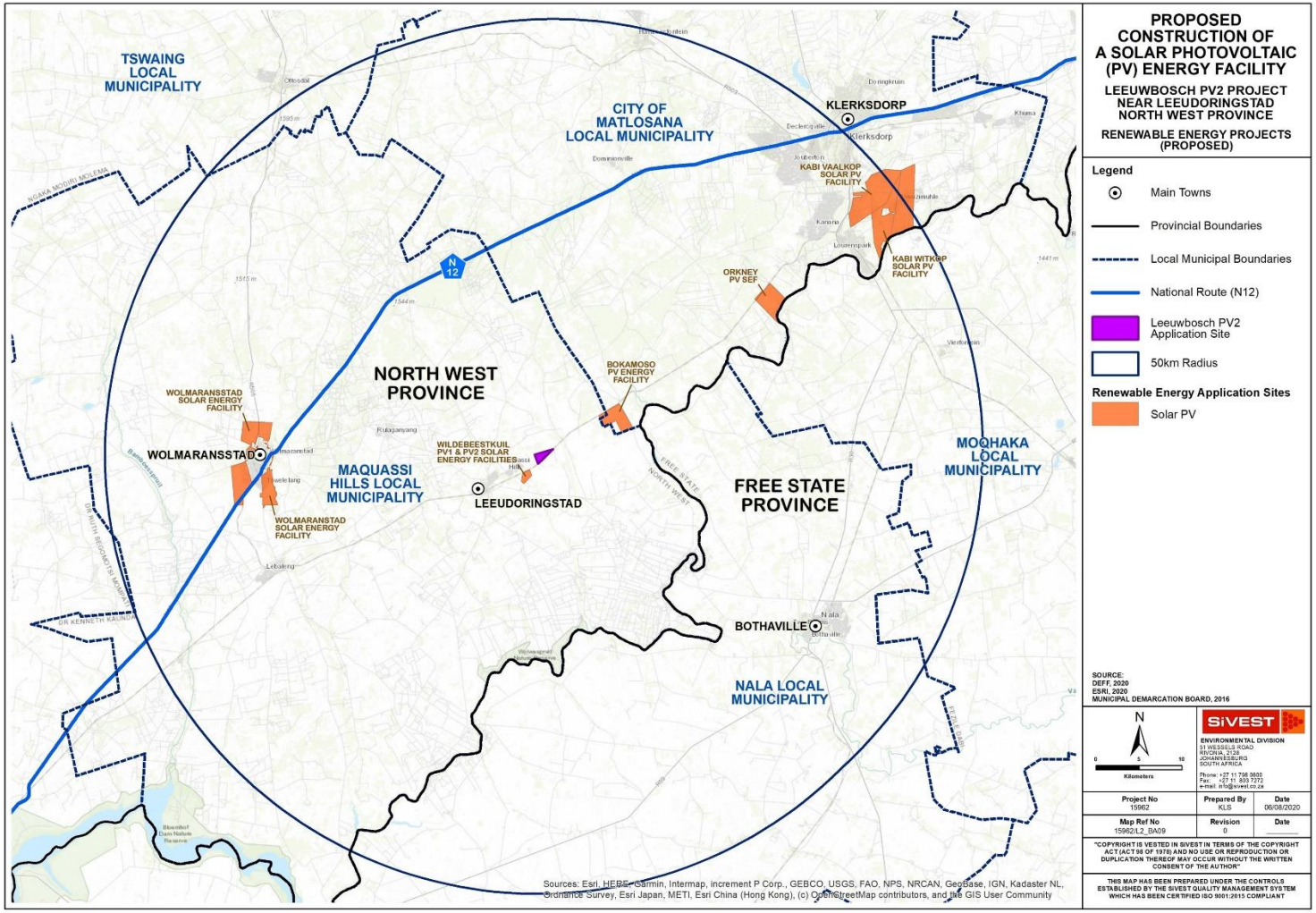

Figure 24: Surrounding Renewable Energy Projects Map – Leeuwbosch 2 Solar PV Plant

9 SPECIALIST RECOMMENDATIONS AND RISK ASSESSMENT

It is recommended that both the proposed Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant 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.

The existing site access roads currently routes through Depression Wetland 2 and associated buffer zone on the study site. It is highly recommended that the access route is re-aligned outside of all the delineated wetlands as well as the associated buffer zones. 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 wetland delineation and impact assessment is provided in this report for the proposed solar PV developments. Findings were based on a method for delineating wetlands as per the **Department of Water Affairs & Forestry 2005** guidelines. Ultimately, two (2) depression wetlands were delineated within the PV project site and one (1) additional depression wetland located to the south west approximately 125m from the study site[7].

The wetland present ecological status (PES), wetland ecosystem services, and environmental sensitivity and importance category (EISC) for the identified depression wetlands were assessed and provided for each depression wetland to determine their functionality and sensitivity. Accordingly, the PES of Depression Wetlands 1 and 2 were categorised to have an overall PES – C Moderately Modified, whilst Depression Wetland 3 was categorised with a PES – D Largely Modified.

With regards to the potential wetland ecosystems services provided by each depression wetland, all were found to score highest in terms of sediment trapping. Other relatively significant potential wetland ecosystem services provided (but at a slightly lower degree) include erosion control, phosphate trapping, toxicant control, nitrate removal and flood attenuation. For the artificial stormwater seeps, the

[7] It should be noted that a combined report has been compiled for both the proposed Leeuwbosch 1 Solar PV Plant and Leeuwbosch 2 Solar PV Plant. This is due to the fact that the proposed solar PV plants are located on the same property (Portion 37 of the Farm Leeuwbosch 44), 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.

potential ecosystem services provided which scored highest were in terms of phosphate trapping, nitrate removal, sediment trapping and erosion control. This is unsurprising since the seeps manage flows containing nutrients from the settlement areas. The stormwater flows also contain sediments which deposit into the seeps. The erosion control function is also important in this regard. Finally, the man-made impoundment scored highest in terms of the tourism and recreational opportunities it provides. Equally, the erosion control functions scored just as high. Other wetland ecosystem service functions however scored relatively low mainly due to the fact that the artificial system is controlled.

With regards to the EISC for the surface water resources, the results were as follows:

- Depression Wetland 1 was categorised as a Class C (Moderate);
- Depression Wetland 2 was categorised as a Class C (Moderate); and
- Depression Wetland 3 was categorised as a Class C (Moderate).

The functional assessments undertaken, as well as potential impacts anticipated, were used to inform a 50m buffer zone to be implemented for the identified depression wetlands.

In terms of potentially applicable environmental and water related legislation, several listed activities and water uses have been identified that will be applicable to the proposed developments based on the scenarios presented. 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 only for the upgrading of the existing road routing through Depression Wetland 2.

With respect to the National Water Act (1998), at a minimum water uses c) and i) will be triggered specifically for the site access road routing through Depression Wetland 2 that is to be upgraded. However, should it be possible to re-align the existing road outside of the wetland, it may be possible to register for General Authorisation under Government Notice 509 of August 2016 (Notice No. 40229). As per Section 9 of this report, the outcome of the Risk Assessment Protocol shows that the proposed developments will have a Low Risk, and thus it should be possible to register for a General Authorisation. The General Authorisation may be applicable to the entire proposed developments where the road is re-aligned out of the wetland as the proposed development falls within the 500m regulated area in terms of Government Notice 509 of August 2016 (Notice No. 40229). 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.

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 are located on the same property (Portion 37 of the Farm Leeuwbosch 44) and are identical in nature, the same impacts have been identified for both proposed solar PV plants. In addition, the recommended mitigation measures are applicable for both proposed solar PV plants. 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 Alternatives	- 20 (low negative)	- 7 (low negative)
CONSTRUCTION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**
Vehicle and Machinery Degradation Impacts to Wetlands	- 33 (medium negative)	- 20 (low negative)
Human Degradation of Flora and Fauna associated with the Wetlands	- 18 (low negative)	- 5 (low negative)
Degradation and Removal of Soils and Vegetation associated with Wetlands	- 33 (medium negative)	- 22 (low negative)
Increased Run-off, Erosion and Sedimentation Impacts	- 20 (low negative)	- 5 (low negative)
OPERATION PHASE		
	Pre-mitigation Rating	**Post-mitigation Rating**
Vehicle Damage to the Wetland	- 33 (medium negative)	- 33 (medium negative)
Stormwater Run-off Impacts to Wetlands	- 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, direct and indirect surface water impacts will be negligible. In consideration of the nearby Wildbeestkuil 1 Solar PV Plant and Wildebeestkuil 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 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.

The existing site access roads currently routes through Depression Wetland 2 and associated buffer zone on the study site. It is therefore highly recommended that the access route is re-aligned outside of all the delineated wetlands as well as the associated buffer zones. 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 Leeuwbosch 1 and Leeuwbosch 2 Solar Photovoltaic (PV) Plants 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

Signature of the Commissioner of Oaths

28/02/2021

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

GUSTAF SWART
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TEL: 082 828 2198

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)

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