PROPOSED AEP KATHU SOLAR (PTY) LTD SOLAR DEVELOPMENT NEAR KATHU, NORTHERN CAPE

SPECIALIST STUDY:
WATER RESOURCES ASSESSMENT STUDY

Prepared for:

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GEORGE

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ACRONYMS

CEMP	Construction Environmental Management Plan
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation, previously DWA & DWAF.
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
GIS	Geographical Information Systems
NFEPA	National Freshwater Ecosystems Priority Areas according to Nel *et al*., 2012
NWA	National Water Act
PES	Present Ecological State
PV	Photovoltaic
RDM	Resource Directed Measures
REC	Recommended Ecological Category
SANBI	South African National Biodiversity Institute
SC&A	Scherman Colloty & Associates
SWMP	Storm Water Management Plan
VEGRAI	Riparian Vegetation Response Assessment Index (Kleynhans *et al*., 2007)
WUA	Water Use Authorisation
WULA	Water Use License Application

1. INTRODUCTION

AEP Kathu Solar (Pty) Ltd. Solar Energy Facility, an Independent Power Producer (IPP) is proposing to establish a commercial solar energy facility on the solar photovoltaic energy facility (SEF) on the farm known as Legoko Farm No 460 portion 0, situated in the District of Kuruman RD, Northern Cape Province, within the jurisdiction area of the Gamagara Local Municipality (Figure 1). The facility will produce 75 MW, requiring 220ha (The Site) of the 1370.898ha farm. An Environmental Impact Assessment (EIA) is being conducted for the facility, and the proponent has been advised that they may require a Water Use Authorisation (WUA).

2. PROJECT DESCRIPTION

Extracted from the Project BID

The project will be developed as a stand-alone project by AEP Kathu Solar (Pty) Ltd., the Special Purpose Vehicle (SPV) established for the project. The use of PV technology allows for the direct conversion of solar radiation into electricity using semiconductors and the PV effect. The technology under consideration is either concentrating photovoltaic (CPV) modules or photovoltaic (PV) modules mounted on tracking structures. Other infrastructure includes:

- Inverter stations,
- Internal electrical reticulation,
- Internal roads,
- An on-site switching station / substation. This will locate the main power transformer/s that will step up the generated electricity to a suitable voltage level for transmission into the national electricity grid, via the OH line,
- A 132 kV overhead (OH) transmission line,
- Auxiliary buildings, *inter alia*, a control building, offices, warehouses, a canteen and visitors center, staff lockers and ablution facilities and gate house and security offices. Depending on the final plant design, these facilities may be integrated
- Construction laydown areas and
- Perimeter fencing and security infrastructure.

It is assumed for the purposes of this report that all the transmission line towers/pylons will be placed outside of any water courses (1:100 year floodlines or outside of any defined pans or water courses, whichever is greater), where possible but this will be limited by the allowed transmission line servitudes within the region.

Water supplied for the construction phase will be obtained from will be obtained from the Gamagara Municipality via an agreement between them and the proponent. The estimated water consumption for construction is 8750m^3 which will the reduce to 4659m^3 per annum for the operational phase/

The project will not employ any on-site treatment or disposal for the sewerage wastewater generated during the project's development phases. The generated quantities will differ significantly between the construction and operational phases of the development. The Gamagara Municipality has agreed to take responsibility for the treatment of sewerage that will be generated and that stored in on-site conservancy tanks and temporary chemical toilets. The waste water will be treated at the Kathu Waste Water Treatment Works (WWTW). According to Municipality this facility has sufficient capacity to deal with all the expected Waste Water quantities generated by the project based on the assumption that a maximum of 6750m^3 will be required.

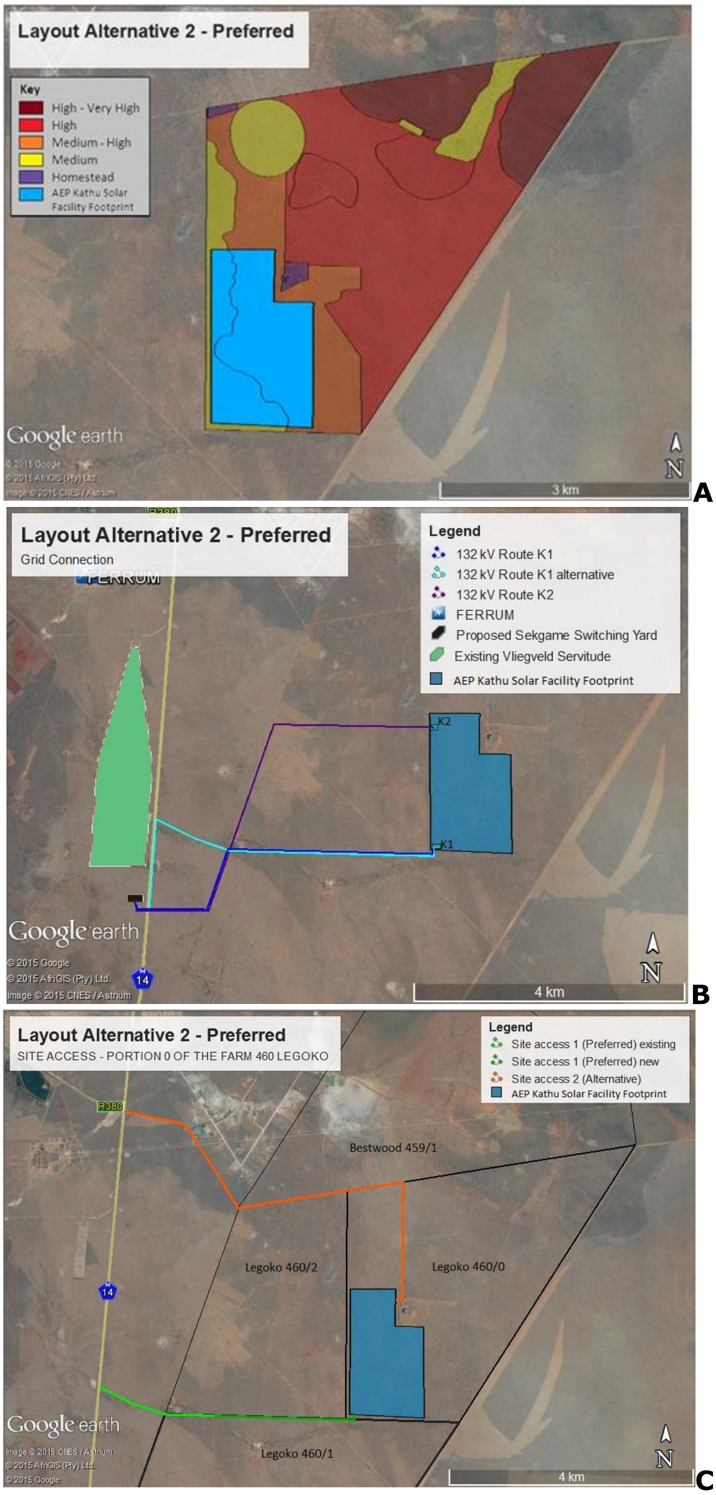

Figure 1: The study area and Preferred site alternative in relation to the ecological sensitivity map (A), the alternative transmission line routes and substations (B) and the alternative road access routes (C)

3. SPECIALIST TEAM

Scherman Colloty & Associates (SC&A) is a specialist consulting firm based in Grahamstown and Port Elizabeth in the Eastern Cape. The two partners have more than 27 years combined experience in the environmental management and aquatic assessment fields, with a diverse suite of clients based nationally and internationally.

Dr. Brian Colloty has a PhD in wetland ecology and importance rating, and has conducted wetland and riverine / estuarine assessments for projects throughout Africa. Brian has produced more than 95 wetland studies in the last 9 years, part of which includes the production of GIS related sensitivity maps with site-specific Environmental Management Plan (EMP) recommendations with regard construction and operational phases of developments.

4. APPROACH / METHODS

The study areas contain is known as an arid rainfall area consisting of dry river beds with little or no flows and clusters of endorheic pans. Thus the following approach was followed for the aquatic assessment:

- A desktop assessment of the study area covering the development footprint in relation to available information related to wetland / riverine ecosystems functioning, river classification, flow regime, water quality, physical, biota, and riparian habitat within the region.
- Mapping to demarcate local drainage and catchments within a 500m radius of the study area (Portion 0 of the Farm Legoko No. 460) (geo-referenced GIS shape files of the aquatic areas) to demonstrate the connectivity between the site and the surrounding region, i.e. the zone of influence. Maps depicting demarcated waterbodies have been delineated at a scale of 1:10 000 after a ground-truthing the study area.
- The determination of the ecological state of any aquatic systems, estimating their biodiversity, conservation and ecosystem function importance with regard ecosystem services at two sites based on their proximity to PV infrastructure or road crossings. Note that this determination does not include avifaunal, herpetological or invertebrate studies; however, possible habitat for species of special concern has been identified.
- Recommendations made for buffer zones and No-go areas around delineated wetland areas based on the relevant legislation, e.g. Conservation Plan guidelines or best practice.
- Impact assessment, based on the standard assessment methodology.
- Recommendations for mitigation of identified impacts, including engineering services that could negatively affect demarcated aquatic areas.
- Recommendations for Environmental Management / Monitoring Plans.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT: REGIONAL, LOCAL AND SITE-SPECIFIC CONTEXT

5.1. The Regional Study Area

The study area is located within the D41J Subquaternary Catchment of the Ga-Mogara River (Figure 2) a tributary of the Kuruman River, located within the Molopo River Catchment. The study area however showed no evidence of any water courses or drainage lines that occurred within the site. However, the National Wetland Inventory (ver 4) (SANBI) does indicate several endorheic pans within the study area and close to the preferred alternative site (Figure 3).

The landscape is characterised by large plains covered by bushveld. The surrounding land use and consequent state of the surrounding vegetation is largely determined by the agricultural practices within the study area, which is dominated by cattle production.

The pans are typical of this flat landscape where runoff accumulates in these depressions (Plate 1). The depressions have formed through the dissolution of the underlying limestone creating these endorheic systems (i.e. inflow but no visible surface outflow) and are thus karst (lime) related systems (Plate 2). This was confirmed by the soil specialist that indicated that large areas within the study area were covered by hard pan carbonates.

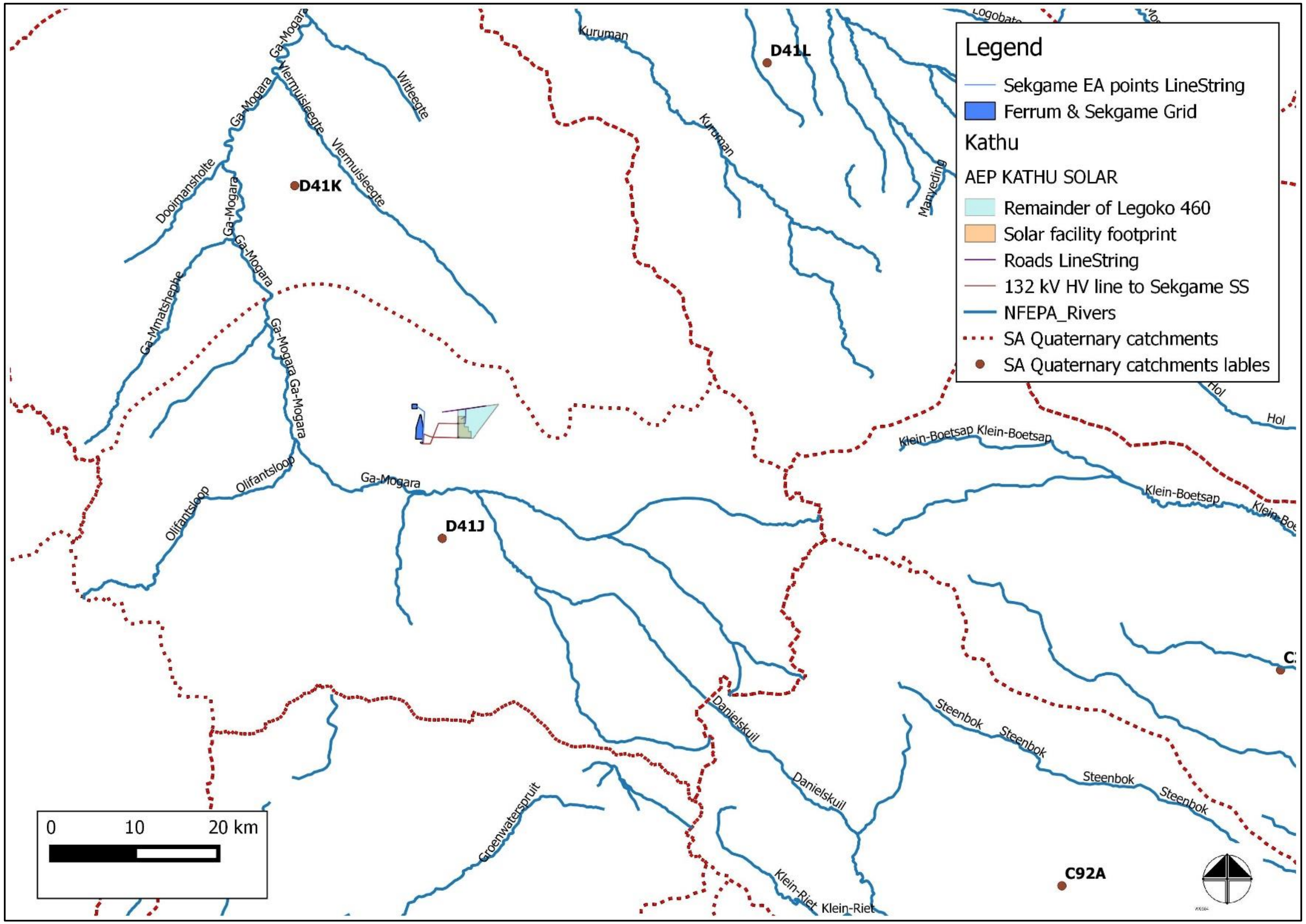

Figure 2: The study area in relation with the Quaternary Catchments and the main stem rivers (Source: DWS & NFEPA)

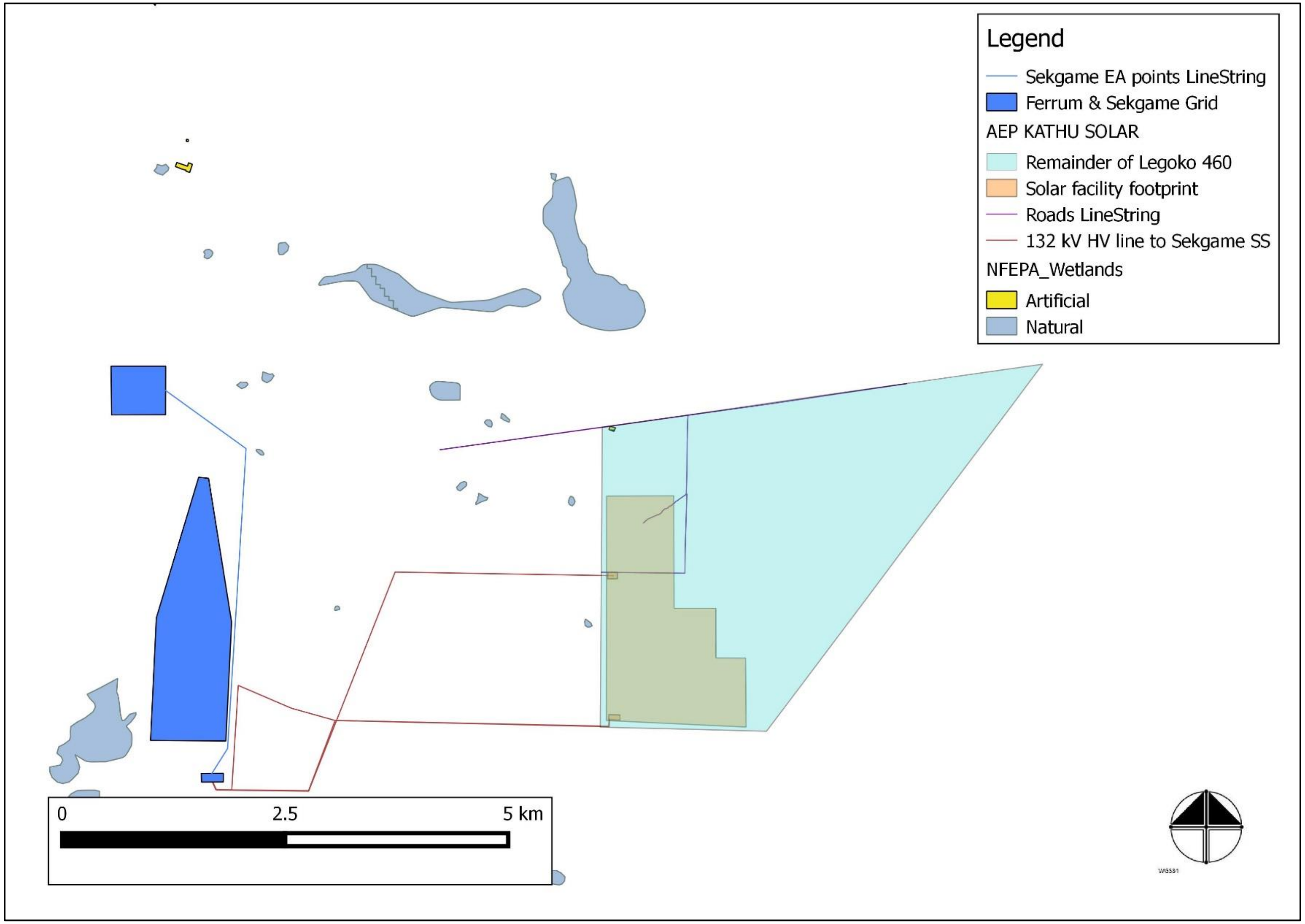

Figure 3: The study area and project components in relation to wetlands and water courses described in National Spatial Databases (SANBI)

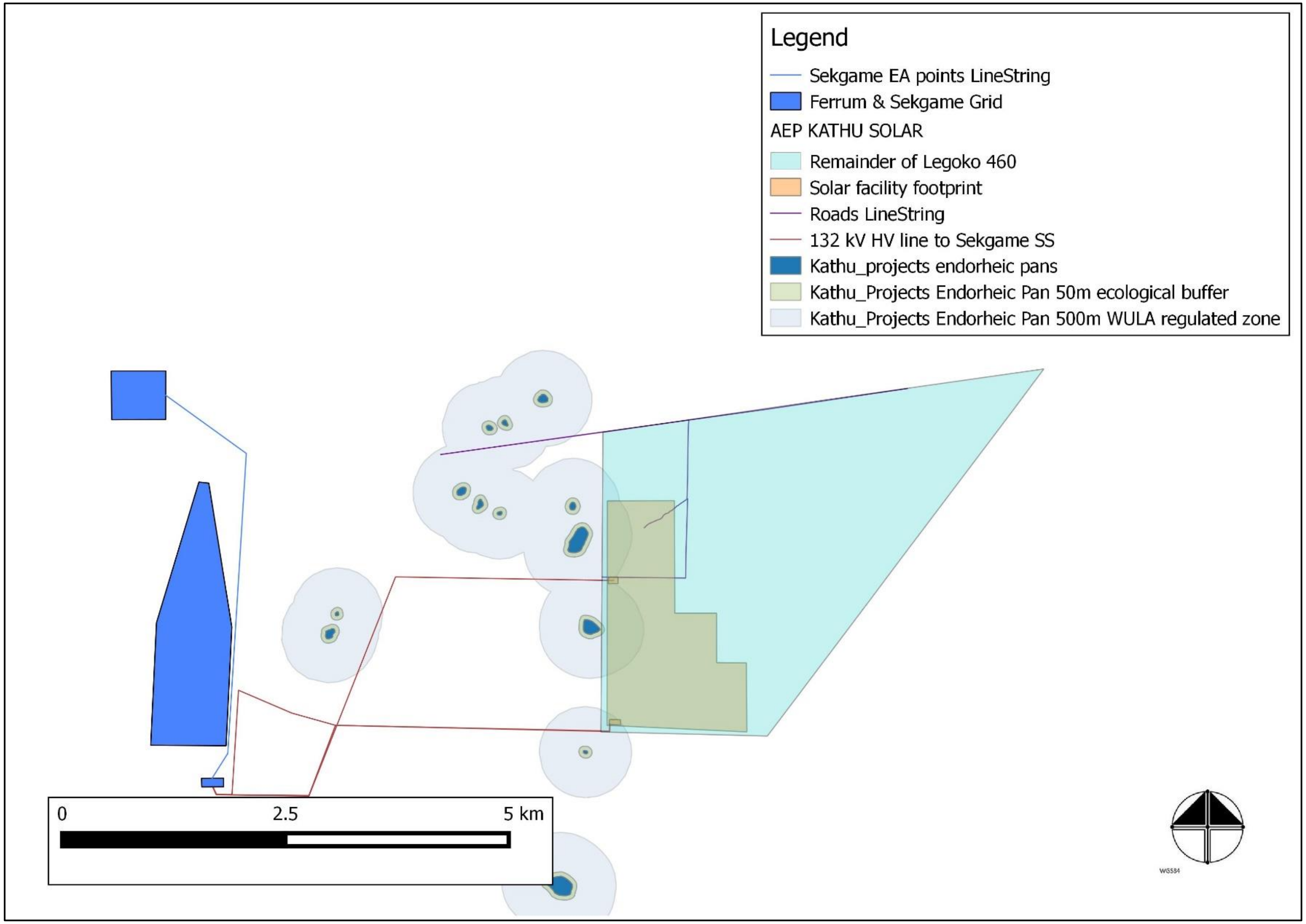

Figure 4: The observed and delineated wetlands observed within the study area

5.3. On-site data

5.3.1. Endorheic Pans

No flow or surface water was observed during the surveys, particularly within any water courses or drainage lines. This assessment is therefore based on a broad evaluation of the natural vegetation found within the region and at the site in relation to the wetlands observed and delineated (Figure 4). The pans a form of wetland are ephemeral for long periods even years at a time. Surface water will thus accumulate for short periods after heavy rainfalls, and then either evaporate or percolate into the surrounding ground water systems. No instream or aquatic vegetation was observed in these systems and species were similar to those observed in the surrounding systems.

Notably none of the proposed development (PV panels, planned access roads or the transmission line alignments) falls within the proposed 50m no-go ecological buffer (Figure 4). Although some of the infrastructure does occur within the 500m regulated zone would require a water use license.

6. PRESENT ECOLOGICAL STATE, ECOLOGICAL IMPORTANCE AND SENSITIVITY

In the compilation of this report, a number of sensitive areas within and adjacent to the study area were identified. From an aquatic systems point of view most of these were associated with the endorheic pans (Figure 4), noting that two of these have been transformed when converted into farm dams.

However, two sites representative of these systems within the study area were identified and rated to assess the Present Ecological State (PES) and Ecological Importance & Sensitivity (EIS) of the affected systems. Although the PES / EIS, was assessed using the VEGRAI 3 models, this was only based on the riparian vegetation component as no instream biota, flows or water quality could be used in the Index for Habitat Integrity due to the extreme ephemeral natural of these systems. The description and scores for each of the sites is presented below, while the overall sensitivity of the systems based on the representative sites assessed below is shown in Figure 5. The only systems that received a Low sensitivity assessment were the two pans that had been transformed (Figure 5):

PES Site 1– 27.744527S; 23.106589E (DD.dddd WGS84)

Plate 1: A small pan located in the northern portion of the study area. Note the hard pan carbonate (limestone) in the foreground

The Present Ecological State (PES) assessment was conducted although no instream vegetation was observed, with the pan colonised by typical grass and shrub species from the region. In the Level 3 Riparian Vegetation Response Assessment Index (VEGRAI, Kleynhans *et al*. 2007), PES scoring system (see table below), the non-marginal woody vegetation thus dominated the overall PES score (B/C = Near Natural / Moderately Modified). The score was lowered due to the presence of grazing, trampling and encroachment by the surrounding shrubs.

The Ecological Importance and Sensitivity (EIS) of this system, which is representative of all the pans found throughout the site was rated as Moderate (importance), however due to type and uniqueness within these systems the **Sensitivity would be rated as High** (= Red areas in Figure 5). The likelihood and significance of this impact is assessed in detail in the impact assessment of this report. The EIS score could have been higher but due to the lack of aquatic habitat, grazing and the presence encroaching vegetation the score was reduced.

LEVEL 3 ASSESSMENT					
METRIC GROUP	**CALCULATED RATING**	**WEIGHTED RATING**	**CONFIDENCE**	**RANK**	**% WEIGHT**
MARGINAL	100,0	66,7	3,0	2,0	2,0
NON MARGINAL	73,3	24,4	3,0	1,0	1,0
	2,0				3,0
LEVEL 3 VEGRAI (%)				76.5	
VEGRAI EC				**B/C**	
AVERAGE CONFIDENCE				3,0	

PES Site 2 – 27.758615S 23.108379E (DD.dddd WGS84)

Plate 2: One of the larger pans showing located in the southern portion of the study area

Present Ecological State (PES) Site 2 was situated south of PES Site 1 within a larger pan. No marginal or instream vegetation or other associated aquatic biota have been observed in this system due to its ephemeral nature. The PES score (See Level 3 VEGRAI assessment results below) was B = Near Natural, but this was due to additional impacts such as existing tracks, livestock tracks and grazing that have affected the this system.

The Ecological Importance and Sensitivity (EIS) of this system, which is representative of all the pans found throughout the site was rated as Moderate (importance), however due to type and uniqueness within these systems the **Sensitivity would be rated as High** (= Red areas in Figure 5). The likelihood and significance of this impact is assessed in detail in the impact assessment of this report. The EIS score could have been higher but due to the lack of aquatic habitat, grazing and the presence encroaching vegetation the score was reduced.

LEVEL 3 ASSESSMENT					
METRIC GROUP	**CALCULATED RATING**	**WEIGHTED RATING**	**CONFIDENCE**	**RANK**	**% WEIGHT**
MARGINAL	100,0	66,7	3.5	1,0	1,0
NON MARGINAL	60,0	20,0	3.5	2,0	2,0
	2,0				3,0
LEVEL 3 VEGRAI (%)				85.8	
VEGRAI EC				**B**	
AVERAGE CONFIDENCE				2,8	

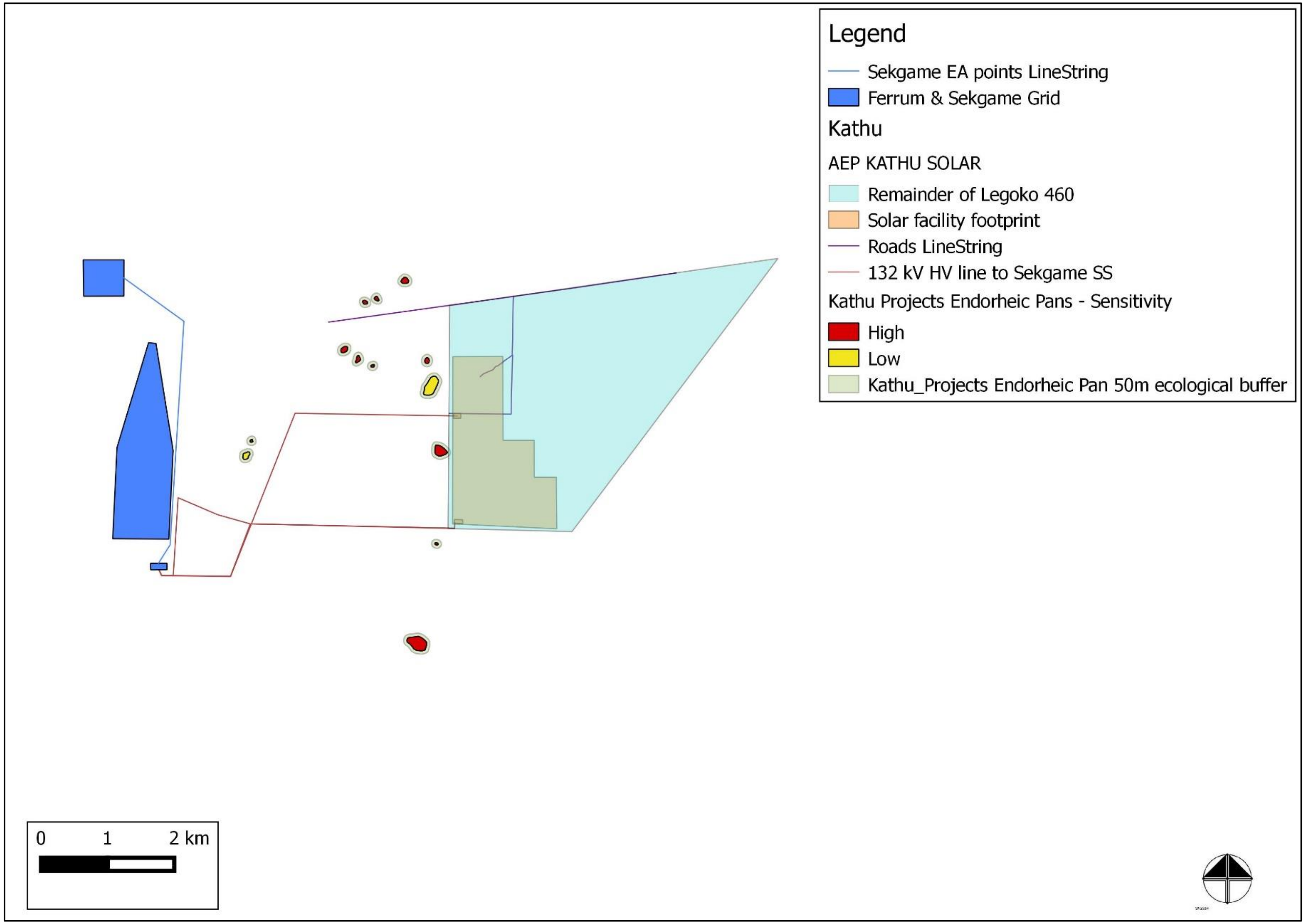

Figure 5: Overall sensitivity rating for the various aquatic systems. Note the 50m no-go buffer is also indicated.

7. IMPACT ASSESSMENT

During the impact assessment study a number of potential key issues / impacts were identified. Note the loss of wetlands (pans) was not assessed as the proposed sites (preferred) would seem to have no direct impact on these systems or their catchments. This is assuming that no structures would be placed within the 50m buffer proposed for the pans (Figure 4).

However, the proposed project could affect these systems through changes in the hydrological environment by the introduction of hard surfaces. Therefore, the following impacts were assessed:

Impact 1: Impact on pans through the possible increase in surface water runoff on form and function

Impact 2: Increase in sedimentation and erosion

Impact 3: Physical disturbance by the supporting infrastructure (e.g. roads) on hydrological environment

Nature: Impact 1 - Impact on pan systems due to hydrological changes. The physical removal or the clearing of natural vegetation could alter the hydrological nature of the area, by increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils. This impact would however be localised (panel arrays), as a large portion of the remaining farm and the catchment would remain intact.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments and reduce flow velocities.		
Cumulative impacts: The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, however considering that the site is not near any drainage channels and the low annual rainfall this impact is not anticipated. It is however assumed, together with the low mean annual run-off that with suitable stormwater management the impacts could however be mitigated, coupled to the fact that a low percentage of projects actually move into the construction phase.		
Residual impacts:		

Diversion of run-off away from downstream systems is unlikely to occur as the annual rainfall figures are low and no natural drainage features or water courses are located within the study area.

Nature: Impact 2 - Increase in sedimentation and erosion within the development footprint		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (1)	Low (1)
Probability	Definite (5)	Probable (3)
Significance	**Medium (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments and reduce flow velocities (e.g. water used when washing the mirrors).		
Cumulative impacts: Additional downstream erosion and sedimentation of systems lower in the catchment although unlikely due to lack of any water courses.		
Residual impacts: Additional downstream erosion and sedimentation of systems lower in the catchment although unlikely due to lack of any water courses.		

Nature: Impact 3 - Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment The proposed alignments will have limited to no (Transmission line) impact on the functioning of any wetlands.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (3)
Probability	Definite (5)	Probable (3)
Significance	**Medium (55)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: The proposed layout has been developed to avoid any wetlands. Care should however be taken when any clearing is done, that this area is monitored for plant re-growth, firstly to prevent alien plant infestations and to ensure no erosion or scour takes place.		

Cumulative impacts: Additional downstream erosion and sedimentation of systems lower in the catchment although unlikely due to lack of any water courses.
Residual impacts: Additional downstream erosion and sedimentation of systems lower in the catchment although unlikely due to lack of any water courses.

8. ENVIRONMENTAL MANAGEMENT PLAN MEASURES

Project component/s	Site selection with regard minimising the overall impact on the functioning of the aquatic environment
Potential impact	Loss of important habitat
Activity risk source	Placement of hard engineered surfaces (PV plants)
Mitigation: Target / Objective	Select a favourable site, having the least impact or within an area that is least sensitive, i.e. not within wetlands and their buffers.
Mitigation: Action/control	Minimise the loss of aquatic habitat – physical removal and replacement by hard surfaces by avoiding as many of the sensitive (High) pans possible as is shown in Figure 5
Responsibility	Developer
Timeframe	Planning and design phase
Performance indicator	N/A
Monitoring	N/A

Project component/s	Alteration of sandy substrata into hard surfaces impacting on the local hydrological regime
Potential impact	Poor stormwater management and the alteration hydrological regime
Activity risk source	Placement of hard engineered surfaces
Mitigation: Target / Objective	Any stormwater within the site will be handled in a suitable manner, i.e. clean and dirty water streams around the plant and install stilling basins to capture large volumes of run-off, trapping sediments and reduce flow velocities.
Mitigation: Action/control	Reduce the potential increase in surface flow velocities and the impact on aquatic systems
Responsibility	Developer / Operator
Timeframe	Planning, design and operation phase
Performance indicator	Water quality and quantity management - "Water Use Licence Conditions"
Monitoring	Surface water monitoring plan that ensures no erosion takes place

Project component/s	The use of chemicals and hazardous substances during construction and operation
Potential impact	These pollutants could be harmful to aquatic biota, particularly during low flows when dilution is reduced. Lime-containing (high pH) construction materials such as concrete, cement, grouts, etc., deserve a special mention, as they are highly toxic to fish and other aquatic biota. If dry cement powder or wet uncured concrete comes into contact with surface run-off or river water, these compounds can elevate the pH to lethal levels. Thus extreme care should be taken when these hazardous compounds are used near water. For fish, pH levels of over 10 are considered toxic.
Activity risk source	Accidental spillage of harmful materials and or hydrocarbons used during the construction process.
Mitigation: Target / Objective	Management actions that are applicable to all the construction sites include: • Strict use and management of all hazardous materials used on site. Considering the extremely low likelihood of surface flows, it is advised that construction activities are suspended unit such contaminants are removed from the site if surface flows are observed at or adjacent to the selected site area • Strict management of potential sources of pollution (hydrocarbons from vehicles and machinery, cement during construction, etc.). • Strict control over the behaviour of construction workers. • All areas adjacent to the hard-engineered erosion-control structures provided for this project, which are (accidently) disturbed during the construction activities, should to be rehabilitated using appropriate indigenous vegetation.
Mitigation: Action/control	Minimise the potential impact of pollutants entering the pans
Responsibility	Developer / Operator
Timeframe	Planning, design and operation phase
Performance indicator	Water quality and quantity management - "Water Use Licence Conditions"
Monitoring	Surface water monitoring plan

9. CONCLUDING COMMENTS/IMPACT STATEMENT

With suitable mitigation and avoidance of the pans (incl of the 50m non go buffer), the development should have no direct impact on the overall status of the aquatic systems and within the study area.

No protected or species of special concern (aquatic flora) were observed within the aquatic areas during the site visit thus the development poses no risk to any such species. Therefore, based on the site visits the significance of the impacts on the aquatic environment within the study area would be **LOW**.

Figure 4 indicates the various water use regulated zones within the study area as required by legislation. A WULA in terms of Section 21 c and i of the National Water Act will be required should any construction take place within any these areas i.e., any development within 500m of a wetland boundary.

When considering any other potential projects within the adjacent / nearby farms the potential for changes to the surrounding aquatic habitat would not be significant especially during the operational phases (hard surfaces and stormwater management). It is however assumed that any such changes would be detrimental to the various projects owners, i.e. erode areas around mirrors. This coupled to the fact that the low mean annual run-off and with suitable stormwater management the impacts could however be mitigated. The likelihood of any cumulative impacts listed in this report is especially low when considering the only a low percentage of projects will actually move into the construction phase.

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