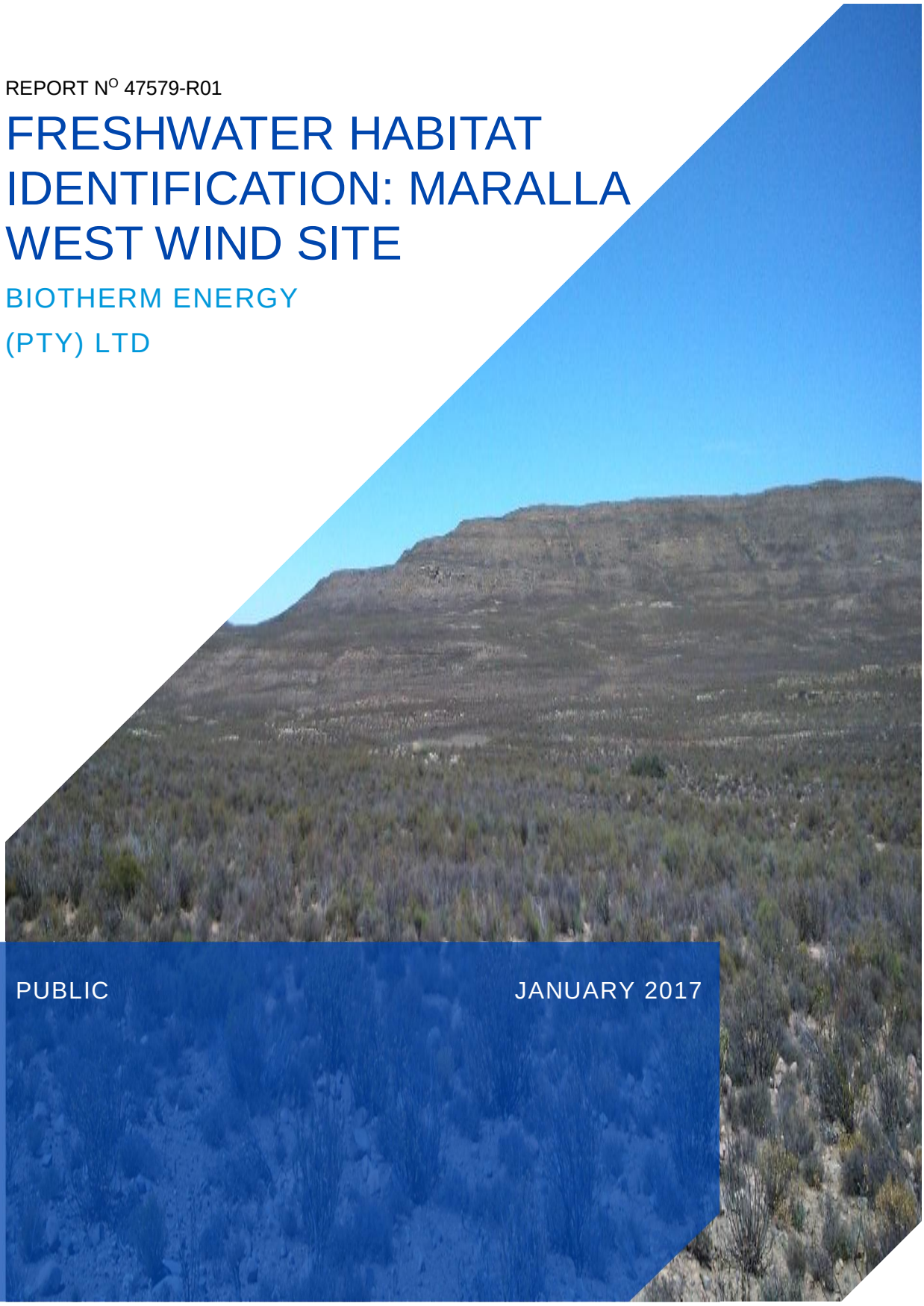
REPORT N^{O} 47579-R01

FRESHWATER HABITAT IDENTIFICATION: MARALLA WEST WIND SITE

BIOTHERM ENERGY (PTY) LTD



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WSP | PARSONS BRINCKERHOFF

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1 INTRODUCTION

BioTherm Energy (Pty) Ltd (BioTherm) have proposed the development for a renewable energy complex Maralla West in the Western Cape Province. As part of the application process for Environmental Authorisation, WSP Environmental (Pty) Ltd (WSP | Parsons Brinckerhoff) was appointed by BioTherm to undertake a Social and Environmental Impact Assessment (SEIA).

The SEIA is divided into two phases, the Scoping Phase and the Environmental Impact Assessment (EIA) Phase. This report will follow from the scoping phase, addressing the freshwater habitat systems (i.e. wetlands and watercourses) located within the project footprint, and providing a high-level assessment of the potential environmental impacts associated with the proposed development.

1.1 OBJECTIVES OF THE REPORT

The objective associated with the assessments include the following:

- Describe the background of the project and contextualise it in the natural environment. This will include identification of freshwater habitat systems located within the project footprint;
- List and assess the potential environmental impacts associated with the proposed project to the environs identified; and
- Conclude the finding of the report, highlighting any significant impacts and their corresponding mitigation and management measures, which should be considered as conditions in the authorisation.

1.2 STUDY APPROACH AND METHODOLOGY

The scope of work covered within this report, which entails freshwater habitat identification, forms part of the process required for BioTherm to apply as a Preferred Bidder to the Department of Environmental Affairs (DEA). The study therefore focuses on the identification and assessment of sensitive environments that may be impacted on by the proposed project.

The purpose of this report was to conduct a high-level study that identified freshwater habitat systems in the area of the proposed Maralla West Site. The potential impacts to the land and freshwater habitat systems were defined at a generic and high level. This entailed a desktop review and site visit from which an initial the scoping report was developed. The desktop review utilised available information at the time, including the following spatial information resources:

- Google Earth Pro;
- Agricultural Geo-Referenced Information System (AGIS);
- National Freshwater Ecosystem Priority Areas (NFEPA);
- The U.S. Geological Survey (USGS);
- The Soil Maps of Africa: European Digital Archive of Soil Maps (EuDASM);
- Hydrological features including rivers and, catchments and water management areas, and
- Existing maps and detailed project information provided by BioTherm which were available at the onset of the project.

Preliminary maps and figures were developed to use during the site visit to verify the information collected during the desktop review, through a ground-truthing exercise.

The site investigation comprised of a three-day site visit conducted between the 1st and 3rd of March 2016. The site assessments entailed a drive through of the property on which the proposed Maralla West is located. The area covered during the site visit was the operational footprint of the proposed project as well as a 500m boundary buffer. The following tasks were undertaken as part of the site investigation:

- Verification of desktop review information;
- Wetland and riparian zone identification and delineation; and,
- Soil profile characterisation and sample collection, including:
  - Soil depth and profile description (i.e. subjective moisture estimation, effective rooting depth, presence of mottling, gleying, pedocretes and soil structure);
  - Classification of soil form and family based on the Taxonomic Soil Classification System for South Africa (Macvicar, 1991);
  - Permeability based on in-situ estimation and texture properties;
  - Underlying lithology.

A handheld Global Positioning System (GPS) and camera were used in conjunction with the maps produced in the desktop review, to conduct the ground-truthing exercise. The GPS was used to delineate areas as well as verify and mark all relevant points with exact co-ordinates. Representative soil samples were collected using a hand-operated auger, where holes were drilled until the parent material/refusal was reached.

FRESHWATER HABITAT IDENTIFICATION

The freshwater habitat identification for the proposed Maralla West project entailed the following tasks described below:

- Desktop review to establish the baseline environmental conditions and location of wetlands marked in the National Land Cover GIS database for South Africa (SANBI – BGIS) and the National Freshwater Ecosystem Priority Areas (NFEPA);
- Identification of wetlands, based on the Department of Water Affairs and Forestry (DWAF) publication *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas* (DWAF, 2008); and
- High-level description of the potential impacts on the identified freshwater habitats located within a 500m radius of the proposed Maralla West project footprint.

DELINEATION OF FRESHWATER HABITATS

The identification and delineation of wetland habitat within 500m of the proposed site boundary initially was undertaken at a desktop level utilising available information, including amongst others topographical maps, current and historical aerial imagery, existing coverages and contour data.

Infield identification of all watercourses (freshwater habitats) in relation to the proposed site, was conducted in accordance with the methods contained in the Department of Water and Sanitation's (previously DWAF) manual 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas'. The freshwater habitats were also classified in accordance with the, 'National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa' document developed by Ollis *et al*. (2013).

There are specific indicators utilised to determine the outer edge of a wetland during the infield investigation: position in landscape, vegetation and soil wetness (determined through soil sampling with a soil auger and the examining the degree of mottling). According to the wetland definition used in the National Water Act, vegetation is the primary indicator, which must be present under normal circumstances. However, in practice the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role. Like wetlands, riparian areas can be identified using a set of indicators. The indicators for riparian areas are: landscape position; alluvial soils and recently deposited material; topography associated with riparian areas; and vegetation associated with riparian areas.

During the infield investigation, the delineation of the four identified wetlands (on a desktop level) were based on the presence of redoxymorphic soil features, soil form classification and wetland vegetation. The soils were investigated through the use of a hand auger, where the soil was drill to 0.5m or until the parent material/refusal was reached. The assessment of these indicators is described in the section below

IMPACT METHODOLOGICAL FRAMEWORK

The impact valuation uses a methodological framework used by WSP | Parsons Brinckerhoff to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014 (GN No. 982) (the “EIA Regulations”). As required by the EIA Regulations (2014), the determination and assessment of impacts will be based on the following criteria:

- Nature of the Impact;
- Significance of the Impact;
- Consequence of the Impact;
- Extent of the impact;
- Duration of the Impact;
- Probability if the impact;
- Degree to which the impact:
  - can be reversed;
  - may cause irreplaceable loss of resources; and
  - can be avoided, managed or mitigated.

Following international best practice, additional criteria have been included to determine the significant effects. These include the consideration of the following:

- **Magnitude** to what extent environmental resources are going to be affected;
- **Sensitivity** of the resource or receptor (rated as high, medium and low) by considering the importance of the receiving environment (international, national, regional, district and local), rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor); and
- **Severity** of the impact, measured by the importance of the consequences of change (high, medium, low, negligible) by considering inter alia magnitude, duration, intensity, likelihood, frequency and reversibility of the change.

It should be noted that the definitions given are for guidance only, and not all the definitions will apply to all of the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

Impacts are assessed in terms of the following criteria:

- The nature, a description of what causes the effect, what will be affected and how it will be affected (**Table 1**);
- The physical extent, wherein it is indicated whether (**Table 2**);
- The duration, wherein it is indicated whether the lifetime of the impact will be (**Table 3**);
- The magnitude of impact on ecological processes, quantified on a scale from 0-10, where a score is assigned (**Table 4)**; and
- The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where (**Table 5**):

Table 1: Nature or Type of Impact

Nature or Type of Impact	Definition
Beneficial / Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g. new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g. noise changes due to changes in road or rail traffic resulting from the operation of Project).
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements).
Cumulative	Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

Table 2: Physical Extent of Impact

Score	Description
1	The impact will be limited to the site.
2	The impact will be limited to the local area.
3	The impact will be limited to the region.
4	The impact will be national.
5	The impact will be international.

Table 3: Duration of Impact

Score	Description
1	A very short duration (0 to 1 years).
2	A short duration (2 to 5 years).
3	A medium term (5–15 years).
4	A long term (> 15 years).
5	Permanent.

Table 4: Magnitude of Impact on Ecological Processes

Score	Description
0	Small and will have no effect on the environment.
2	Minor and will not result in an impact on processes.
4	Low and will cause a slight impact on processes.
6	Moderate and will result in processes continuing but in a modified way.
8	High (processes are altered to the extent that they temporarily cease).

10	Very high and results in complete destruction of patterns and permanent cessation of processes.

Table 5: Impact Probability of Occurrence

SCORE	DESCRIPTION
1	very improbable (probably will not happen.
2	improbable (some possibility, but low likelihood).
3	probable (distinct possibility).
4	highly probable (most likely).
5	definite (impact will occur regardless of any prevention measures).

- The significance, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;
- The status, which is described as either positive, negative or neutral;
- The degree to which the impact can be reversed;
- The degree to which the impact may cause irreplaceable loss of resources; and
- The degree to which the impact can be mitigated.

The significance is determined by combining the criteria in the following formula:

$$S = (E + D + M) \times P$$

S = Significance weighting;

E = Extent;

D = Duration;

M = Magnitude, and

P = Probability.

The significance weightings for each potential impact are as follows (**Table 6**):

Table 6: Significance Weightings for Each Impact

OVERALL SCORE	SIGNIFICANCE RATING	DESCRIPTION
< 30 points	Low	where this impact would not have a direct influence on the decision to develop in the area
31-60 points	Medium	where the impact could influence the decision to develop in the area unless it is effectively mitigated
> 60 points	High	where the impact must have an influence on the decision process to develop in the area

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the Project's actual extent of impact, and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures, and is thus the final level of impact associated with the development of the Project. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this EIA Report.

1.3 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations were identified as part of the assessment:

- The various published data sources (i.e. aerial imagery, mapping and previous reports) have been assumed to be accurate at the time of use.
- At the time of the site investigation, the final layout routes of the powerlines and substations was not made available, and as such could not be investigated as part of the site assessment.
- Identification of freshwater habitats in the region of the proposed Maralla West project, was limited to a high level desktop exercise.
- Owing to the extent of the site and accessibility constraints, groundtruthing was only possible in certain areas of the site. Conditions of freshwater habitat in inaccessible areas were therefore inferred based on site observations of accessible habitats.
- The site visit was limited to a 500m radius around the farm properties of the BioTherm sites viz. Esizayo, Maralla East and Maralla West. As such, only the freshwater habitats identified within the 500m buffer of the farm property that were accessible by vehicle at the time of the site visit, were investigated.
- The site visit was conducted during the dry season for the region, making it difficult to identify and distinguish any freshwater habitats in the area due to arid nature of the region.

1.4 DECLARATION OF INDEPENDENCE

Bruce Wickham is a Hydrologist with an MSc from the University of KwaZulu-Natal in 2015. He joined WSP | Parsons Brinckerhoff in 2015 and has worked on various soil and wetland related projects. He is registered as a Candidate Natural Scientist – Water Resources Science with the South African Council for Natural Scientific Professions (SACNASP).

Colin is a Senior Environmental Consultant at WSP | Parsons Brinckerhoff with an MSc in Applied Environmental Science. He has also completed wetland management courses with the University of Free State. He has completed and managed numerous projects relating to wetland and riparian delineations, Present Ecological State and Ecological Importance and Sensitivity assessments, and the compilation of IWWMPs. He is registered with the South African Council for Scientific Professions – Professional Natural Scientist (Environmental Scientist) and is a SETA accredited Carbon Footprint Analyst.

Greg Matthews has 17 years of professional experience and is registered with the South African Council for Scientific Professions – Professional Natural Scientist (Environmental Scientist and Hydrological Scientist). He has been involved in numerous projects associated with the assessment of activities on both soil and water resources.

WSP | Parsons Brinckerhoff has no financial or other interest in the proposed development and will derive no benefits other than fair remuneration for consulting services provided.

I, Greg Matthews, 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 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 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 offense in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Name: Greg Matthews Sign:  **Date:** 11/10/2016

2 DESCRIPTION OF THE PROJECT

The Maralla West Site is located along the provincial boarder between the Western Cape and Northern Cape, approximately 28 km north-west of the town of Laingsburg, (**Figure 1**). Other nearby towns include Matjiesfontein and Sutehrland. The site falls within the Central Karoo District Municipality DC5 and stretches over four farm properties viz. RE/180 Drie Roode Heuvels, RE/181 Annex Drie Roode Heuvels, 1/182 Wolven Hoek, 2/182 Wolven Hoek, occupying a total area of 51.6km^2. The Komsberg-Kareendoringkraal" district road off the R354 serves at the primary access route to the Maralla West Site (**Figure 1**).

This report is primarily focused towards potential activities and impacts associated with the Maralla West Site, however there are also proposed infrastructure options associated with the development (i.e. substations and power transmission lines). The associated infrastructure has been assessed in separate reports.

The Maralla West will house up to 70 wind turbines which will produce electrical energy that will be fed directly into the national grid. The characteristics of the wind turbines includes the following:

- Up to 70 Wind Turbines, with a maximum 120 m hub height and 150 m rotor diameter;
- Generating capacity between 1.5 to 4 MW;
- Tower footprint of 0.5 ha;
- Operational and Maintenance building occupying an area of 0.038 ha;
- Connection cables;
- Access roads (up to 6 m wide);
- Sub-station (up to 132 kV), occupying an area of 2.25 ha;
- Powerlines (up to 132 kV);
- Servitude (up to 65 m);
- Fences;

- Permanent laydown area for turbine cranes (0.3 ha); and
- Temporary laydown areas, involved during the construction phase (12 ha).

In addition to the proposed Maralla West project, there are several potential wind energy developments earmarked in the surrounding area (**Figure 2**). This area falls within the Komsberg Wind Renewable Energy Development Zone (REDZ). These zones were identified throughout South Africa in a Strategic Environmental Assessment (SEA), as part of the Department of Environmental Affairs Strategic Integrated Project National Infrastructure Plan.

In a separate SEA - Electrical Grid Infrastructure (EGI), national power corridors were delineated for the efficient and effective expansion of the transmission infrastructure throughout South Africa. The location of the BioTherm sites (Esizayo and Maralla East and West), as well as the proposed neighbouring renewable energy developments, are strategically placed to overlap with the REDZs and EGI demarcated zones (**Figure 2**). The neighbouring developments will be factored into the EIA as part of the cumulative impact assessment. These renewable energy developer entities include:

- Mainstream Renewable Power SA (Pty) Ltd;
- Networx Renewables (Pty) Ltd;
- African Clean Energy Developments (Pty) Ltd; and
- G7 Renewable Energies (Pty) Ltd.

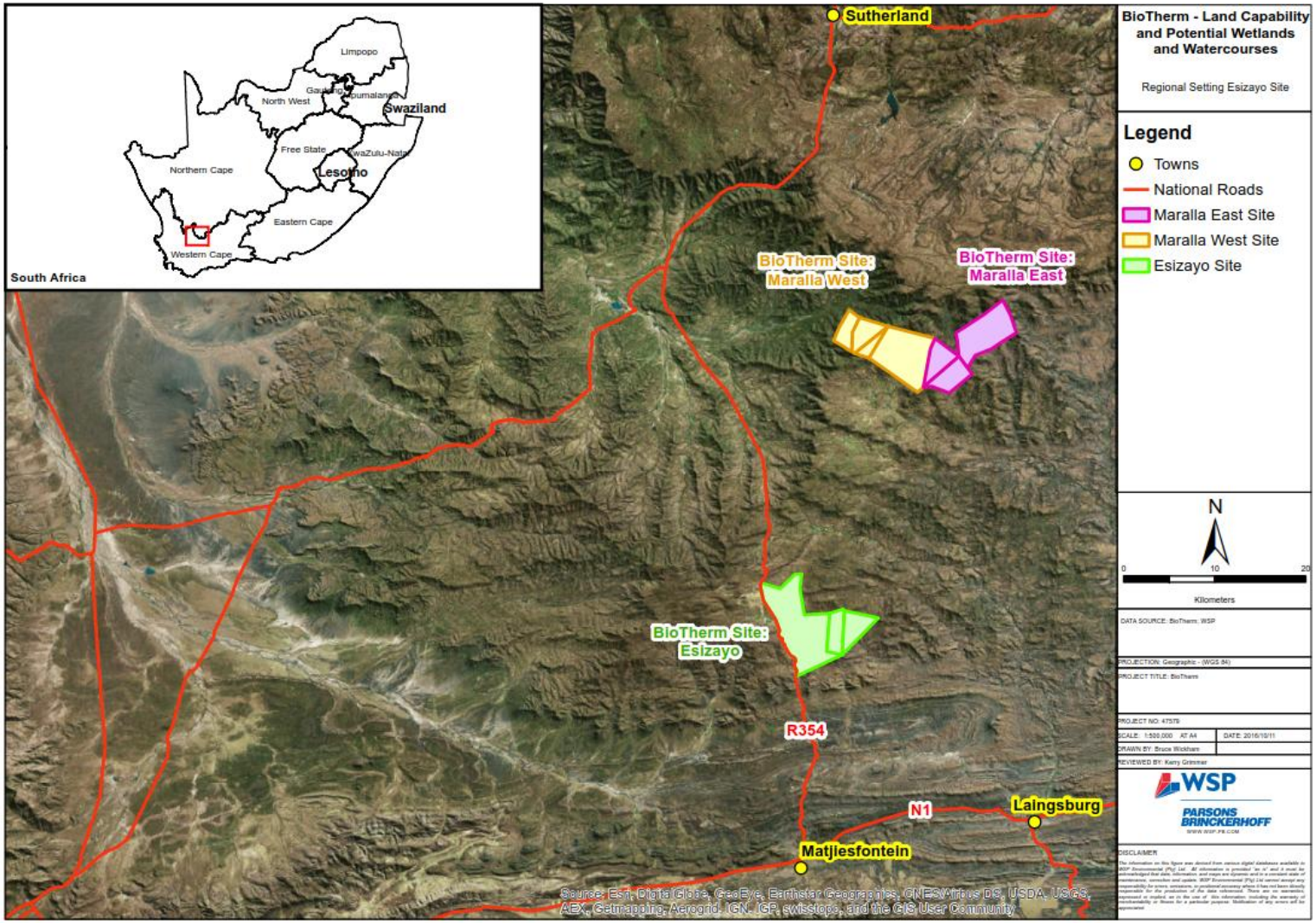

Figure 1: Regional Setting of the Maralla West Site in relation to the entire BioTherm Project

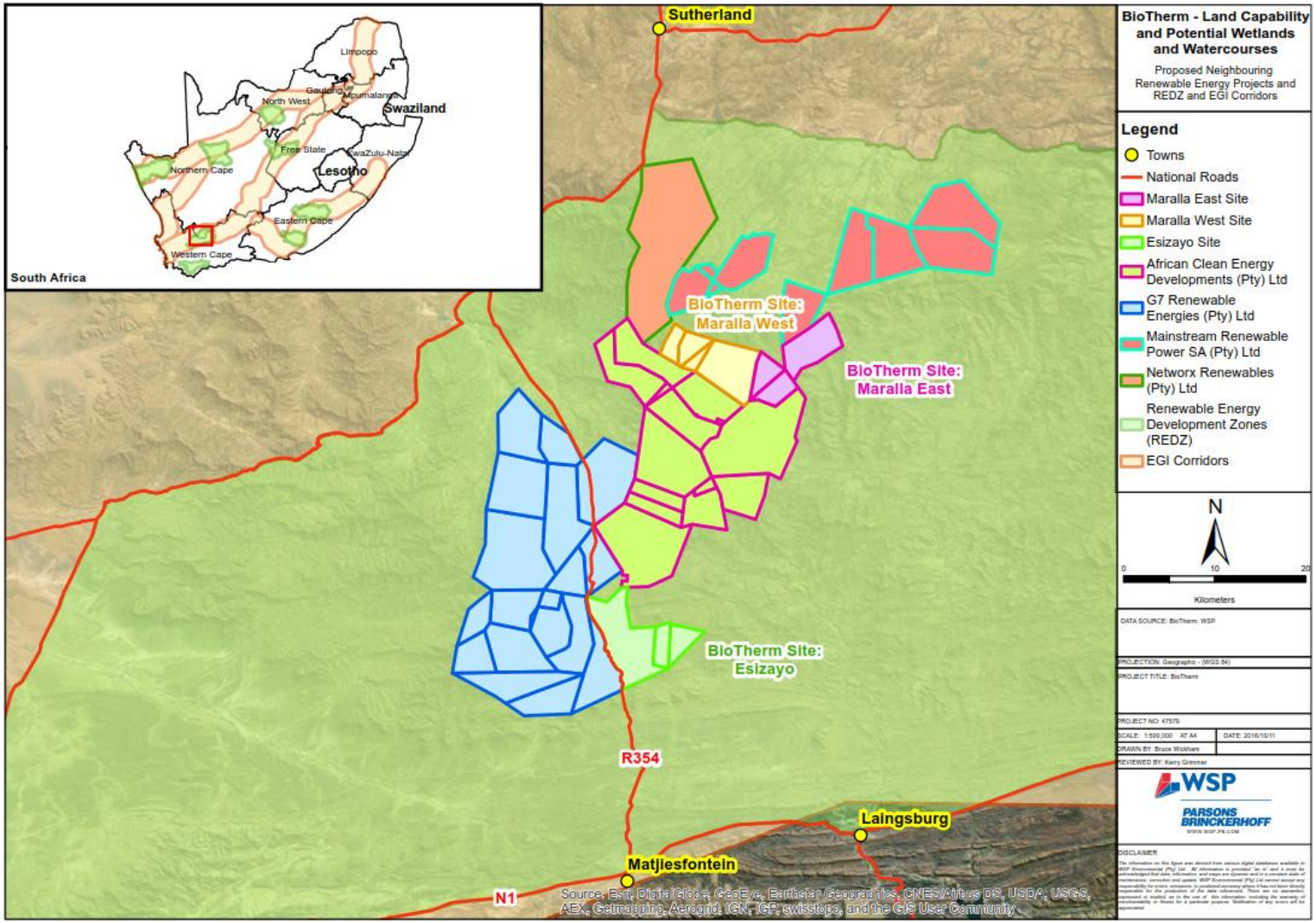

Figure 2: Proposed Neighbouring Renewable Energy Projects, REDZ and EGI

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The local natural environment within which the proposed Maralla West project is located is summarised in the following section. This will include the local hydrology, natural vegetation and land use, soil type and characterisation, and a simple geological description. This will serve as basic description of the present natural conditions in the area of the proposed Maralla West project.

3.1 HYDROLOGY

South Africa is divided into nine Water Management Areas (WMAs), where the proposed Maralla West wind power sites are situated in the Breede-Gouritz WMA 6 (**Figure 3**). The topography of the area comprises of mountainous hillslopes (part of the Roggeveld Mountain Range) with small patches of open rocky ground in between, and numerous watercourses and drainage channels. The hillslopes have an average gradient of 33.7 % and 1.1% on the open flat ground. The elevation of the Maralla West Site ranges from 1 148 m to 1 483 m above mean sea level (amsl) (**Figure 4**).

The Maralla West Site lies within quaternary catchments J11A and E23A (**Figure 4**). The J11A and E23A quaternary hydrological characteristics are summarised in **Table 7**, including catchment area, Mean Annual Precipitation (MAP), Mean Annual Evaporation (MAE) and Mean Annual Runoff (MAR). The MAE largely exceeds the MAP, reinforcing the arid conditions of the region.

Table 7: Quaternary J11A and E23A Catchments' Hydrological Characteristics

QUATERNARY	CATCHMENT AREA (km^2)	MAP (mm)	MAE (mm)	MAR (million m^3/a)
J11A	438	295	1965	5.86
E23A	762	254	1895	3.25

Source: WRC/DWA, 2012

Upon the site visit, there were several watercourses/drainage channels present within the Maralla West Site, the main river being the Kamberg, which runs through the site (**Figure 4**). However, a few of the watercourses that were visited within the site were dry and only the Kamberg River exhibited small puddles of water at intermittent section along the watercourse (**Plate 1**). Given the arid climatic condition of the region, majority of the watercourses are ephemeral and are likely to only convey water during infrequent high rainfall events.

Figure 3: Location of BioTherm Sites In Relation to New WMA

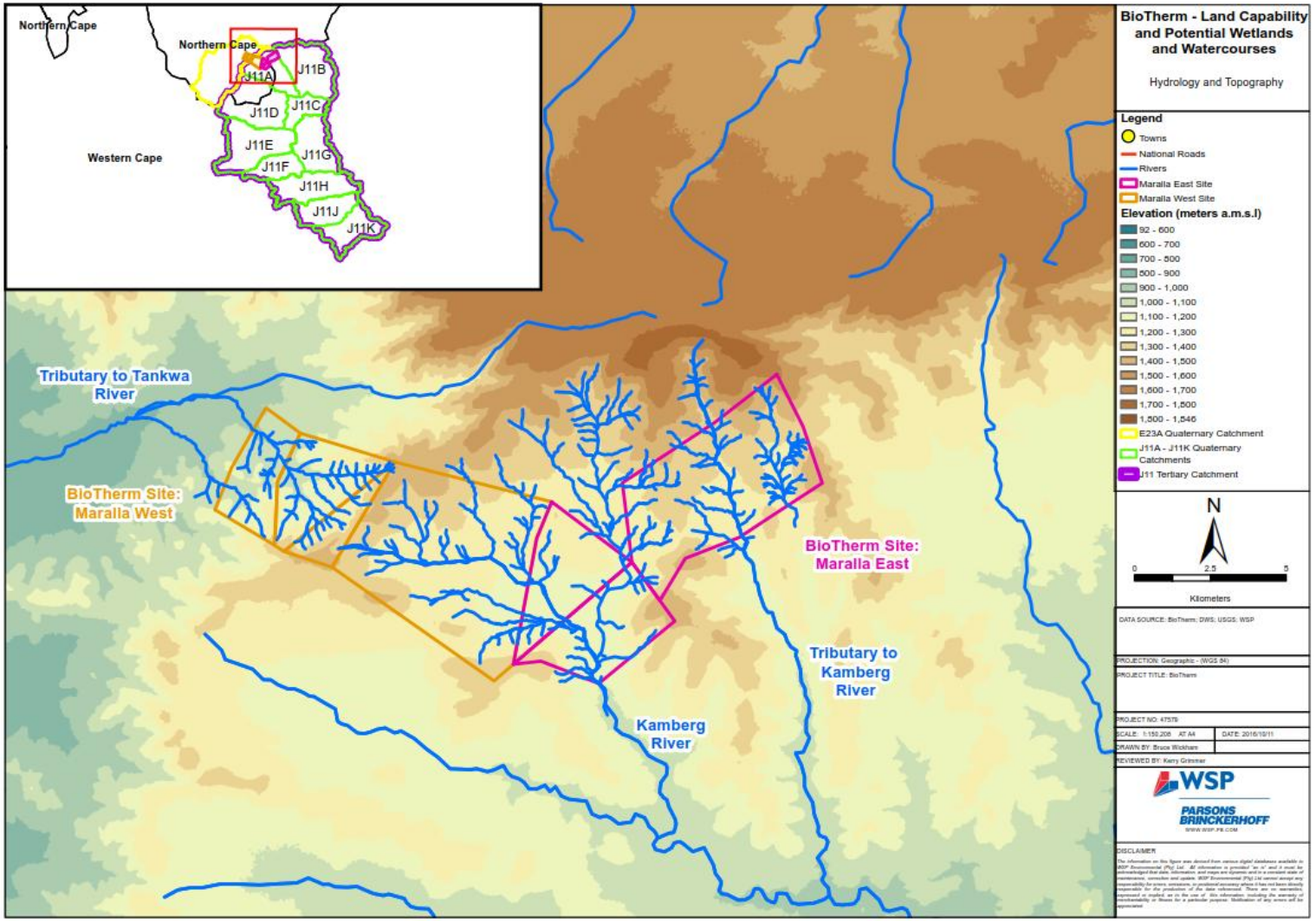

Figure 4: Local Hydrology and Topography

3.2 VEGETATION AND LAND USE

Based on the Mucina and Rutherford (2006) natural vegetation classification map, the area of proposed BioTherm wind power project is mostly Central Mountain Shale Renosterveld, with a minor contribution of Koedoesberge-Moordenaars Karoo and Tanqua Escarpment Shrubland (**Figure 5**).

The Department of Agriculture, Forestry and Fisheries (DAFF) define the land use within the site, as predominantly Shrubland and Low Fynbos (DAFF, 2012) (**Figure 6**). As shown in **Figure 6**, there are fourteen freshwater habitats located within a 500 m radius of the Maralla East and West site boundaries.

Upon the site visit, the vegetation was identified as mostly shrub-like vegetation and Fynbos (**Plate 2**), which is primarily used for sheep grazing. Indigenous antelope (Springbok) were also present within site boundary.

The majority of the fourteen freshwater habitats identified as part of the desktop review, were confirmed to be cultivated (irrigated or dryland) areas and small earth-walled farm dams (**Plate 3** and **Plate 4**) upon the site visit. However, there were two different freshwater habitats (i.e. Depressional Pans) which were not originally included in the desktop review, but were identified within the Maralla West Site during the site visit (**Plate 5**).

The delineation and identification of these freshwater habitats is described in section 4 of this report. There are additional surface features present in the Maralla West Site including telecommunication mast towers, windmill-driven boreholes and small farm reservoirs.

Beyond the Maralla West Site, additional land use activities identified during the site walkover included, sheep and small scale crop farming, and the Eskom Komsberg Sub-station, located approximately several km south of the site boundary.

3.3 SOILS AND GEOLOGY

Based on the information included in the land type maps of South Africa (AGIS, 2007) the soils in the region of the Maralla West Site are mostly as “Glenrosa and/or Mispha forms with lime generally present in the landscape” and “miscellaneous land classes, rocky areas with miscellaneous soils” (**Figure 7**).

The general geological description of the area is based on the 1:1 000 000 geological map for Northern Cape Province, published by the Trigonometrical Survey Office in 1970 (Schifano *et.al*., 1970). The Maralla West Site is nested in the Roggeveld Mountains range, in the Larger Cape Fold belt system. The site is located on the Beaufort Series which forms part of the Karoo system (**Figure 8**). The rock type for the series comprises of shale, mudstone, sandstone and limestone (Schifano *et al*., 1970). Upon the site visit, it was observed that shale and mudstone were the dominant rock type for the area.

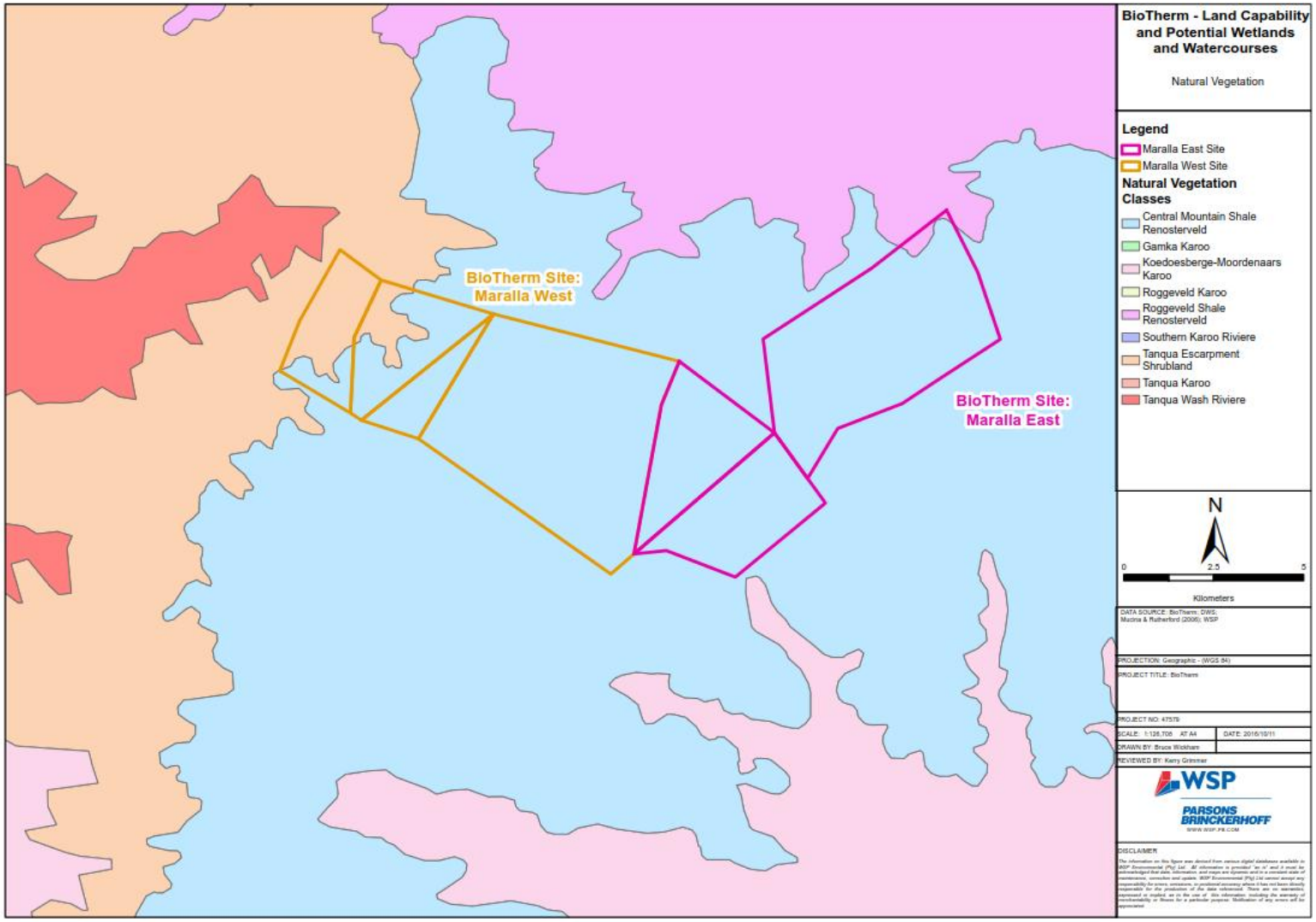

Figure 5: Local Natural Vegetation

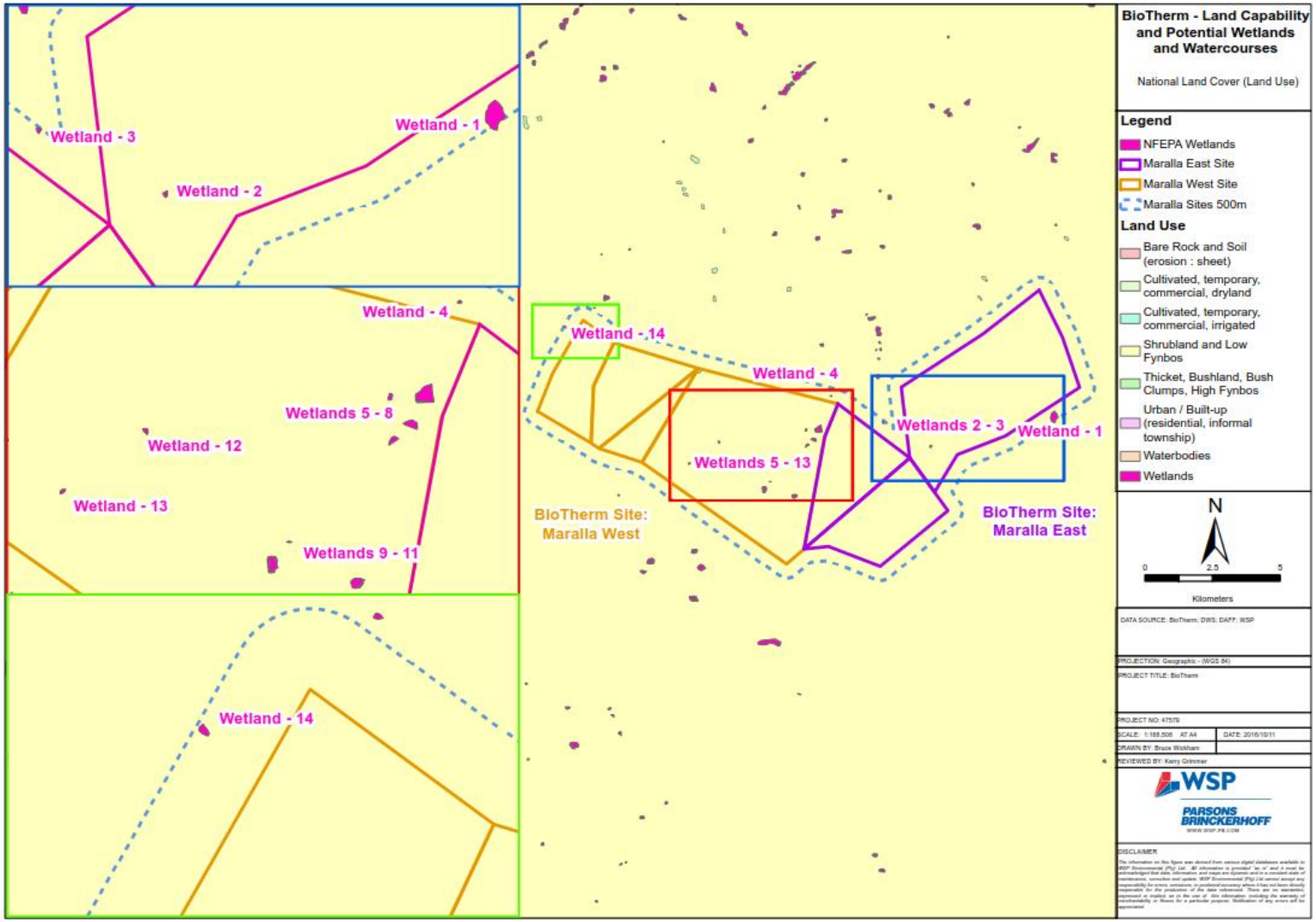

Figure 6: Local Land Cover (Land Use)

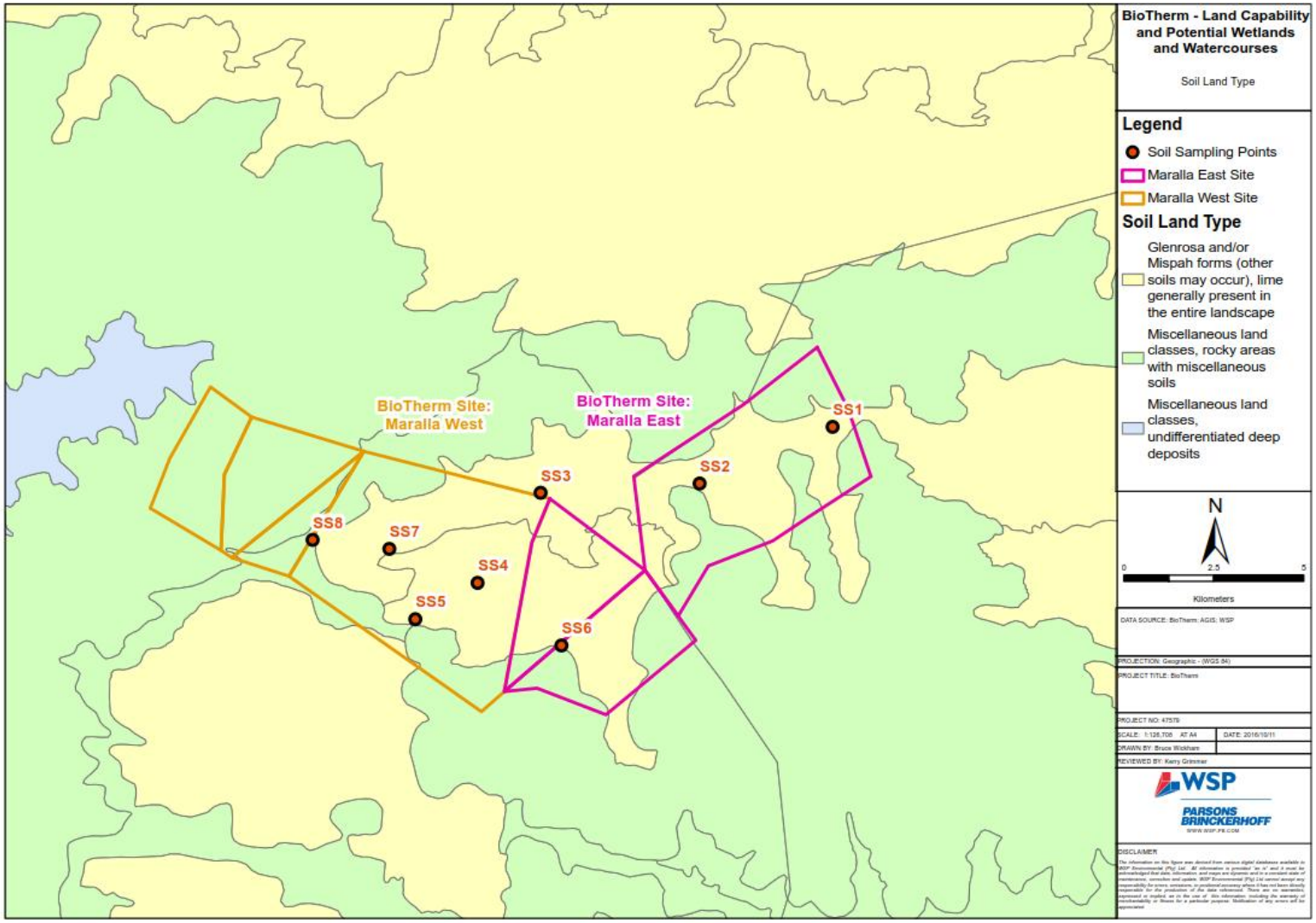

Figure 7: Local Soil land Type and Soil Sampling Locations

Figure 8: Local General Geology

4 FINDINGS – MARALLA WEST SITE

A wetland is defined as land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil (National Water Act, Act 36 of 1998). Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

There were two wetlands (i.e. Depressional Pans) which were confirmed within the Maralla West Site and a 500m radius of the site boundary. The wetlands were identified as a Depressional Pan type, based off the definition of the wetland described in DWA document *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas* (DWA, 2005), and their characteristics determined from the infield assessment.

CONFIRMED WETLANDS

A total of two Depressional Pan type wetlands were identified and delineated at the Maralla West (**Figure 9**). The characteristics of the wetlands include:

- Circular/oval shape of bare earth exhibiting shrink-swell cracks, typical of clayey soils, and surface fluvial flow features indicative of overland sheet flow towards the centre of the pans after high rainfall events. **Plate 5**, **Plate 6** and **Plate 7** depicts the Depressional Pan wetlands, surface shrink-swell clay cracks and surface fluvial flow ripple patterns flowing inwards on the wetland, respectively;
- A very hard clayey layer at 0.2 – 0.3 m, which is typical of Hardpan diagnostic soil horizon;
- The soil from the centre of the Depressional Pan wetland exhibited a relatively high clay percentage (20%), which decreased further away from the centre (6%); and
- A well-defined ring of shrub-like vegetation around the edge of the wetland, which is indicative of the Central Mountain Shale Renosterveld natural vegetation (**Plate 5**).

The location of the two Depressional Pan in relation to the proposed infrastructure of the Maralla West wind facility is indicted in **Figure 9**. From **Figure 9** majority of the wind turbines, roads and cables fall within 500m of a watercourse and Depressional pans, yet none of infrastructure sits within 32m radius from pan.

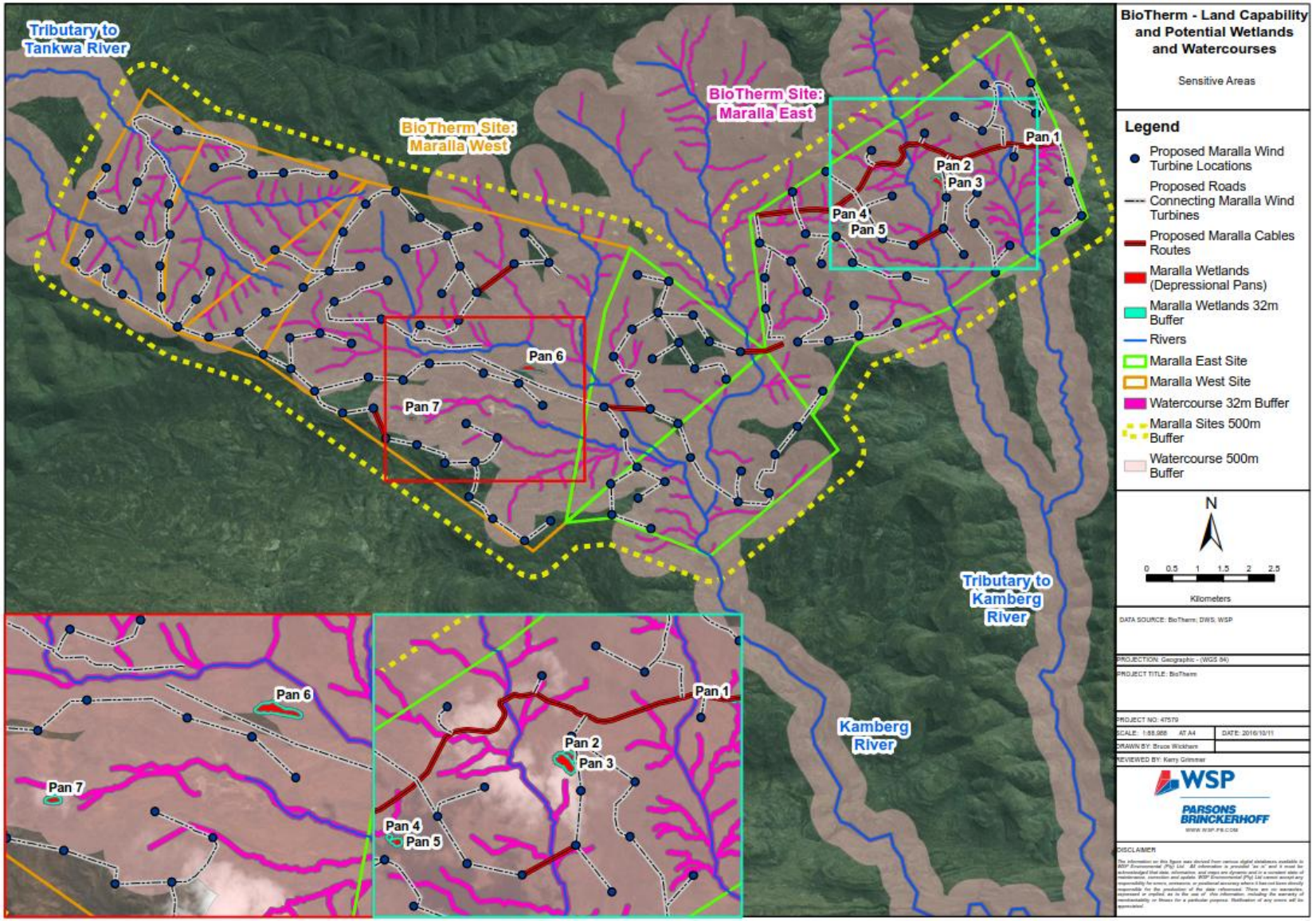

Figure 9: Sensitive Areas at Maralla East and West Sites

5 ASSESSMENT OF IMPACTS

The impacts identified for the Maralla West Site are assessed in the section that follows. The methodology for defining the significance of the respective impacts is described in section 1.2 of this report. The impacts will be assessed for the construction, operational and de-commissioning phases of the project.

A cumulative impact assessment was also conducted for the neighbouring BioTherm sites and adjacent renewable energy projects. This section will provide a summary of the findings from the significance rating tables used for each impact. The process for determining the relevant significances of each impact for the various phases of the project is provided in **Appendix A**.

5.1 CONSTRUCTION PHASE

The anticipated impacts for the Maralla West Site during the construction phase of the project are summarised in **Table 8**. The impacts summarised below are relevant to the freshwater habitats identified within the site and 500m radius of the site boundary.

Table 8: Construction Phase Impacts

ACTIVITY	POTENTIAL IMPACT
Site preparation and construction of wind turbine facility and associated infrastructure.	Alterations of flow regimes of watercourses, in close proximity to the site, or that is proposed to be traversed by roads.
	Increased potential of soil erosion due to vegetation clearance, soil disturbance and a high traffic movement on site. Subsequent potential sedimentation of watercourses.
	Potential land contamination from hazardous substances. This includes spillage of concrete onto soil surface, as well as oils, fuel, grease (from construction vehicles) and sewage from temporary on-site ablution facilities.
	Potential degradation of wetland habitat due to the proposed positioning of road access

There are no fatal flaws identified for the construction phase associated with the proposed Maralla West project, other than the potential impact to Depressional pans located within 500m radius of the proposed infrastructure of wind turbines, roads and cables. Potential impacts of soil erosion and spillage of hazardous substances were both classified with a low environmental significance, before and after mitigation measures, due to the lower probability of significant erosion or spills occurring.

5.2 OPERATIONAL PHASE

The anticipated impacts for the Maralla West Site during the operational phase of the project are summarised in **Table 9**. The impacts summarised below are relevant to the freshwater habitats identified within the site and 500m radius of the site boundary.

Table 9: Operational Phase Impacts

ACTIVITY	POTENTIAL IMPACT
Day-to-day operational activities during the normal functioning of the wind turbine facility, including maintenance.	Loss of aesthetical value of the natural landscape.
	Alterations of flow regimes of watercourses, in close proximity to the site, or where the road accesses traverse watercourses.
	Increased potential of soil erosion due to vegetation clearance, and more run-off from harden surfaces (i.e. roads). Subsequent potential sedimentation of watercourses.
	Potential land contamination from hazardous substances. This includes spillage of oils, fuel, grease (from site operational and maintenance vehicles) and permanent onsite sewage systems.

Similar to the construction phase, there were no fatal flaws identified during this phase of the project, other than the potential impact to Depressional pans located within 500m radius of the proposed infrastructure of wind turbines, roads and cables. The other negative impacts of potential soil erosion and spillage of hazardous substances were assigned a low environmental significance before and after mitigation measures, due to the majority of the risk/impact being isolated to the construction phase (therefore short term) and the lower probability of significant erosion or spills occurring.

5.3 DECOMMISSIONING PHASE

The anticipated impacts for the Maralla West Site during the operational phase of the project are summarised in **Table 10**. The impacts summarised below are relevant to the freshwater habitats identified within the site and 500m radius of the site boundary.

Table 10: De-commissioning Phase Impacts

ACTIVITY	POTENTIAL IMPACT
De-commissioning of the wind turbine facility.	Increased potential of soil erosion due to removal of wind turbine infrastructure, soil disturbance and a high traffic movement on site.
	Alterations of flow regimes of watercourses, in close proximity to the site, or that is proposed to be traversed.
	Potential land contamination from hazardous substances. This includes spillage of oils, fuel, grease (from construction vehicles) and sewage from on-site systems.

The decommissioning phase exhibited the lowest environmental significance rating scores for the associated impacts of the proposed Maralla West project. There were no fatal flaws identified during this phase of the project, other than the potential impact to Depressional pans located within 500m radius of the proposed infrastructure of wind turbines, roads and cables. The potential for soil erosion and spillage of hazardous substances were classified as a low environmental significance rating before and after mitigation measures.

5.4 CUMULATIVE IMPACTS

There are a number of Environmental Authorisations (EA) (either issued or in process) in the area surrounding the Proposed Project site. It must be stressed that the fact that there are several approved EA surrounding the site does not equate to actual 'development'. The surrounding projects, except for the Preferred Bidders, are still subject to the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bidding process like the Maralla project.

In addition to the Maralla West Site, the proposed BioTherm project includes two additional wind sites (viz. Esizayo and Maralla East) and four separate proposed renewable energy projects located within a 100 km radius from the centroid of the BioTherm sites (**Figure 2**). The footprint of all the BioTherm sites and the proposed neighbouring projects spread over several watercourses in the region. While an in-field site walkover in all these neighbouring projects is beyond the scope of this report, a high level desktop assessment was performed, counting the number of watercourses (mostly ephemeral) and wetlands that intersect the proposed footprint of the neighbouring projects. The desktop review of the proposed neighbouring projects (including BioTherm sites) is summarised in **Table 11**.

The renewable energy projects that have received Environmental Authorisation were investigated to determine any identified potential impacts on freshwater habitats. These individual impacts were tabulated and assigned a significance rating (Low to High) which allowed for the cumulative assessment of these impacts on the landscape. Overall the cumulative impact of the proposed Maralla West Site is deemed to be of 'Low' significance (**Appendix** B).

The proposed Maralla West Site (and associated infrastructure) as well as the neighbouring renewable energy developments potentially intersect freshwater habitat systems. The turbines for

the Maralla West Site are not located within watercourses, within only a few access roads potentially requiring to traverse ephemeral watercourses. Each of these crossings should not have a regional impact on water resources therefore limiting the cumulative impact on the greater landscape. There was no fatal flaw identified for the cumulative impacts for the proposed Maralla West Site. The assessment of these potentially affected ecological features within the four neighbouring renewable energy developments is beyond the scope of this study, and will require an individual assessment for the respective projects in their own scoping and EIA studies. It is assumed that the impacts during the construction, operational and de-commissioning phases are expected to be the same as those summarised above for the Maralla West Site.

Potential impacts of soil erosion and spillage of hazardous substances were both classified with a low environmental significance, before and after mitigation measures, due to the majority of the risk/impact being isolated to the construction phase (therefore short term) and the lower probability of significant erosion or spills occurring.

6 MITIGATION AND MANAGEMENT MEASURES

The potential impacts identified in Section 5 of this report, have been assessed with and without mitigation and management measures. These mitigation and management measures are summarised in **Table 12**, for the construction, operation and decommissioning phases of the project.

The same mitigation and management measures are proposed for the cumulative impacts identified in the previous section, however the responsible person may differ according to the renewable energy project developer.

In addition, an aquatic specialist should be present onsite before the site preparation phase of construction to conduct an in-depth site walkover prior to any site work to assess the area for any freshwater habitats which may be affected by the actions conducted during the construction phase.

Table 11: Neighbouring Renewable Energy Projects Comparison

Energy Entity	Renewable Energy Technology	Footprint (km^2)	No. of Water Courses intersections	NFEPA Wetlands Intersections (Inc. 500m radius)	Parent Farm Properties	Towns Intersected
Esizayo	Wind	61.0	4	8	à Aurora 285 à Aanstoot 1/72 à Joseph's Kraal 84	None
BioTherm Maralla East	Wind	42.32	3	6	à RE/180 Drie Roode Heuvels à RE/204 Schalkwykskraa à RE/268 Welgemoed	None
Networx Renewables (Pty) Ltd	Unknown	118.00	4	60	à Brand Hoek 176 à De Kruis 153	None
Mainstream Renewable Power SA (Pty) Ltd	Unknown	199.12	5	82	à 1/178 Van Wyks Kraal à 2/178 Van Wyks Kraal à 6/152 Tonteldoosfontein à 1/152 Tonteldoosfontein à 1/179 Schietfontenin	None
African Clean Energy Developments (Pty) Ltd	Unknown	332.28	5	58	à Zwanepoelshoek 184 à Leeuwe Hoek 183 à Orange Fontein 185 à Orangie Fontein 203 à 2/203 Orangie Fontein à 3/203 Orangie Fontein à 4/203 Orangie Fontein à Kentucky 206 à 1/207 Volvenkop à De Hoop 202 à Rheebokke Fontein 209 à 1/209 Rheebokke Fontein à Standvastigheid 210	None
G7 Renewable Energies (Pty) Ltd	Unknown	449.83	9	77	à RE/188 Wilgebosch Rivier à RE/200 Karree Bosch	None

Energy Entity	Renewable Energy Technology	Footprint (km^2)	No. of Water Courses intersections	NFEPA Wetlands Intersections (Inc. 500m radius)	Parent Farm Properties	Towns Intersected
					à Appels Fontein 201 à Ek Kraal 199 à Klipbanks Fontein 198 à Riet Fontein 197 à Bon Espirange 73 à Fortuin 74 à RE/284 à Hartjies Kraal 77 à Barendskraal 76 à Brandvalley 75 à Kabeltouw 160	

Table 12: Mitigation and Management Measures for Potential Impacts

Activity	Mitigation and Management Measure	Responsible Person	Applicable Development Phase	Include as Condition of Authorisation	Monitoring requirements
Alterations of flow regimes of watercourses, in close proximity to the site, or that is proposed to be traversed.	Construction of the turbines and associated infrastructure (e.g. access roads and cables) should, where feasibly possible, occur during the dry season and the site rehabilitated before major rainfall events occur. Access roads and cables must only cross perpendicular to a watercourse and the chosen alignment must endeavour that the span across the watercourse is minimalised. Regular inspections during operation are required to ensure the structural integrity of the roads and cables. These crossings (and infrastructure located within 500m of a wetland) have a potential of requiring a Water Use Licence in terms of the National Water Act.	Site construction managers (BioTherm contractors); SHEQ representative.	Construction and Operational	Yes – all requirements of Section 21 of the NWA must be compiled with, resulting in the potential need for a water use licence application where a more in-depth freshwater habitat assessment will be required.	A freshwater habitat specialist must conduct an in-depth site walkover prior to the construction phase commencing to assess the area for any freshwater habitats which may be affected by the actions conducted during the construction phase (e.g. road construction, trenching, etc.). Any identified systems must be visibly demarcated.
Increased potential for soil erosion (especially wind driven) due to vegetation clearance, soil disturbance and high traffic movement on site.	Areas of construction should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum. Traffic of construction vehicles should be kept to a minimum to reduce soil compaction, and limited to existing or proposed roadways where practical. Soils excavated during construction of the facility should be appropriately stored in stockpiles which are protected from erosion (i.e. through use of vegetation cover in the case of long-term stockpiles- this should form part of the rehabilitation process after the construction phase). Wind erosion is dominant for the region. Water erosion action is considered limited, however backfilling with soil and use of gabions or Reno Mattresses should be used where evidence of erosion is present.	Site construction managers (BioTherm contractors)	Construction, Operational and Decommissioning	No – activity has been assigned a low environmental significance during the construction phase	A site compliance audit should be conducted (1) prior to construction, (2) during construction on a monthly basis and (3) after rehabilitation measures have been implemented.
Potential spillage of hazardous substances such as oils, fuel, grease from construction and operational vehicles, and sewage from on-site sanitation systems	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and proper upkeep of machinery and vehicles.	Site construction managers (BioTherm contractors)	Construction, Operational and Decommissioning	No – activity has been assigned a low environmental significance during the construction, operational and decommissioning phases	A site compliance audit should be conducted (1) prior to construction, (2) during construction on a monthly basis and (3) after rehabilitation measures have been implemented.
Degradation of wetland habitat due to the proposed positioning of cables and road access	Should BioTherm be recognised as a Preferred Bidder, the required application for a Water Use Licence (WUL) in terms of Section 21 of the National Water Act (NWA) (Act 36 of 1998) may commence. This application (WULA) will require detailed functional assessments (i.e. PES, EIS and EcoServices) of freshwater habitats potentially affected by the roads and infrastructure. At this stage design details should be available allowing the freshwater specialist to assess specific areas within the site. Therefore, a more in-depth and thorough freshwater functional assessment should be conducted should BioTherm be recognised as a Preferred Bidder. The detailed freshwater habitat assessment must provide recommendations in terms of road access in relation to freshwater habitats.	Site construction managers (BioTherm contractors) and onsite specialist	Design, Construction and Decommissioning	Yes – all requirements of Section 21 of the NWA must be compiled with, resulting in the potential need for a water use licence application where a more in-depth freshwater habitat assessment will be required.	A freshwater habitat specialist must conduct an in-depth site walkover prior to the construction phase commencing to assess the area for any freshwater habitats which may be affected by the actions conducted during the construction phase (e.g. road construction, trenching, etc.). Any identified systems must be visibly demarcated.

7 STAKEHOLDER CONSULTATION

7.1 STAKEHOLDER CONSULTATION PROCESS

Public participation is a requirement of the S&EIR process; it consists of a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the S&EIR decision-making process. Effective public participation requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the Proposed Project.

A comprehensive stakeholder consultation process was undertaken during the scoping phase. Stakeholders were identified through existing databases, site notices, newspaper adverts and meetings. All stakeholders identified to date have been registered on the project database. All concerns, comments, viewpoints and questions (collectively referred to as 'issues') received to date have been documented and responded to in a Comment and Response Report.

There will be ongoing communication between WSP | Parsons Brinckerhoff and stakeholders throughout the S&EIR process.

7.2 STAKEHOLDER COMMENTS AND RESPONSE

The stakeholder's queries and comments to the Draft Environmental Scoping Report, relating to Freshwater Habitats, have been responded to in **Table 13** below.

Table 13: Stakeholder Comments and Queries and the associated Responses

STAKEHOLDER DETAILS	COMMENT	SPECIALIST RESPONSE
Ms Mmamohale Kabasa **Department of Environmental Affairs** 12 October 2016	It is noted that the property is affected by numerous watercourses and NFEPA wetlands, and that activities that may trigger Section 19 and Section 21 of the National Water Act No. 36 of 1998 were applied for/included in the application form. Please note that a separate hydrological impact assessment must be conducted to assess the impacts of the proposed development on the surface hydrology of the area. The terms of reference for the study must include, inter alia the following: à Identification and sensitivity rating of all surface water courses for the impact phase of the proposed development; à Identification, assessment of all potential impacts to the water courses and suggestion of mitigation measures; and, à Recommendations on the preferred placement of the parabolic troughs and all associated infrastructure and preference must be provided to the avoidance of the watercourses on the property.	à This report provides an initial high-level identification of freshwater habitat systems within the site boundary. This is due to the extent of the site, accessibility constraints and lack of information relating to the positioning of operational and road infrastructure. Should BioTherm be recognised as a Preferred Bidder, the required WULA in terms of NWA may commence. This application (WULA) will require detailed functional assessments (i.e. PES, EIS and EcoServices) of freshwater habitats potentially affected. Therefore, a recommendation within this freshwater identification report (Section 8) is a more in-depth and thorough freshwater functional assessment be conducted should BioTherm be recognised as a Preferred Bidder. Appropriate buffers for the identified systems must then form part of the in-depth assessment report. At this stage design details should be available allowing the freshwater specialist to assess specific areas within the site and determine proximity of the structures to freshwater systems. Another recommendation is that the freshwater specialist be present onsite during the construction phase of the project, and conduct an in-depth site walkover prior to any site work to assess the area for any wetlands and watercourses which may be affected by the actions conducted during the construction phase (e.g. road construction). à Noted, the abovementioned detailed freshwater habitat assessment must provide recommendations in terms of placement of the associated infrastructure in relation to freshwater habitats. It must be noted that parabolic troughs are associated with solar renewable energy and not wind.
C Schwartz **Department of Water and Sanitation** Northern Cape Region (Lower Orange Water Management Area) 25 October 2016	à The Department takes note of the proposed activity and therefore provides the following comments: à Any spillage of any hazardous materials including diesel that may occur during construction and operation must be reported immediately to this Department. à Damaging the beds and banks of a water course has been identified as one of the characteristic flow of a watercourse is identified as a water use by the National Water Act and carrying out of such activity will need a Water Use Licence Application in terms of the above-mentioned act.	à Noted. à Noted. Spill response has been addressed within the site-specific EMPr. It is specified that all major spills are reported to the DWS immediately. A representative onsite must be trained in the use of the spill kit stop, contain and remove contamination, to prevent further pollution of the environment. à Agreed. It is understood that if BioTherm become the preferred bidder then the Water Use Licence Application (WULA) process will proceed. This will then require a full functional assessment (i.e. PES, EIS and EcoServices) of the freshwater habitats that may potentially be impacted upon by the proposed development. At this stage design details should be available allowing the freshwater specialist to assess specific areas within the site and determine proximity of the structures to freshwater systems.

STAKEHOLDER DETAILS	COMMENT	SPECIALIST RESPONSE
	à Stormwater must be diverted from the construction works and roads and must be managed in such a manner as to disperse runoff and to prevent the concentration of stormwater flow. à Please indicate where the water that will be used for construction purposes will be sourced from.	à Stormwater management and erosion control have been addressed within this report and the site-specific EMPr. A stormwater management plan must be compiled and approved by DWS. à The source of water will be from the local municipality and trucked in using water bowsers. Should the need arise to use water from the site urgently for workers, it will be sourced from the nearest farmer.
Mr Sabelo Malaza **Department of Environmental Affairs** 1st December 2016	It is noted that the property is affected by numerous watercourses and NFEPA wetlands and that activities, which may trigger Section 19 and Section 21 of the National Water Act No. 36 of 1998, were applied for/included in the application form. Please note that a separate hydrological impact assessment must be conducted to assess the impacts of the proposed development on surface hydrology of the area. The terms of reference of the study must include, inter alia, the following: à Identification and sensitivity rating of all surface water courses for the impact phase of the proposed development; à Identification, assessment of all potential impacts to the water courses and suggestion of mitigation measures; and, à Recommendations on the preferred placement of the parabolic troughs and all associated infrastructure and preference must be provided to the avoidance of the watercourses on the property.	à This report provides an initial high-level identification of freshwater habitat systems within the site boundary. This is due to the extent of the site, accessibility constraints and lack of information relating to the positioning of operational and road infrastructure. Should BioTherm be recognised as a Preferred Bidder, the required WULA in terms of NWA may commence. This application (WULA) will require detailed functional assessments (i.e. PES, EIS and EcoServices) of freshwater habitats potentially affected. Therefore, a recommendation within this freshwater identification report (Section 8) is a more in-depth and thorough freshwater functional assessment be conducted should BioTherm be recognised as a Preferred Bidder. Appropriate buffers for the identified systems must then form part of the in-depth assessment report. At this stage design details should be available allowing the freshwater specialist to assess specific areas within the site and determine proximity of the structures to freshwater systems. Another recommendation is that the freshwater specialist be present onsite during the construction phase of the project, and conduct an in-depth site walkover prior to any site work to assess the area for any wetlands and watercourses which may be affected by the actions conducted during the construction phase (e.g. road construction). à Noted, the abovementioned detailed freshwater habitat assessment must provide recommendations in terms of placement of the associated infrastructure in relation to freshwater habitats. It must be noted that parabolic troughs are associated with solar renewable energy and not wind.

8 CONCLUSION

There were two freshwater habitat systems identified within a 500m radius of the Maralla West Site. All of the pans sit within 500m of the proposed wind facility infrastructure, and should be given consideration before the construction phase of the project commences.

There are no fatal flaws anticipated for the proposed Maralla West project, from a freshwater habitat perspective (assuming that the proposed wind facility infrastructure takes into account the identified Depressional pans). It is recommended that the mitigation and management measures outlined in this report be followed throughout all phases of the project.

Indirect impacts of increased soil erosion are expected at the site given the dry environment of the region. Furthermore, spillage of hazardous substances onto the land as a result of the activities of the Maralla West project, is a possibility. However, all these potential impacts were classified with a low environmental significance risk, should the appropriate mitigation measure be followed during the construction, operational and decommissioning phases of the project.

This report provides an initial high-level identification of the freshwater habitat systems within the site boundary. This is due to the extent of the site, accessibility constraints and lack of information relating to the positioning of operational and road infrastructure. Should BioTherm be recognised as a Preferred Bidder, the required application for a Water Use Licence (WUL) in terms of Section 21 of the National Water Act (NWA) (Act 36 of 1998) may commence. This application (WULA) will require detailed functional assessments (i.e. PES, EIS and EcoServices) of freshwater habitats potentially affected. Therefore, it is recommended that a more in-depth and thorough study be conducted by an aquatic specialist should BioTherm be recognised as a Preferred Bidder.

It is also recommended that an aquatic specialist must conduct an in-depth site walkover prior to the construction phase commencing, after the proposed construction footprint has been confirm and demarcated. This is to assess the footprint for any freshwater habitats, allowing for slight alterations in the footprint, to prevent any impacts on the freshwater habitats due to the actions conducted during the construction phase.

9 PLATES

Plate 1: Ephemeral main watercourse

Plate 2 : Natural vegetation with grazing sheep

Plate 3: Irrigated cultivated grazing land

Plate 4: Earth-wall dam with water

Plate 5: Depressional Pan

Plate 6 : Surface shrink-swell cracks on Depressional Pan

Plate 7 : Multi directional surfaceflow features on the edge of the Depressional Pan

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Appendix A

ENVIRONMENTAL SIGNIFICANCE FOR EACH IMPACT

BioTherm Energy - Maralla West (Wetland)

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Significance Rating Table

Construction Phase									
Maralla West									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Alterations of flow regimes of watercourses, in close proximity to the site, or that is proposed to be traversed by roads	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	2	8	4	48	Medium	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Construction of the road infrastructure should occur during the dry season and disturbed areas rehabilitated before major rainfall events occur. Roads must only cross perpendicular to a watercourse and the chosen alignment must							
	With Mitigation	2	2	4	3	24	Low	-	Medium
Construction activities will entail vegetation clearance, soil disturbance and high traffic movement on site, resulting in a higher potential for soil erosion	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	2	4	3	24	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Areas of construction should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum. Traffic of construction vehicles should be kept to a minimum to							
	With Mitigation	1	2	2	2	10	Low	-	Medium
	Nature of impact:	Indirect							
	Without Mitigation	2	2	2	2	12	Low	-	Medium

Potential spillage of hazardous substances such as oils, fuel, grease from construction vehicles, and sewage from on-site sanitation systems	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and proper							
	With Mitigation	1	2	0	1	3	Low	-	Medium
Temporary potential degradation of wetland habitat due to the proposed positioning of road access	Nature of impact:	Direct							
	Without Mitigation	2	2	6	4	40	Medium		
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The WULA application will require detailed functional assessments (i.e. PES, EIS and EcoServices) of freshwater habitats potentially affected by the site and roads. At this stage design details should be available allowing the							
	With Mitigation	1	2	4	3	21	Low		
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								

	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							
	Nature of impact:							
	Without Mitigation							
	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							
	Nature of impact:							
	Without Mitigation							
	degree to which							
	degree of impact on irreplaceable resources:							
	Mitigation Measures							
	With Mitigation							

Maralla West - No-Go

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)	Status (+ve or -ve)	Confidence
	Nature of impact:							
	Without Mitigation							
	degree to which impact can be reversed:							
	degree of impact on irreplaceable resources:							

	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
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	degree to which impact can be reversed:								
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	degree of impact on irreplaceable resources:								
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	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
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	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								

	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

BioTherm Energy - Maralla West (Wetland)

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Significance Rating Table

Operational Phase

Maralla West

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Vegetation clearance for wind turbines and roads, soil disturbance and stockpiles, and increased traffic movement on site, resulting in a higher potential for soil erosion	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	4	4	3	30	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Areas of disturbance should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum. Traffic of maintenance vehicles should be kept to a minimum to							
	With Mitigation	1	4	2	2	14	Low	-	Medium
Potential spillage of hazardous substances such as oils, fuel, grease from maintenance vehicles, and sewage from on-site sanitation systems	Nature of impact:	Indirect							
	Without Mitigation	2	4	2	2	16	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and							
	With Mitigation	1	4	2	1	7	Low	-	Medium

Alterations of flow regimes of watercourses, in close proximity to the site, or where the road accesses traverse watercourses.	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	5	6	4	52	Medium	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Roads must only cross perpendicular to a watercourse and the chosen alignment must endeavour that the span across the watercourse is minimalised. The proposed road infrastructures (e.g. culverts) should be positioned							
	With Mitigation	2	1	2	2	10	Low	-	Medium
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
Maralla West - No-Go									
Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								

	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								

	degree of impact on irreplaceable resources:									
	Mitigation Measures									
	With Mitigation									

BioTherm Energy - Maralla West (Wetland)

{insert specialist filed here}

Significance Rating Table

Decommissioning Phase

Maralla West

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Increased potential of soil erosion due to removal of wind infrastructure (i.e. turbines), soil disturbance and a high traffic movement on site.	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	2	4	3	24	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Areas of disturbance should be (where practical) limited to the extent of the project footprint, and activities outside of the site should be kept to a minimum. Traffic of de-construction vehicles should be kept to a minimum							
	With Mitigation	1	2	2	2	10	Low	-	Medium
Potential spillage of hazardous substances such as oils, fuel, grease from maintenance vehicles, and sewage from on-site sanitation systems	Nature of impact:	Indirect							
	Without Mitigation	2	2	2	2	12	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and							
	With Mitigation	1	2	0	1	3	Low	-	Medium

Alterations of flow regimes of watercourses, in close proximity to the site, or that is proposed to be traversed.	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	3	6	5	55	Medium	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	After the decommissioning, rehabilitation of the site must occur immediately to ensure no residual impacts remain. A rehabilitation specialist must compile the rehabilitation plan and monitoring its implementation.							
	With Mitigation	2	1	2	2	10	Low	-	Medium
Temporary & Permanent degradation of wetland/riparian habitat due to the proposed traversing roads	Nature of impact:	Direct							
	Without Mitigation	2	3	6	5	55	Medium	-	
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	After the decommissioning, rehabilitation of the site must occur immediately to ensure no residual impacts remain. A rehabilitation specialist must compile the rehabilitation plan and monitoring its implementation.							
	With Mitigation	2	1	2	2	10	Low	-	
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
Maralla West - No-Go									
Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
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	Nature of impact:								
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	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								

	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								

	Mitigation Measures								
	With Mitigation								

BioTherm Energy - Maralla West (Wetland)

{insert specialist filed here}

Significance Rating Table

Cumulative Impacts									
Maralla West									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Permanent degradation/loss of wetland/riparian habitat due to the proposed positioning of infrastructure	Nature of impact:	Direct							
	Without Mitigation	2	2	8	5	60	Medium		
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The WULA application will require detailed functional assessments (i.e. PES, EIS and EcoServices) of freshwater habitats potentially affected by the site and powerlines. At this stage design details should be available allowing							
	With Mitigation	1	2	4	3	21	Low		
Vegetation clearance for wind turbines and roads, soil disturbance and stockpiles, and increased traffic movement on site, resulting in a higher potential for soil erosion	Nature of impact:	Direct and Indirect							
	Without Mitigation	2	4	4	3	30	Low	-	Low
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Areas of disturbance should be (where practical) limited to the extent of the respective project footprint, and activities outside of the site should be kept to a minimum. Traffic of maintenance vehicles should be kept to a							
	With Mitigation	1	4	2	2	14	Low	-	Low

Potential spillage of hazardous substances such as oils, fuel, grease from maintenance vehicles, and sewage from on-site sanitation systems	Nature of impact:	Indirect							
	Without Mitigation	2	4	2	2	16	Low	-	Low
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	The proper handling and storage of hazardous materials, the use of hardstanding in storage areas of hazardous substances and where spillages are possible. The use of bunding around storage of hazardous materials and							
	With Mitigation	1	4	2	1	7	Low	-	Low
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								

	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

Maralla West - No-Go								
Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)	Status (+ve or -ve)	Confidence
	Nature of impact:							

	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
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	Nature of impact:								
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	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
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	Nature of impact:								
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	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
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	Nature of impact:								
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	degree to which impact can be reversed:								

	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

Appendix B

CUMULATIVE IMPACT ASSESSMENT

BIOTHERM – CUMULATIVE ASSESSMENT

APPROACH

The Department of Environmental Affairs (DEA) has requested that a detailed cumulative assessment is undertaken for each of the proposed BioTherm projects. The cumulative assessment must take the specialist studies from the surrounding Environmental Authorisations into account.

In order to ensure that a consolidated cumulative assessment can be developed for each project, a template has been produced to ensure that the specialist studies across the disciplines utilise the same approach.

Each specialist discipline will be required to compile the table below and provide a qualitative discussion on the overall cumulative impact of the projects in the study area.

MASTER ASSUMPTIONS

The following assumptions and limitations have been identified in relation to the above approach:

- Due to the number of different significance rating methodologies utilised across the various projects, significance ratings have been simplified to include only Low, Medium and High ratings.
- In the event that specialist studies were unable to be obtained, this has been noted.
- Solar – All approved and ongoing environmental authorisations within a 70km radius above been considered
- Wind – All approved and ongoing environmental authorisations within an 80 radius above been considered

Table 1: Cumulative Impacts – Wind Surface Water

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation				Decommissioning				
							Watercourses and wetlands	Water erosion	Sediment, leaks and spills		Watercourse sedimentation	Water erosion	Sediment, leaks and spills		Sediment, leaks and spills	Water erosion			
Proposed 280 MW Gunstfontein Wind Energy Project	14/12/16/3/3/2/395	S&EIR	Networx Eolos Renewables (Pty) Ltd	12 000	280 MW														
Proposed development of renewable energy facility at the Sutherland site, Western and Northern Cape.	12/12/20/1782/AM1	S&EIR	Mainstream Power Sutherland	28 600	811 MW														
Proposed Hidden Valley Wind Energy Facility, Northern Cape	12/12/20/2370/2	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd	9 530	150 MW		L	L			L	L							
Proposed Hidden Valley wind energy facility , Northern cape	12/12/20/2370/3	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd	9 180	150 MW		L	L			L	L							
Proposed Hidden Valley wind energy facility , Northern cape	12/12/20/2370/1	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd	16 620	150MW		L	L			L	L							
Proposed Hidden Valley wind energy facility , Northern cape	12/12/20/2370	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd		650 MW		L	L			L	L							
Proposed Construction Of The 140Mw Roggeveld Wind Farm Within The Karoo Hoogland Local Municipality Of The Northern Cape Province And Within The Laingsburg Local Municipality Of The	12/12/20/1988/1/AM1	Amendment	G7 Renerable Energies (Pty) Ltd	26 529	140 MW				L				L		L				

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Measures	Mitigation
							Construction				Operation				Decommissioning					
							Watercourses and wetlands	Water erosion	Sediment, leaks and spills		Watercourse sedimentation	Water erosion	Sediment, leaks and spills		Sediment, leaks and spills	Water erosion				
Western Cape Province																				
Proposed Photovoltaic (PV) Solar Energy Facility On A Site South Of Sutherland, Within The Karoo Hoogland Municipality Of The Namakwa District Municipality, Northern Cape Province	12/12/20/2235	BAR	Inca Komsberg Wind (Pty) Ltd	2	10 MW															
Proposed establishment of the Suurplaat wind energy facility and associated infrastructure on a site near Sutherland, Western Cape and Northern Cape.	12/12/20/1583	S&EIR	Moyeng Energy (Pty) Ltd	28 600	120 MW															
Proposed establishment of the Witberg Bay wind energy facility, Laingsburg Local Municipality, Central Karoo District, Western cape	12/12/20/1966/A2	Amendment	Witberg Wind Power (Pty) Ltd		Unknown															
Proposed renewable energy facility at Konstabel	12/12/20/1787	S&EIR	South Africa Mainstream Renewable Power Development		170 MW															
Proposed development of a renewable Energy facility at Perdekraal, Western Cape - Split 1	12/12/20/1783/2/AM1	Amendment	South Africa Mainstream Renewable Power Development		Unknown															
Proposed Touwsrivier Solar energy facility	12/12/20/1956	S&EIR	Unknown	215	36 MW			H				H				L				
				Total Ha	**Total MW**															
				128 276	2667 MW															
Significance Totals per impact	Significance Rating						**Total Hectares per impact**													

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Measures	Mitigation
							Construction				Operation				Decommissioning					
							Watercourses and wetlands	Water erosion	Sediment, leaks and spills		Watercourse sedimentation	Water erosion	Sediment, leaks and spills		Sediment, leaks and spills	Water erosion				
	High Significance							215				215								
	Medium Significance																			
	Low Significance						35 330	35 330	26 529		35 330	35 330	26 529		26 529	215				
	Positive Impacts																			

The following EAs surrounding the solar developments have been either withdrawn or have lapsed and are therefore not been considered as part of the cumulative impact assessment:

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms
Proposed wind energy facility near Komsberg, Western Cape	12/12/20/2228	S&EIR	Inca Komsberg Wind (Pty) Ltd		300 MW	
Proposed wind and solar project near Laingsburg, Western Cape	12/12/20/2328	S&EIR	Unknown		50 MW	