SERVICES REPORT

FOR

RENEWABLE ENERGY GENERATION PROJECT ON THE FARM EAST 270 KURUMAN RD

EAST 2 SOLAR PARK

May 2016 - rev.2

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Project No : 215/26

CONTENTS

1 INTRODUCTION

GMH/Tswelelo Consulting Engineers of Thabazimbi have been appointed as consulting engineers for the roads and civil services to the proposed **East 2 Solar Park.** The client is **Palus Energy (Pty) Ltd** (Registration number 2013/087976/07). The solar park is to be developed on the eastern boundary of the **Remaining Extent of the Farm East 270, Kuruman RD**, 964.2695 hectares in extent. The property is located in the Joe Morolong Local Municipality, part of the John Taolo Gaetsewe District Municipality in the Northern Cape Province of South Africa. The site is located 10km North-East of Hotazel, 62 km North of Kathu and 59 km North-West of Kuruman. The property is currently being used for grazing purposes. This report sets out the methodology for the provision of civil services to the proposed development.

As indicated in the Locality Map attached to this report, the East 2 Solar Park may deliver the electrical energy either:

a) to the Eskom Hotazel substation, 5.5 km south of the project site, via a new 132 kV power line approximately 2.7 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (alternative connection 1); or

b) to the new Eskom Umtu substation, ±8.5 km south-west of the project site, via a new 132 kV power line approximately 11,3 km long and running parallel to the existing Eskom "Hotazel - Heuningvlei" 132 kV power line (for 5.3 km) and to the Eskom "Hotazel - Umtu" 132 kV power line (for ±6.0 km) (alternative connection 2).

2 INTERNAL ROADS

It is proposed that gravel roads be constructed as required to access the PV power plant. The development will be contained inside a security area and the roads are not intended for public use.

2.1 Existing Roads

Very few roads exist on the development area. The existing roads consist of informal basic farm tracks traversing the area. These roads are typical of the roads used for farming purposes.

2.2 Access to the Project Site and Proposed Road Layout

The PV power plant is to be located on the eastern boundary of the Remaining Extent of the Farm East 270, Kuruman RD; the footprint (fenced area) of the proposed development is approximately 250 ha. The property is adjacent to the Eskom "Hotazel - Heuningvlei" 132 kV power line.

Access to the PV plant will be from the secondary road (connecting to the R31) running along the Eastern boundary of Portion 2 of the Farm East 270. A new access road - approximately 4.6km long and be developed along the southern boundary of Portion 2 of the farm East 270 Kuruman RD from secondary Road R31 to serve the development.

The proposed internal roads are indicated in ochre on the proposed layout plan attached to this report. All internal roads are to be gravel roads.

2.3 Typical Road Design

The internal roads will be designed with sufficient structural capacity in order to withstand the expected traffic loading required for the construction and maintenance of the PV power plant. It is proposed that these roads be constructed to a maximum width of 8.0m, which will allow slow moving heavy vehicles to pass each other. The road pavement will consist of roadbed preparation, fill where required, and a wearing course.

Due to the fact that all accessible material on site are not suitable for use in the roads, road will have to be at least partially constructed using material imported from a local mine. The roadbed needs to be impact rolled in order to remove residual collapse potential while the wearing course will benefit from the mixing in of gravel material to create aggregate interlock.

The roads are expected to take minimal traffic once the solar farm is in operation and will mainly then be used for maintenance and inspections.

The portion of the property (where the development area is planned to be located) is underlain by a plain land facet with a gentle undulating to flat topography with a gradient of 1.5%. The average elevation is 1047 m amsl, with the lowest point 1040m amsl and the highest point 1054 m amsl.

Due to the flatness of the development area, no earthworks are envisaged for the installation of the PV module mounting systems. The mounting systems will consist of metallic frames to be assembled on-site, supported by the driven friction piles or pre-bored cast-in-situ concrete piles. Concrete ballasted footing foundations are also possible.

Earthworks will be required during the construction of internal roads. The vertical alignment of the roads will not present any significant challenges due to the flatness of the terrain so that no deep cuts or fills will be required. Considering a road pavement thickness of 200 mm (wearing course) and an overall road surface approximately 100,000 m^2, the amount of imported material or fill is estimated to be approximately 12 000 m^3 based on the assumption that 60% of the wearing course will consist of imported material. Cut to fill quantities will be negligible.

Small earthworks will be required for the installation of the medium-voltage stations. None of these activities should require earthworks in excess of 500 mm cut or fill.

Only the foundation plate for the small high-voltage substation may require earthworks in excess of 500 mm cut or fill (the footprint will be up to 4000 m^2). The topsoil stripping will result in temporary spoils heaps which must be spread over the site upon completion of the project.

Underground cables will be laid down along the internal roads.

Most of the site is characterized by microphyllous woodland that varies in density and species composition. No major drainage features occur on site, although the

Gamagara River runs further to the West of the site. The planned footprint (approximately 250 ha) will be cleared from the existing shrubs and vegetation.

2.4 Road Building Materials

The deep sandy soils present on site is not suitable for use as aggregate for road construction. Discard material from the nearby manganese mines can be used for roads. Other aggregates should be sourced from commercial suppliers in the area. The soil is also non expansive but collapse potential exists due to the very low densities of the *in situ* materials.

3 STORMWATER DESIGN

The permeability of the sand is high, so the rainfall penetrates the soil readily. Sheet wash do occur along preferred flow path but the water sinks into the ground after some distance. No pans or wetland areas were identified on site. Sub surface drainage is expected to occur towards the Gamagara River.

Given the low rainfall, flat topography and low flow speed of run-off, no formal storm water structures are required as the proposed gravel roads will be developed at ground level so as not to disturb the natural flow of storm water. This means that run-off will not be concentrated and the existing drainage patterns will be left undisturbed.

4 WATER RETICULATION

A Geo-Hydrological Study was conducted in order to assess the water availability on the property.

As indicated in the Geo-technical and Geo-Hydrological Report, one borehole is located on the Remainder Portion of the farm East 270. This borehole is not equipped as it has a very low yield.

The Geo-technical and Geo-Hydrological Study concluded that, should water for the project be sourced by means of groundwater abstraction, a new borehole should be drilled, as the existing on-site borehole is not suitable due to the low yield and poor water quality. It is recommended that the fractured rock aquifer located below the Kalahari sediments be targeted at depths between 80 and 120 m below surface as a source of water for the project. In this case, a Water Use License application would have be submitted to the Department of Water Affairs by Palus Energy.

A new borehole with a sustainable abstraction of 3600 l/h (0.042 l/s) will be sufficient to supply the solar project with sufficient water during the construction and operational phases.

Alternatively (preferred alternative - under investigation by Palus Energy) water can be sourced from the Vaal Gamagara Pipeline, which is operated by Sedibeng Water, the local water provider.

The water required during the 15 months construction phase can be summarised as follows:

- Water is required for the compaction of earthworks relating to the project. The surface area of the proposed gravel roads come to 100 000 m^2 and the water use is expected to be 50 l/m^2.
- The average number of workers expected to be employed on site during construction is 100, each of which is expected to require 30 litres of water per day over 15 months (330 working days). Therefore, water consumption for sanitary use will be:
  100 people x 30 l/person x 330 working days = 990 m^3 over 15 months
- Water will also be required for the production of concrete. The overall volume of concrete to be cast is 10 000 m^3, which will require 200l of water per m^3.
- The water requirement for the cleaning of vehicles and plant is expected to be negligible.

The overall water usage during the construction period can be summarised as follows:

WATER REQUIREMENT DURING THE CONSTRUCTION PHASE		
DESCRIPTION	UNIT	TOTAL
Time frame of the construction activities	*months*	up to 15
Overall water consumption for internal roads	m^3	8 220
Overall water consumption for sanitary and other uses (over 330 working days)	m^3	2 640
Overall water consumption for concrete production	m^3	4 800
TOTAL WATER CONSUMPTION	***m^3***	**15 660**

After the construction phase, the water consumption will drop dramatically. Water will mainly be used for sanitary purposes by the core team on site, and for cleaning of the PV panels. It is expected that 14 persons will be on site during the daytime, and only 6 persons will be on site overnight. Assuming an average water consumption of 60 l/person/day, the 20 persons will require 1 200 l/day. The cleaning of the solar panels will be done twice a year when 1 litre of water will be required per m^2 of PV panel surface. Therefore,850 m^3 of water will be used for each cleaning cycle, which will last approximately two weeks (12 working days). The overall water consumption for cleaning activities will be1 700m^3/year (two cleaning cycles per annum).

The water consumption will increase from 1 200 l/day to 72200l/day only during the days when the solar panel cleaning is done (71000 l/day for cleaning activity and 1200 l/day for sanitary use). The PV modules are conceived as self-cleaning with rain, but it is possible that cleaning as set out above will be required during some years. It is proposed that 90 000l be stored on site in a reservoir for emergencies (like fire), and to tide the development over when pumps or water mains are maintained or repaired.

The water consumption during the operational phase can be summarised as follows:

WATER REQUIREMENT DURING THE OPERATIONAL PHASE		
DESCRIPTION	UNIT	TOTAL
Average daily water consumption for sanitary use	*l/day*	4 800
Average daily water consumption during cleaning activity (*)	*l/day*	110 000
Average monthly water consumption for sanitary use	*l/month*	130 500
Annual water consumption for sanitary use	m^3/*year*	1 566
Annual water consumption for PV modules cleaning cycles	m^3/*year*	2 640
ANNUAL WATER CONSUMPTION	m^3/*year*	4 206
DAILY WATER CONSUMPTION (average over 365 days)	m^3/*day*	11.52

(*) over 12 working days, twice per year

The water requirement during both the construction and operational phase of the proposed development is relatively low and it is expected that sufficient water will be available to serve the long term needs of the development.

4.1 Methodology of Water Reticulation

Potable water will be reticulated using HDPE water mains. In the case of groundwater abstraction, water will be pumped from the new on-site borehole by means of water mains. Water from this borehole will be used to fill storage tanks (proposed capacity of 90 000l) to be used for fire-fighting and purposes as set out above.

4.2 Fire Fighting Requirements

Fire will need to be contained over the whole of the property and it is therefore proposed that 90kl of water be stored on site. It is further proposed that suitable vehicle mounted water tanks suitably fitted with water pumps be available for this purpose, and that competent fire breaks be constructed and maintained. The "fire team" will be composed by the people for general maintenance, who will attend a comprehensive fire-fighting training program. After this training programme, the fire team will be able to drive/use/manage properly the fire-fighting equipment that will be available on the site. Firebreaks will be provided and maintained around the planned footprint. Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to Prepare and maintain firebreaks).

5 SEWER RETICULATION/SYSTEM

It is foreseen that the sewer reticulation will be handled by the patented and commercially available Ballam Waterslot (or similar) sewer treatment system. The sewer system will therefore consist of an installation to serve the office in the control building. It is foreseen that the system will be installed in line with the requirements of the manufacturer. Most typical systems consist in essence of a conservancy tank (built underground on site), and a patented digester. Most systems require electricity to power the pumps and fans used in the aeration process, although some systems use wind power (whirlybird). The only other item worth noting is the fact that some systems could require chlorine tablets available commercially, but systems where effluent is treated with ozone (like the Ballam Waterslot system) is getting more common and affordable.

The effluent from these systems will be suitable for irrigation of the vegetation buffer zone, or re-use in the offices as water for the flushing of toilets, or for fire fighting purposes. This will reduce the overall water requirement of the development substantially.

6 ELECTRICAL CONNECTION

Electricity is available in the site and it is expected that a suitable connection can be applied for, in order to meet the internal consumption of the solar park (offices in the control building, lighting and video-surveillance systems, electrical devices on stand-by during the night, etc.).

7 REFUSE REMOVAL

It is foreseen that an agreement will be entered into with the Joe Morolong Local Municipality for accepting refuse from the solar farm. This refuse shall be transported to the appropriate site by the developer. It is not proposed that any refuse be buried or incinerated on site.

8 SUMMARY

We believe that adoption of the abovementioned proposals will result in acceptable and sustainable civil engineering services to be available to the proposed East 2 Renewable Energy Generation Project.

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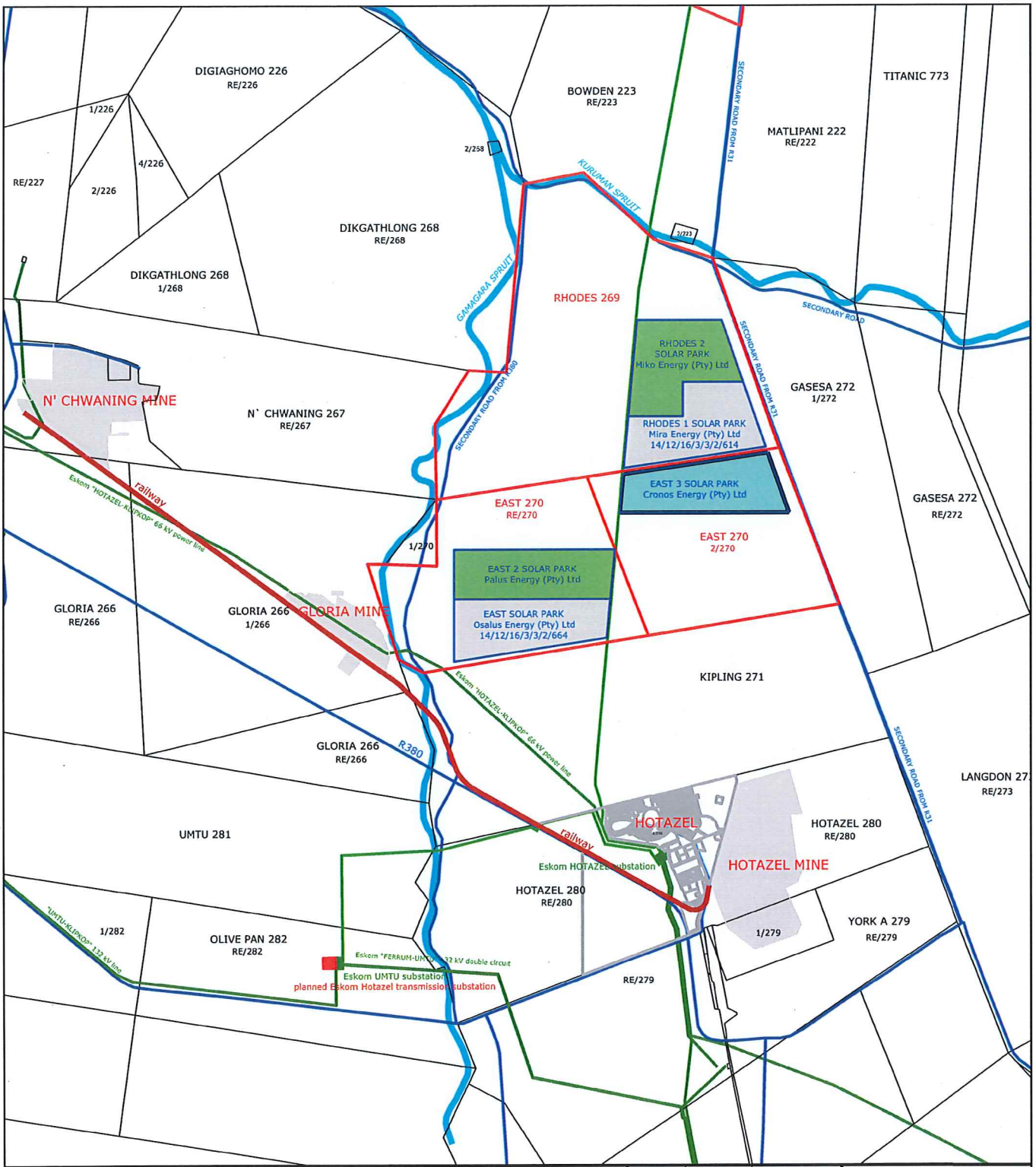
LOCALITY MAP AND DEVELOPMENT AREA



PROJECT SITE:

Portion 2 of the Farm EAST 270
Kuruman RD
Joe Morolong Local Municipality
John Taolo Gaetsewe District Municipality
Northern Cape Province
LPI code: C0410000000027000002
Extent: 856.5320 hectares
27° 09' 50" S , 22° 56' 15" E

Development area: Extent: 210 hectare

Revision	Date	Description
01	FEB 2016	Draft EIA Report

EAST 3 SOLAR PARK

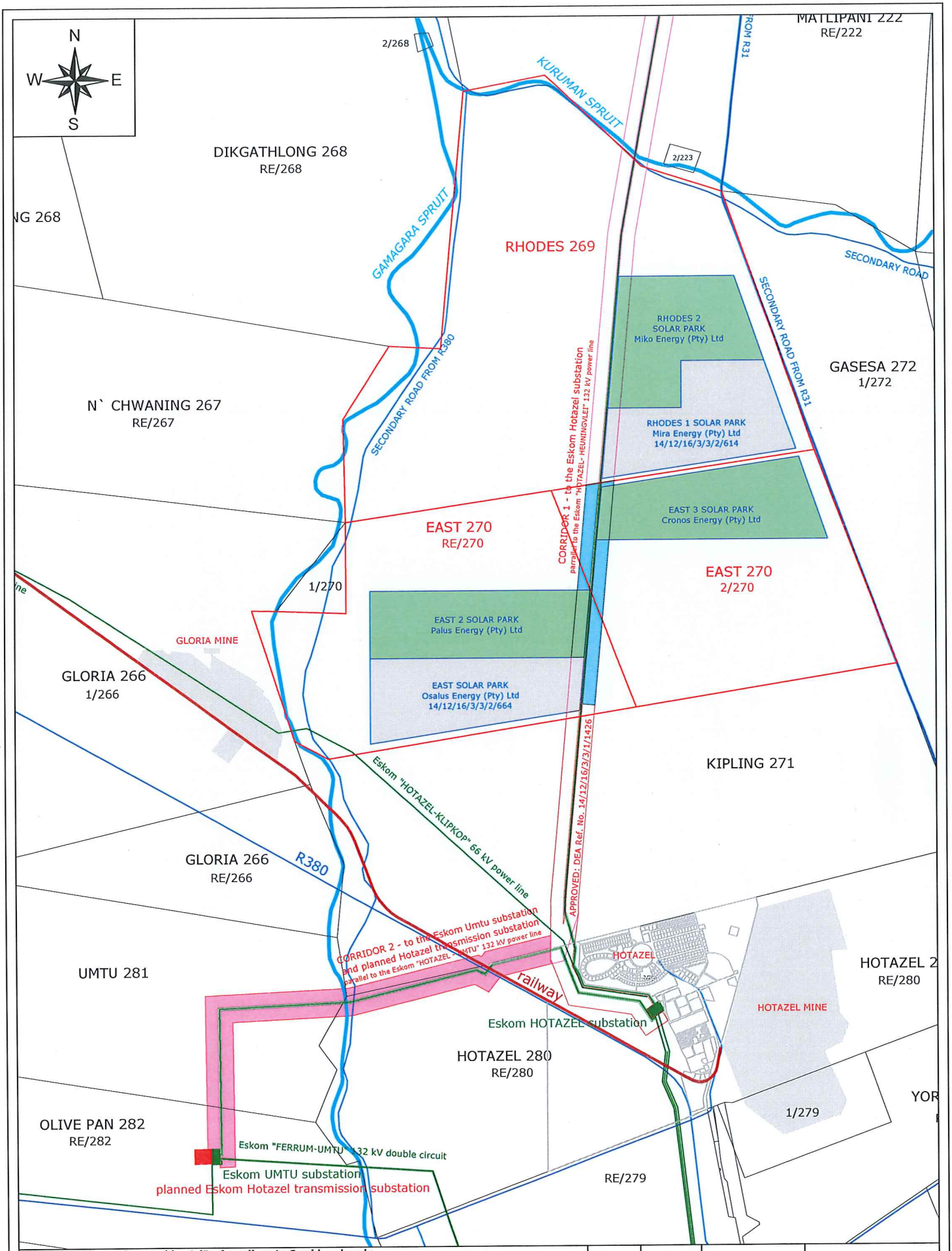
LOCALITY MAP

Cronos Energy (Pty) Ltd.
[Registration No: 2013/097343/07]

Size A4 | Scale 1:1500

Id. E3SP LP

LOCALITY MAP AND CONNECTION ALTERNATIVES



Alternative Corridor 1 (Preferred) up to Corridor already approved [DEA Ref. No. 14/12/16/3/3/1/1426]
New power line to be built up to the Hotazel sub-station
Corridor Lenght: ±2.7 km - study width 150m + 150m

Alternative Corridor 2 to the Umtu sub-station
Corridor Lenght: ±6.0 km - study width 150m + 150m
To be investigated under separate Basic Assessment

Portion 2 of the Farm EAST 270
Kuruman RD
Joe Morolong Local Municipality
John Taolo Gaetsewe District Municipality
Northern Cape Province
LPI code: C0410000000027000002
Extent: 856.5320 hectares
27° 09' 50" S , 22° 56' 15" E

Revision	Date	Description
01	Feb 2016	Draft EIA Report

EAST 3 SOLAR PARK

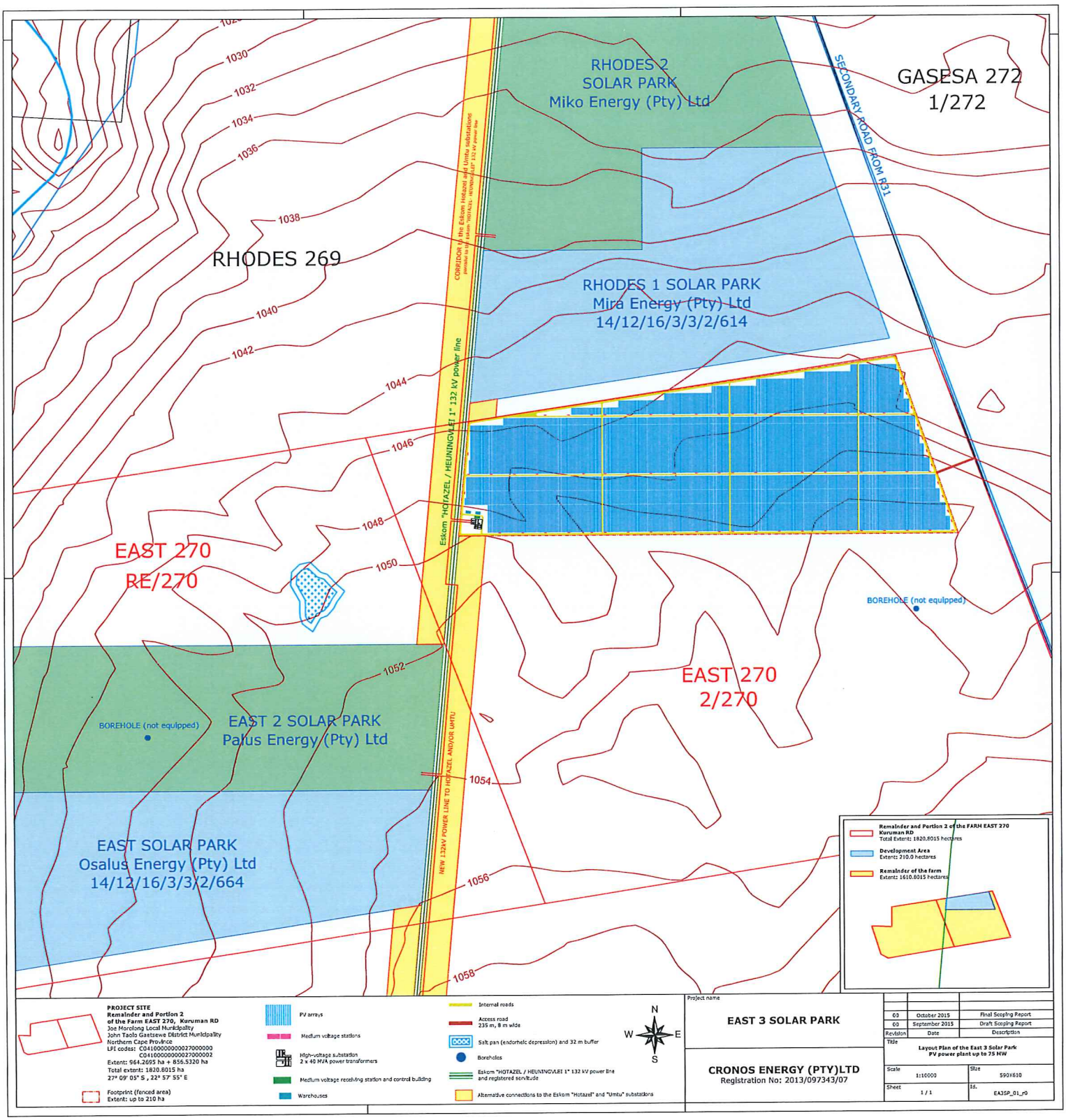
Connection alternatives and other projects under development at Hotazel

Cronos Energy (Pty) Ltd
Reg. No. 2013/097343/07

Size A3 | Scale 1:40000

Id. E3SP Connection Alt

PROPOSED LAYOUT OF THE EAST 2 SOLAR PARK
PV Power Plant up to 120 MW


RHODES 2
SOLAR PARK
Miko Energy (Pty) Ltd
GASESA 272
1/272
SECONDARY ROAD FROM R31
RHODES 269
RHODES 1 SOLAR PARK
Mira Energy (Pty) Ltd
14/12/16/3/3/2/614
CORRIDOR of the Eskom Hotazel and Umtu substations
Eskom "HOTAZEL / HEUNINGVLEI 1" 132 kV power line
EAST 270
RE/270
BOREHOLE (not equipped)
EAST 270
2/270
BOREHOLE (not equipped)
EAST 2 SOLAR PARK
Palus Energy (Pty) Ltd
EAST SOLAR PARK
Osalus Energy (Pty) Ltd
14/12/16/3/3/2/664
NEW 132kV POWER LINE TO HOTAZEL AND/OR UMTU
1030
1032
1034
1036
1038
1040
1042
1044
1046
1048
1050
1052
1054
1056
1058
Remainder and Portion 2 of the FARM EAST 270
Kuruman RD
Total Extent: 1820.8015 hectares
Development Area
Extent: 210.0 hectares
Remainder of the farm
Extent: 1610.8015 hectares
PROJECT SITE
Remainder and Portion 2
of the Farm EAST 270, Kuruman RD
Joe Morolong Local Municipality
John Taolo Gaetsewe District Municipality
Northern Cape Province
LPI codes: C0410000000027000000
C0410000000027000002
Extent: 964.2695 ha + 856.5320 ha
Total extent: 1820.8015 ha
27° 09' 05" S , 22° 57' 55" E
Footprint (fenced area)
Extent: up to 210 ha
PV arrays
Medium voltage stations
High-voltage substation
2 x 40 MVA power transformers
Medium voltage receiving station and control building
Warehouses
Internal roads
Access road
235 m, 8 m wide
Salt pan (endorheic depression) and 32 m buffer
Boreholes
Eskom "HOTAZEL / HEUNINGVLEI 1" 132 kV power line
and registered servitude
Alternative connections to the Eskom "Hotazel" and "Umtu" substations
N
W
E
S
Project name
EAST 3 SOLAR PARK
CRONOS ENERGY (PTY)LTD
Registration No: 2013/097343/07
03 October 2015 Final Scoping Report
02 September 2015 Draft Scoping Report
Revision Date Description
Title
Layout Plan of the East 3 Solar Park
PV power plant up to 75 MW
Scale 1:10000
Size 590X610
Sheet 1 / 1
Id. EA3SP_01_r0