CAMDEN I GREEN ENERGY (RF) (PTY) LTD

CAMDEN I GREEN HYDROGEN AND AMMONIA FACILITY

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

MDARDLEA REFERENCE NUMBER: 1/3/1/16/1 G-242

23 OCTOBER 2022

FINAL

CAMDEN I GREEN HYDROGEN AND AMMONIA FACILITY

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DOCUMENT DESCRIPTION

APPLICANT

Camden I Green Energy (RF) (Pty) Ltd

PROJECT NAME

Proposed Camden I Green Hydrogen and Ammonia Facility, Mpumalanga, South Africa

PRE-APPLICATION REFERENCE NUMBER

2021-10-0008

MDARDLEA REFERENCE NUMBER

1/3/1/16/1 G-242

REPORT TYPE

Final Environmental Impact Assessment Report

WSP PROJECT NUMBER

41103247

PRODUCTION TEAM

APPLICANT

Camden I Green Energy (RF) (Pty) Ltd	Mercia Grimbeek

WSP

Project Manager	Ashlea Strong
Consultant	Thirushan Nadar
Traffic Specialist	Christo Bredenhann
Groundwater Specialist	Adam Sanderson
Acoustic Specialist	Kirsten Collett
Air Quality Specialist	Loren Dyer

SPECIALISTS

Heritage & Palaeontology Specialist	Jaco van der Walt & Marion Bamford (Beyond Heritage)
Agriculture Specialist	Johan Lanz
Ecology Specialist	David Hoare (David Hoare Consulting (Pty) Ltd
Aquatic Specialist	Brian Colloty (EnviroSci Pty Ltd)
Avifauna Specialist	Chris van Rooyen (Chris van Rooyen Consulting)
Social Specialist	Tony Barbour (Tony Barbour Environmental Consulting)
Visual Specialist	Kerry Schwartz (SiVEST SA (Pty) Ltd / SLR Consulting (Pty) Ltd))
Risk Specialist	Debra Mitchell (Ishecon cc)
Bat Specialists	Werner Marais, Diane Smith & Caroline Bell (Animalia Consultants (Pty) Ltd)

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1 INTRODUCTION

Changes made from the Draft Environmental Impact Report have been underlined in this Final Environmental Impact Report for ease of reference to the updates made in the reporting.

1.1 PURPOSE OF THIS REPORT

This final environmental impact report (EIR) documents the processes and findings of the impact assessment phase of the Scoping and Environmental Impact Reporting (S&EIR) process for the proposed establishment of the for the proposed Camden I Green Hydrogen & Ammonia Facility, located approximately 10km south of Ermelo (near Camden) in the Mpumalanga Province of South Africa.

The EIR aims to provide stakeholders with information on the proposed development including location, layout and technological alternatives, the scope of the environmental assessment and key impacts to be addressed in the environmental assessment, and the consultation process undertaken through the environmental impact assessment (EIA) process.

1.2 BACKGROUND INFORMATION

The proponent is proposing the development of a Camden Renewable Energy Complex within the vicinity of the Camden Power Station in Mpumalanga. The Complex consists of eight distinct projects referred to as:

— Camden I Wind Energy Facility (up to 200MW) (subject to a S&EIR process);
— Camden I Wind Grid Connection (up to 132kV) (subject to a Basic Assessment (BA) Process);
— Camden Grid Connection and Collector substation (up to 400kV) (subject to a S&EIR process);
— Camden I Solar (up to 100MW) (subject to a S&EIR process);
— Camden I Solar Grid Connection (up to 132kV) (subject to a BA Process);
— Camden II Wind Energy Facility (up to 200MW) (subject to a S&EIR process);
— Camden II Wind Energy Facility up to 132kV Grid Connection (subject to a BA Process); and
— Camden Green Hydrogen and Ammonia Facility, including grid connection infrastructure (subject to a S&EIR process).

The Complex (except for the Green Hydrogen and Ammonia project) is being developed in the context of the Department of Mineral Resources and Energy's (DMRE Integrated Resource Plan, and the Renewable Energy Independent Power Producer Procurement Programme (REIPPP).

The focus of this Final EIR is the proposed Camden I Green Hydrogen and Ammonia Facility, including grid connection infrastructure project.

The proposed project will be operated under a Special Purpose Vehicle (SPV), and the Project Applicant is Camden Green Energy RF (Pty) Ltd. The proposed facility will connect directly to the nearby Camden Collector substation through an up to 132kV powerline, which will supply the GH&A facility with green energy for the production of hydrogen (and ultimately Ammonia) via the Haber–Bosch process. The broader Camden developments (i.e. seven of the abovementioned projects) will connect to the Camden Power Station substation through an up to 400kV powerline (either single or double circuit) (subject to a separate Scoping and EIA process).

In order for the proposed project to proceed, it will require an Environmental Authorisation (EA) from the Competent Authority (CA) (i.e. the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA)).

1.3 KEY ROLE PLAYERS

1.3.1 PROJECT PROPONENT

Camden I Green Energy (RF) (Pty) Ltd is the project proponent (Applicant) with regards to this application for the construction and operation of the Facility and associated infrastructure. **Table 1-1** provides the relevant details of the project proponent.

Table 1-1: Details of Project Proponent

PROPONENT:	CAMDEN I GREEN ENERGY (RF) (PTY) LTD
Contact Person:	Mercia Grimbeek
Postal Address	Suite 104, Albion Springs, 183 Main Road, Rondebosch, Cape Town, South Africa 7700
Telephone:	071 752 8033
Email:	Gideon.raath@enertrag.co.za

1.3.2 COMPETENT AUTHORITY

Section 24C(2)(a) of NEMA stipulates that the Minister of Forestry, Fisheries, and the Environment ("the Minister") must be identified as the CA if the activity has implications for international environmental commitments or relations. GN 779 of 01 July 2016 identifies the Minister as the CA for the consideration and processing of environmental authorisations and amendments thereto for activities related the Integrated Resource Plan (IRP) 2010 – 2030.

The CA (i.e., MDARDLEA) was confirmed during the Pre-Application Meeting held on **4 November 2021**.

Table 1-2 provides the relevant details of the competent authority on the Project.

Table 1-2: Competent Authority

ASPECT	COMPETENT / COMMENTING AUTHORITY	CONTACT DETAILS
Competent Authority: Environmental Authorisation	Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA)	Case Officer: Sindisiwe Mbuyane mbuyanesb@mpg.gov.za MDARDLEA Reference: 1/3/1/16/1 G-242

1.3.3 COMMENTING AUTHORITIES

The following commenting authorities have been identified for this application:

- Department of Mineral Resources and Energy (DMRE);
- DFFE: Biodiversity and Conservation;
- DFFE: Protected Areas;
- Mpumalanga Department Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA);
- Department of Water and Sanitation (DWS);

- Vaal Water Management Area (WMA) Authority;
- South African Heritage Resource Agency (SAHRA);
- Mpumalanga Heritage Resources Authority (MHRA);
- Mpumalanga Tourism and Parks Agency (MTPA);
- Civil Aviation Authority (CAA);
- Air Traffic and Navigation Services (ATNS);
- Department of Defence (SA Army) (DD);
- Astronomy Management Authority (AMA);
- South African Weather Services (SAWS);
- South African National Roads Agency Limited (SANRAL);
- Gert Sibande District Municipality;
- Msukaligwa Local Municipality; and
- Dr Pixley Ka Seme Local Municipality.

1.3.4 ENVIRONMENTAL ASSESSMENT PRACTITIONER

WSP Group Africa (Pty) Ltd (WSP) has been appointed in the role of Independent Environmental Assessment Practitioner (EAP) to undertake the S&EIR processes for the development of the Project. The CV of the EAP is available in **Appendix A**. The EAP declaration of interest and undertaking is included in **Appendix B**. **Table 1-3** details the relevant contact details of the EAP. In order to adequately identify and assess potential environmental impacts, a number of specialists will support the EAP.

Table 1-3: Details of the Environmental Assessment Practitioner

ENVIRONMENTAL ASSESSMENT PRACTITIONER	WSP GROUP AFRICA (PTY) LTD
Contact Person:	Ashlea Strong
Postal Address:	Building C, Knightsbridge, 33 Sloane Street, Bryanston, 2191, South Africa
Telephone:	011 361 1392
Fax:	011 361 1381
E-mail:	Ashlea.Strong@wsp.com
EAP Qualifications:	— Masters in Environmental Management, University of the Free State — B Tech, Nature Conservation, Technikon SA — National Diploma in Nature Conservation, Technikon SA
EAPASA Registration Number:	EAPASA (2019/1005)

STATEMENT OF INDEPENDENCE

Neither WSP nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any business, financial, personal or other interest that could be reasonably regarded as being capable of affecting their independence. WSP has no beneficial interest in the outcome of the assessment.

1.3.5 SPECIALISTS

Specialist input was required in support of this application for EA. The details of the specialists are provided in **Table 1-4** below. The specialist declarations are included in **Appendix C**.

Table 1-4: Details of Specialists

ASSESSMENT	NAME OF SPECIALIST	COMPANY	SECTIONS IN REPORT
Agriculture	Johann Lanz	Independent consultant	Section 7.1.5 Section 8.4 **Appendix H-1**
Avifauna	Chris van Rooyen	Chris van Rooyen Consulting	Section 7.2.6 Section 8.8 **Appendix H-2**
Terrestrial Biodiversity Animal Species Plant Species	David Hoare	David Hoare Consulting (Pty) Ltd	Section 7.2.4 Section 8.7 **Appendix H-3** **Appendix H-14** **Appendix H-15**
Aquatic	Brian Colloty	EnviroSci Pty Ltd	Section 7.1.6 Section 8.5 **Appendix H-4**
Bats	Werner Marais, Diane Smith & Caroline Bell	Animalia Consultants (Pty) Ltd	Section 7.2.4 Section 8.1.5 **Appendix H-5**
Heritage	Jaco van der Walt	Beyond Heritage	Section 7.3.4 Section 8.12 **Appendix H-6**
Palaeontology	Marion Bamford	Beyond Heritage	Section 7.3.4 Section 8.13 **Appendix H-7**
Socio-economic	Tony Barbour	Tony Barbour Environmental Consulting	Section 7.3.6 Section 8.14 **Appendix H-8**
Traffic	Christo Bredenhann	WSP Group Africa (Pty) Ltd	Section 7.3.3 Section 8.11 **Appendix H-9**
Visual	Kerry Schwartz	SiVEST SA (Pty) Ltd / SLR Consulting (Pty) Ltd	Section 7.3.4 Section 8.9 **Appendix H-10**
Noise	Kirsten Collett	WSP Group Africa (Pty) Ltd	Section 7.3.2 Section 8.3 **Appendix H-11**
SHE Risk	Debra Mitchel	Ishecon cc	Section 7.3.7 Section 8.15 **Appendix H-13**

ASSESSMENT	NAME OF SPECIALIST	COMPANY	SECTIONS IN REPORT
Air Quality	Loren Dyer	WSP Group Africa (Pty) Ltd	Section 7.1.2 Section 8.2 **Appendix H-12**
Desktop Geotechnical	Muhammad Osman	SLR Consulting (South Africa) (Pty) Ltd	**Section 7.1.4** **Appendix H-16**

1.4 IMPACT ASSESSMENT TERMS OF REFERENCE

The 2014 Environmental Impact Assessment (EIA) Regulations (GNR 982), as amended, identifies the proposed Camden I G&A development as an activity being subject to an S&EIR process due to the applicability of the EIA Listing Notices 1 and 2 (GNR 983 and 984, as amended). In order for the project to proceed it will require an Environmental Authorisation (EA) from MDARDLEA.

WSP has been appointed as the independent EAP to carry out the S&EIR process in accordance with the EIA Regulations, 2014, as amended in 2017.

The Scoping Process has been completed and involved consultation with interested and affected parties and the drafting of the Plan of Study (PoS) for EIA, which culminated in the submission of a Final Scoping Report (FSR) to the MDARDLEA. The MDARDLEA acceptance of the FSR and authorisation to proceed with the EIR was received on 20 May 2022 (**Appendix G**). A request for extension to the submission deadline of the FEIR was submitted to the MDARDLEA in terms of EIA Regulation 3(7). A 50-day extension was approved on 27 June 2022.

The draft EIAR was made available for public comment from **7 September 2022 to 10 October 2022**. <u>The final EIAR was submitted to MDARDLEA on the **23 October 2022**</u>

As defined in Appendix 3 of GNR 982, as amended, the objective of the impact assessment process is to, through a consultative process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- Determine the—
  - Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - Degree to which these impacts-
    - Can be reversed;
    - May cause irreplaceable loss of resources, and
    - Can be avoided, managed or mitigated;
- Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- Identify suitable measures to avoid, manage or mitigate identified impacts; and
- Identify residual risks that need to be managed and monitored.

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. The objectives of the public participation process can be summarised as follows:

— Identify relevant individuals, organisations and communities who may be interested in or affected by the Proposed Project;
— Clearly outline the scope of the Proposed Project, including the scale and nature of the existing and proposed activities;
— Identify viable Proposed Project alternatives that will assist the relevant authorities in making an informed decision;
— Identify shortcomings and gaps in existing information;
— Identify key concerns, raised by Stakeholders that should be addressed in the subsequent specialist studies;
— Highlight the potential for environmental impacts, whether positive or negative; and
— To inform and provide the public with information and an understanding of the Proposed Project, issues and solutions.

1.5 IMPACT ASSESSMENT REPORT STRUCTURE

Table 1-5 cross-references the sections where the legislated requirements as per Appendix 3 of GNR 982 of 2014 can been located within the EIR.

Table 1-5: Legislated Report Requirements as detailed in GNR 982

APPENDIX 3	LEGISLATED REQUIREMENTS AS PER THE NEMA GNR 982	RELEVANT REPORT SECTION
(a)	Details of	
	the EAP who compiled the report; and	Section 1.3.4 Appendix A
	the expertise of the EAP, including a Curriculum Vitae	Appendix A
(b)	The location of the activity, including-	
	The 21-digit Surveyor code for each cadastral land parcel;	Section 6.1
	Where available, the physical address and farm name	Section 6.1
	Where the required information in terms of (i) and (ii) is not available, the coordinates of the boundary of the property.	N/A
(c)	A plan which locates the proposed activities applied for at an appropriate scale, or, if it is-	
	A linear activity, a description of the corridor in which the proposed activity or activities is to be undertaken; or	Section 7
	On land where the property has not been defined, the coordinates within which the activity is to be undertaken.	N/A
(d)	A description of the proposed activity, including-	
	All listed and specified activities triggered and being applied for;	Section 2.1
	A description of the associated structures and infrastructure related to the development;	Section 6
(e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section 2

APPENDIX 3	LEGISLATED REQUIREMENTS AS PER THE NEMA GNR 982	RELEVANT REPORT SECTION
(f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 5
(h)	A full description of the process followed to reach the proposed development footprint within the approved site, including-	
	Details of the development footprint alternatives considered;	Section 6.5
	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 4.3
	A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Appendix D
	The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 7
	The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated.	Section 8
	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 4.2
	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8
	The possible mitigation measures that could be applied and level of residual risk;	Section 8
	If no alternative development locations for the activity were investigated, the motivation for not considering such; and	Section 6.5
	A concluding statement indicating the preferred alternative development location within the approved site.	Section 6.5
(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including-	
	A description of all environmental issues and risks that were identified during the environmental impact assessment process; and;	Section 8
	An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	Section 8
(j)	An assessment of each identified potentially significant impact and risk, including-	
	Cumulative impacts;	Section 9

APPENDIX 3	LEGISLATED REQUIREMENTS AS PER THE NEMA GNR 982	RELEVANT REPORT SECTION
	The nature, significance and consequences of the impact and risk;	Section 8
	The extent and duration of the impact and risk;	Section 8
	The probability of the impact and risk occurring;	Section 8
	The degree to which the impact and risk can be reversed;	Section 8
	The degree to which the impact and risk may cause irreplaceable loss of resources; and	Section 8
	The degree to which the impact and risk can be mitigated.	Section 8
(k)	Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	Section 10.3
(l)	An environmental impact statement which contains-	
	A summary of the key findings of the environmental impact assessment:	Section 10
	A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	Section 10
	A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	Section 6.5 & Section 10.4
(m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.	Appendix I
(n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.	Section 6.5
(o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 8
(p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.	Section 1.7
(q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Section 10.6
(r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.	N/A
(s)	An undertaking under oath or affirmation by the EAP in relation to-	
	The correctness of the information provided in the report;	Appendix B

APPENDIX 3	LEGISLATED REQUIREMENTS AS PER THE NEMA GNR 982	RELEVANT REPORT SECTION
	The inclusion of comments and inputs from stakeholders and I&APs;	Appendix B
	The inclusion of inputs and recommendations from the specialist reports where relevant; and	Appendix B
	Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.	Appendix B
(t)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	N/A
(u)	An indication of any deviation from the approved scoping report, including the plan of study, including-	N/A
	any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and	N/A
	a motivation for the deviation	N/A
(v)	Any specific information required by the competent authority; and	N/A
(w)	Any other matter required in terms of section 24(4)(a) and (b) of the Act	N/A

1.6 ADDITIONAL PERMITS AND AUTHORISATIONS

Table 1-6 outlines the additional permits and authorisations required for the proposed development, as well as the relevant Competent Authorities responsible.

Table 1-6: Additional Permits and Authorisations required for the proposed development

PERMITS/AUTHORISATION	LEGISLATION	RELEVANT AUTHORITY	STATUS
Water Use Licence / General Authorisation	National Water Act (Act No. 36 of 1998)	Department of Water and Sanitation	Application process will run concurrently with the EIA Phase.
Atmospheric Emissions License	National Environmental Management: Air Quality Act (Act 39 of 2004)	Gert Sibande District Municipality	Application process will run concurrently with the EIA Phase.
Section 50 Approval	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	DFFE: Protected Areas Directorate	In Process The Project Proponent is engaging with the MTPA and the Management Authority (i.e. the respective Landowner/s) to investigate the best way forward regarding the Langcarel Nature Reserve. The MTPA has undertaken a site visit on 01 June 2022. The MTPA has further submitted a letter to the Department (letter dated, 20 June 2022)

PERMITS/AUTHORISATION	LEGISLATION	RELEVANT AUTHORITY	STATUS
			of the intent to issue a notice to withdraw the declaration of the Langcarel Private Nature Reserve in terms of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998), and a process of partial or complete deproclamation is therefore underway. As no formal management authority has been designated by the provincial conservation authority, the landowner is considered the appropriate signatory for the Section 50 consent letter. This consent letter will be added to the final EIA report for submission to the Competent Authority.
Section 38 Notification	National Heritage Resource Act (Act No. 25 of 1999)	Mpumalanga Heritage Resources Authority	In Process
Section 53 Approval	Minerals and petroleum Resources Development Act (No. 28 of 2002)	Department of Mineral Resources and Energy	Application submitted on 13 May 2022 DMR Ref: MP30/5/4/2/11094SU
Subdivision of Agricultural Land Act (SALA) Consent / Change of Land Use (re-zoning)	Subdivision of Agricultural Land Act (Act No. 70 of 1970) / Spatial Planning and Land Use Management Act (Act No. 16 of 2013) (SPLUMA)	Department of Agriculture, Land Reform and Rural Development (DALRRD) / Msukaligwa Municipality	Given that the project is proposed on land zoned for Agriculture, SALA requires that any long-term lease associated with the renewable energy facility be approved by the DALRRD. Subdivision and consolidation of land are also regulated as part of municipal planning, and will therefore be subject to municipal by-laws and provincial legislation. The SALA consent and Land use zoning are separate processes from the Application for EA, and needs to be applied for and obtained separately from the EA and S&EIR process. It is however noted that a rezoning application is already underway for the proposed project, however, can only be complete once the EA is issued. The proponent will ensure all municipal approvals and zoning requirements are met

PERMITS/AUTHORISATION	LEGISLATION	RELEVANT AUTHORITY	STATUS
			prior to commencement of construction.

1.7 ASSUMPTION AND LIMITATIONS

General assumptions and limitations

- The EAP hereby confirms that they have undertaken to obtain project information from the client that is deemed to be accurate and representative of the project;
- Site visits have been undertaken to better understand the project and ensure that the information provided by the client is correct, based on site conditions observed;
- The EAP hereby confirms their independence and understands the responsibility they hold in ensuring all comments received are accurately replicated and responded to within the EIA documentation;
- The comments received in response to the public participation process, will be representative of comments from the broader community; and
- Based on the Pre-Application meeting and subsequent minutes, the CA would not require additional specialist input, in order to make a decision regarding the application.

Agricultural

- There were no assumptions and limitation associated with this study.

Risk

- The engineering detailed designs for the Liquid Air Energy System (LAES), electrolysers, hydrogen and ammonia facilities are not yet available, so assumptions will be made based on engineering judgement.
- Final storage and any transportation of ammonia, hydrogen, nitrogen and oxygen is assumed to be in the liquid phase.
- The electrolysers are assumed to be located indoors while the remaining facilities will be outdoors.

Aquatic Ecology

- To obtain a comprehensive understanding of the dynamics of both the flora and fauna of communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are thus mostly based on instantaneous sampling.
- Due to the scope of the work presented in the report, a long-term investigation of the proposed site was not possible and as such not perceived as part of the Terms of Reference – EIA Phase. However, a concerted effort was made to sample and assess as much of the potential site, as well as make use of any supporting literature, species distribution data and aerial photography.
- This limitation is common to many impact assessment type studies, but the findings are deemed adequate for the purposes of decision-making support regarding project acceptability in this Phase, unless otherwise stated.
- It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.
- The full extent of the grid and water pipeline corridors were assessed to allow for micro siting therein.

Avifauna

The avifaunal study made the basic assumption that the sources of information used are reliable and accurate. The following must be noted:

- The SABAP2 dataset is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, and the results of the on-site surveys.

— Conclusions in the report are based on experience of these and similar species at developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.
— It is assumed that the up to 132kV overhead line will be built on poles/towers designed to 132kV specifications.

Plant Species

— The purpose of the fieldwork undertaken for this Project to characterize the habitat of the study area, compile species checklists from as diverse a variety of habitats as possible, and to map habitats within the entire collection of farms within which the Project is situated.
— The proposed project layout was provided during the EIA process, therefore no development footprint areas were assessed for the Project, only the general area in which the project is located.
— A final walk-through to survey conducted in Spring or Summer, where possible, is therefore recommended to check for potential species of conservation concern within footprints of the development.

Animal Species

— Inventory surveys of animal species occurring on a site are difficult to achieve within the time-frames associated with an EIA. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons and be undertaken a much longer timeframe and include extensive sampling. It is more important to know of fauna of value, as well as ecological processes. Therefore, the assessment attempts to identify threatened and other significant species, important habitats, and ecological processes.
— Compiling the list of species that could potentially occur on site is limited by the density of collection records for the area. The list of animal species that could potentially occur on site was therefore taken from a wider area and from literature sources that may include species that do not occur on site and may miss species that do occur on site.
— The assessment is based on a field survey conducted 3-7 February 2020. The current study is based on an extensive site visit as well as a desktop study of the available information. The time spent on site was adequate for understanding general patterns across affected areas. The seasons in which the fieldwork (peak summer flowering period) was conducted was ideal for assessing the composition and condition of the vegetation, which is also suitable for assessing habitat condition and suitability for animals.

Terrestrial Biodiversity

The following assumptions, limitations, uncertainties are listed regarding the ecological assessment of the Camden site:

— The assessment is based on a field survey conducted 3-7 February 2020. The current study is based on an extensive site visit as well as a desktop study of the available information. The time spent on site was adequate for understanding general patterns across affected areas. The seasons in which the fieldwork (peak summer flowering period) was conducted was ideal for assessing the composition and condition of the vegetation.
— The vegetation was in good condition for sampling at the time of the field assessment, and the species lists obtained are considered reliable and relatively comprehensive.
— Compiling the list of species that could potentially occur on site is limited by the paucity of collection records for the area. The list of plant species that could potentially occur on site was therefore taken from a wider area and from literature sources that may include species that do not occur on site and may miss species that do occur on site. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons, be undertaken over a number of years and include extensive sampling. Due to time constraints inherent in the EIA process, this was not possible for this study. However, the comprehensive field survey is sufficient for the purposes of this report and towards sufficiently informing the decision making process by the Competent Authority.
— Rare and threatened plant and animal species are, by their nature, usually very difficult to locate and can be easily missed.
— The faunal component of the study relies primarily on existing information, as available in various spatial databases and published accounts. These databases are not intended for fine-scale use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has been sampled in the past.

Many remote areas have not been well sampled with the result that the species lists for an area do not always adequately reflect the actual fauna and flora present at the site. In order to counter the likelihood that the area has not been well sampled in the past and in order ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger than the study area and are likely to include a much wider array of species than actually occur at the site. This ensures that no species of potential conservation concern are missed ion the assessment. The study excludes Bats, Avifauna, Aquatic Ecology and Invertebrates

Social

The following assumptions and limitations are associated with the social impact assessment study:

— Identification of social issues: The identification of social issues is based on the authors experience associated with undertaking in the region of 130 SIAs for renewable energy facilities and associated infrastructure (substations, transmission lines, roads etc.). Based on this the author is confident that the majority of social issues have been identified. A site visit was undertaken during the Assessment Phase of the SIA.

— Technical suitability: It is assumed that the development site represents a technically suitable site for the establishment of the proposed development.

— Strategic importance of the project: The strategic importance of promoting renewable and other forms of energy is supported by the national and provincial energy policies.

— Fit with planning and policy requirements: Legislation and policies reflect societal norms and values. The legislative and policy context therefore plays an important role in identifying and assessing the potential social impacts associated with a proposed development. In this regard, a key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents. As such, if the findings of the study indicate that the proposed development in its current format does not conform to the spatial principles and guidelines contained in the relevant legislation and planning documents, and there are no significant or unique opportunities created by the development, the development cannot be supported.

— Demographic data: Some of the provincial documents do not contain data from the 2011 Census and or 2016 Household Community Survey. However, where required the relevant 2011 and 2016 data has been provided.

— Site visit: A site visit was undertaken during this EIA Phase. The site visit included interviews with key stakeholders and interested and affected parties. However, as indicted above, the specialist is confident that the key social issues have been identified.

Visual

The following assumptions and limitations are associated with the visual study:

— Given the nature of the receiving environment and the assumed height of certain components of the Facility, the study area or visual assessment zone is assumed to encompass an area of 5km from the two proposed site alternatives. This limit on the visual assessment zone relates to the fact that visual impacts decrease exponentially over distance. Thus, although the higher elements of the Facility may theoretically still be visible beyond 5km, the degree of visual impact would diminish considerably. As such, the need to assess the impact on potential receptors beyond this distance would not be warranted.

— The identification of visual receptors involved a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Where possible, these receptor locations were verified and assessed during a site visit which was undertaken in mid-September 2019. Due to the extent of the study area however and the number of receptors that could potentially be sensitive to the proposed development, it was not possible to visit or verify every potentially sensitive visual receptor location. As such, a number of broad assumptions have been made in terms of the likely sensitivity of the receptors to the proposed development.

— It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility, the economic dependency of the occupants on the scenic quality of views from the facility and on people's perceptions of the value of "Green Energy". Sensitive receptor locations typically include sites such as tourism facilities and scenic locations within natural settings which are likely to be adversely affected by the visual intrusion of the proposed development. Thus, the presence of a receptor in an area potentially affected by the proposed development does not necessarily mean that any visual impact will be experienced.

- The potential visual impact at each sensitive visual receptor location was assessed using a matrix developed for this purpose. The matrix is based on three main parameters relating to visual impact and, although relatively simplistic, it provides an indicative assessment of the degree of visual impact likely to be experienced at each receptor location as a result of the proposed development. It is however important to note the limitations of quantitatively assessing a largely subjective or qualitative type of impact and as such the matrix should be seen merely as a representation of the likely visual impact at a receptor location.
- As stated, the exact status of all the receptors could not be verified during the field investigation and as such the receptor impact rating was largely undertaken via desktop means. Where details of the levels of leisure / tourism activities on different sectors of the relevant farms are not known, the impact rating matrix for these receptors is based on the assumed location of the main accommodation complex on each property.
- Where receptors have been identified within the Camden 1 Renewable Energy project area, it has been assumed that the landowners or residents at these locations support the proposed development and would not view the project in a negative light.
- Based on the project description provided by the Proponent, all analysis for the VIA is based on a worst-case scenario where the highest structure associated with the Facility (Air Separation Unit) is assumed to be 20m.
- Due to the varying scales and sources of information; maps may have minor inaccuracies. Terrain data for this area, derived from the National Geo-Spatial Information (NGI)'s 25m Digital Elevation Model (DEM), is fairly coarse and somewhat inconsistent and as such, localised topographic variations in the landscape may not be reflected on the DEM used to generate the viewshed(s) and visibility analysis conducted in respect of the proposed development.
- In addition, the viewshed / visibility analysis does not take into account any existing vegetation cover or built infrastructure which may screen views of the proposed development. This analysis should therefore be seen as a conceptual representation or a worst-case scenario.
- No feedback regarding the visual environment has been received from the public participation process to date. Any feedback from the public during the review period of the Draft EIA Report (DEIR) for the Facility will however be incorporated into further drafts of this report, if relevant.
- At the time of undertaking the visual study no information was available regarding the type and intensity of lighting that will be required for the proposed Facility and therefore the potential impact of lighting at night has not been assessed at a detailed level. General measures to mitigate the impact of additional light sources on the ambiance of the nightscape have been provided.
- In the light of the fact that green hydrogen and ammonia facilities are still relatively new in South Africa and as such, this report is based on assumptions as to the likely generic impacts associated with the proposed development.
- This study includes an assessment of the potential cumulative impacts of other renewable energy and infrastructural / mining developments on the existing landscape character and on the identified sensitive receptors. This assessment is based on the information available at the time of writing the report and where information has not been available, broad assumptions have been made as to the likely impacts of these developments.
- It should be noted that the fieldwork for this study was undertaken in mid-September 2019, during late winter which is characterized by low levels of rainfall and reduced vegetation cover. In these conditions, increased levels of visual impact will be experienced from receptor locations in the surrounding area.
- The overall weather conditions in the study area have certain visual implications and are expected to affect the visual impact of the proposed development to some degree. In clear weather conditions, the Facility would present a greater contrast with the surrounding environment than they would on an overcast day. Although the field investigation was conducted during clear weather conditions however, localised pollution in the study area results in relatively hazy skies which would reduce the visibility of the Facility.

Heritage

The following assumptions and limitations are associated with the heritage study:

- Due to the nature of heritage resources and pedestrian surveys, the possibility exists that some features or artefacts may not have been discovered/recorded and the possible occurrence of graves and other cultural material cannot be excluded.
- This limitation is successfully mitigated with the implementation of a Chance Find Procedure, pre-construction walkthrough and monitoring of the study area by the Environmental Control Officer (ECO).

- The assessment only deals with the footprint area of the proposed development (including the assessment corridor for linear features) and consisted of non-intrusive surface surveys
- It is assumed that information obtained for the wider area is applicable to the study area and the authors acknowledge that the brief literature review is not exhaustive on the literature of the area.
- Due to the subsurface nature of cultural deposits, the possibility exists that some features or artefacts may not have been discovered/recorded during the survey, similarly the possible occurrence of graves and other cultural material cannot be excluded.
- This study did not assess the impact on medicinal plants and intangible heritage as it is assumed that these components would be highlighted through the public consultation process if relevant.
- It is possible that new information could come to light in future, which might change the results of this scoping report.

Palaeontology

The following assumptions and limitations are associated with the acoustic assessment study:

- Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and do contain fossil plant, insect, invertebrate and vertebrate material.
- The site visit and walk through confirmed that there are no fossils present on the land surface. It is not known if there are any fossils below the land surface.
- The sands of the Quaternary period and the Jurassic dolerite would not preserve fossils.

Noise

The following assumptions and limitations are associated with the acoustic assessment study:

- The Environmental Acoustic Impact Assessment was undertaken and, various assumptions were made and limitations experienced that may impact on the results obtained. These include:
- The information provided regarding the proposed operational activities is assumed to be representative of what will occur in reality.
- Identification of sensitive receptors is based on a desktop assessment and it is assumed that all key receptors have been included.
- Night-time monitoring could only be conducted on one night due to inclement weather. Being such a remotely located rural sight, measurements on one night provide sufficient data to evaluate the current noise climate.
- This assessment represents a worst-case scenario, where it has been assumed that one of each piece of equipment will be operational simultaneously at the boundary of the plant area, in closest proximity to each sensitive receptor.
- The acoustic calculations do not take terrain or vegetation into account, thus representing an absolute worst-case scenario.

Air Quality

The following assumptions and limitations are associated with the air quality study:

- In the absence of appropriate methodologies to quantify emission rates using the available activity data, this study qualitatively assessed potential air quality impacts from the proposed site activities.
- The assessment relied on the intended operational design data provided by Camden Green Energy and well understood principles of bulk liquid storage and compound properties.

Geotechnical

The following assumptions and limitations are associated with the desktop geotechnical study

- The interpretation of the overall geotechnical conditions across the site is based on a review of available information on the project area.
- Subsurface and geotechnical conditions have been inferred at a desktop level from the available information, past experience in the project area and professional judgement.
- The information and interpretations are given as a guideline only and there is no guarantee that the information given is totally representative of the entire area in every respect. No responsibility will be accepted for consequences arising out of the fact that actual conditions vary from those inferred. The information must be verified by the undertaking of a detailed geotechnical site investigation.

Bats

As with any environmental study, there are certain assumptions and limitations that exist around the current knowledge we possess regarding bats and their behaviour, movements and distribution. Some important points are discussed briefly below.

- Distribution maps of South African bat species still require further refinement, thus the bat species proposed to occur on the site (and not detected in the area yet) should be considered precautionary. If a species has a distribution marginal to the site, it was assumed to occur in the area.
- The migratory paths of bats are largely unknown, thus some uncertainty in this regard will remain until the end of operational monitoring of at least 2 years. Based on the currently available data from the pre-construction monitoring, there is nothing to date that indicates that the site is located in a migratory path.
- The sensitivity map is based partially on satellite imagery and from detailed site visits, although given the large extent of the site, there is always the possibility that what has been mapped may differ slightly to what is on the ground.

Traffic

The traffic impact assessment assumptions associated with the construction phase with the are as follows:

- An estimated construction period of 24 months, with a variable number of staff required depending on the construction phase.
- An estimated maximum of 250 workers will be on-site every day during the peak construction period.
- Workers will not be accommodated on-site.
- 85% of the work force (unskilled and semi-skilled workers) will utilise public transport to site from neighbouring towns, most notably Ermelo which is located approximately 30 km away.
- Skilled personnel will travel by private car with an average occupancy of 1.5 persons.
- 80% of Public Transport will be by bus, with a 65 person per bus occupancy.
- 20% of Public Transport will be by mini-bus, with a 16 person per vehicle occupancy.
- Staff will not utilise NMT to site due to the excessive distances to the closest towns.
- It is assumed that the public transport vehicles will not remain on-site during the workday, therefore all these vehicles will arrive and again depart during the AM and PM peaks.

Notwithstanding these assumptions and limitations, it is the view of WSP that this EIR provides a good description of the issues associated with the project, and a reasonable plan of study for this EIA phase.

2 GOVERNANCE FRAMEWORK

2.1 NATIONAL ENVIRONMENTAL LEGAL FRAMEWORK

The South African regulatory framework establishes well-defined requirements and standards for environmental and social management of industrial and civil infrastructure developments. Different authorities at both national and regional levels carry out environmental protection functions. The applicable legislation and policies are shown in **Table 2-1**.

Table 2-1: Applicable National Legislation[1]

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
The Constitution of South Africa (No. 108 of 1996)	The Constitution cannot manage environmental resources as a stand-alone piece of legislation hence additional legislation has been promulgated in order to manage the various spheres of both the social and natural environment. Each promulgated Act and associated Regulations are designed to focus on various industries or components of the environment to ensure that the objectives of the Constitution are effectively implemented and upheld in an on-going basis throughout the country. In terms of Section 7, a positive obligation is placed on the State to give effect to the environmental rights.
National Environmental Management Act (No. 107 of 1998)	In terms of Section 24(2) of the NEMA, the Minister may identify activities, which may not commence without prior authorisation. The Minister thus published GNR 983 (as amended) (Listing Notice 1), GNR 984 (as amended) (Listing Notice 2) and GNR 985 (as amended) (Listing Notice 3) listing activities that may not commence prior to authorisation. The regulations outlining the procedures required for authorisation are published in the EIA Regulations of 2014 (GNR 982) (as amended). Listing Notice 1 identifies activities that require a BA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. Listing Notice 2 identifies activities that require an S&EIR process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. Listing Notice 3 identifies activities within specific areas that require a BA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. WSP undertook a legal review of the listed activities according to the proposed project description to conclude that the activities listed in in this section are considered applicable to the development: A S&EIR process must be followed. An EA is required and will be applied for with the MDARDLEA.
Listing Notice 1: GNR 983	***Activity 9(i)*** *The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water—* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where—* *(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve or railway line reserve; or* *(b) where such development will occur within an urban area.* **Description**:

[1] It should be noted that all dimensions outlined in relation to Listing Notice 1, 2 and 3 are provisional and are subject to final design.

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	The Facility is located outside an urban area and will require, depending on the water source and water quality obtained, an above or below ground water supply pipeline exceeding 1 000 metres in length, of internal diameter in excess of 0,36m towards feed water supply of the Facility. The exact pipeline specifications will be confirmed once final designs have been provided.
	Activity 10(i) *The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes –* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where—* *(a) such infrastructure is for the bulk transportation of sewage, effluent, process* *water, waste water, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or* *(b) where such development will occur within an urban area.* **Description**: The Facility is located outside an urban area and road/railway line reserve, and will require infrastructure exceeding 1000m in length for the bulk transportation of effluent/process water of internal diameter in excess of 0,36m for crystalisation, associated with the Reverse Osmosis plant. The exact pipeline specifications will be confirmed once final designs have been provided..
	Activity 11(i) *The development of facilities or infrastructure for the transmission and distribution of electricity—* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or* *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;* **Description**: The Facility is located outside urban areas and will be supplied with electricity by a single up to 132kV overhead or underground power line from a common Collector Substation. In addition, electrical substation infrastructure associated with the Facility is rated at 33/132kV whilst being located outside urban areas or industrial complexes.
	Activity 12(ii)(a)(c) *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; **Description**: The physical footprint of access roads, stormwater control infrastructure, electrical cabling and water supply pipelines related to the Facility will exceed 100m^2 within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site. The exact footprint will be confirmed once final designs have been provided.
	Activity 16 *The development and related operation of facilities for the desalination of water with a design capacity to produce more than 100 cubic metres of treated water per day.* **Description**: The Facility's Reverse Osmosis (RO) infrastructure (with a design capacity to produce ~3182 m^3 purified/treated water per day) will be required to supply the electrolysis process with sufficient quality feed water.
	Activity 19 *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;* **Description**: Access roads, stormwater control infrastructure, electrical cabling and water supply pipelines related to the Facility will collectively require the excavation, infilling or removal of soil exceeding 10m^3 from delineated watercourses on site. The exact values will be confirmed once final designs have been provided.
	Activity 24(ii) *The development of a road—* *(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* **Description**: Internal and access roads required by the Facility will be between 5m and 8m wide, and exceed 1km in length in a rural area. Where required for turning circle/bypass areas, however, access or internal roads may be up to 20m to allow for larger component transport. The exact values will be confirmed once final designs have been provided.
	Activity 25 *The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres.*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	Description: Depending on the water source and water quality obtained, an evaporator / crystaliser for the treatment of more than 2 000m^3 effluent at any one time will be constructed and operated as part of the Facility.
	Activity 27 *The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation* **Description**: The power lines, water pipelines and access/internal roads related to the Facility are considered linear activities and therefore is excluded from this activity. However, the respective infrastructure components related to the Facility individually require in excess of 1 ha but not more than 20ha of indigenous vegetation clearance each. The exact values will be confirmed once final designs have been provided.
	Activity 28(ii) *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;* **Description**: The Facility development footprint is collectively approximately 30ha (subject to finalisation based on technical and environmental requirements). As part of this buildable area, infrastructure such as the individual components will have footprints of between 1 ha and 12ha, all located outside an urban area and which is currently used for agriculture.
	Activity 30 *Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).* **Description:** The Facility and associated infrastructure is located within, and will require vegetation clearance or disturbance of Eastern Highveld Grassland and Chrissiesmeer Panveld, both ecosystems of which are listed in the National List of Ecosystems That Are Threated And In Need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
	Activity 48(i)(a)(c) *The expansion of—* *(i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or* *(ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more;* *where such expansion occurs—*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	(a) within a watercourse; *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;* **Description**: Transport of large infrastructure components related to the Facility will require the expansion of existing access and/or internal roads, culverts or similar drainage crossing infrastructure collectively exceeding 100m^2 or more beyond existing road or road reserves located within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site. The exact values will be confirmed once final designs have been provided.
	Activity 56(i)(ii) *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre—* *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres;* **Description**: The Facility is located within a rural area. Transport of large infrastructure components related to the facility will require the widening of existing access and/or internal roads where no reserve exists and where such road is wider than 8 metres. Similarly, access road upgrades required for the Facility's entrance will require widening of a road with existing reserve in excess of 13.5m by ~8m, subject to detailed design.
Listing Notice 2: GNR 984	***Activity 4*** *The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.* **Description**: Dangerous goods product stores related to the operation of the Facility include Nitrogen, Oxygen, Hydrogen and Ammonia storage tanks (of varying sizes, pressures and temperatures) in excess of 500m^3. In addition, fuel, cement, transformer oil and other chemicals will be stored onsite. Collectively all storage and handling of dangerous goods on site will exceed 500m^3.
	Activity 6 *The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent,* *excluding—* *(i) activities which are identified and included in Listing Notice 1 of 2014;* *(ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	(iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or *(iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.* **Description**: The Facility will produce up to 100,000 tons per annum of liquid ammonia and therefore requires licensing in terms of the NEM: AQA (specifically Category 7, subcategory 7.1: “Production and or Use in Manufacturing of Ammonia, Fluorine, Fluorine Compounds, Chlorine, and Hydrogen Cyanide”, with a threshold trigger value of greater than 100 tons per annum). After consultation, the AELA have noted that a provisional AEL is required under the NEM:AQA regulations for this project. Therefore, this activity is considered applicable.
	Activity 7 (ii) *The development and related operation of facilities or infrastructure for the bulk transportation of dangerous goods—* *(i) in gas form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 700 tons per day;* *(ii) in liquid form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 50 cubic metres per day; or* *(iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons per day.* **Description**: Liquid ammonia of up to ~402 m^3 per day will be produced by the Facility, which will be transported within the Facility as a liquid in pipelines exceeding 1000m in length. In addition, up to 800 m^3 per day of liquid hydrogen will be produced by the Facility, which will be transported within the Facility as a liquid in pipelines exceeding 1000m in length. Both Hydrogen and Ammonia are substances listed in SANS10234.
	Activity 15 *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for—* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.* **Description**: The non-linear infrastructure components of the development footprint (buildable area) is approximately 30ha (subject to finalisation based on technical, final design and environmental requirements), within areas containing indigenous vegetation.
Listing Notice 3: GNR 985	***Activity 4(f)(i)(aa)(bb)(cc)(ee)(ff)*** *The development of a road wider than 4 metres with a reserve less than 13,5 metres.* *f. Mpumalanga* *i. Outside urban areas:* *(aa) A protected area identified in terms of NEMPAA, excluding disturbed areas;*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	(bb) National Protected Area Expansion Strategy Focus areas; *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(dd) Sites or areas identified in terms of an international convention;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(ff) Core areas in biosphere reserves; or* *(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas, where such areas comprise indigenous vegetation; or* *ii. Inside urban areas:* *(aa) Areas zoned for use as public open space; or* *(bb) Areas designated for conservation use in Spatial Development Frameworks* *adopted by the competent authority or zoned for a conservation purpose.* **Description**: Internal and access roads required by the Facility will be between 5m and 8m wide, and exceed 1km in length in a rural area. Where required for turning circle/bypass areas, however, access or internal roads may be up to 20m to allow for larger component transport. The exact values will be confirmed once final designs have been provided. In addition, the Facility Infrastructure is located in the Mpumalanga Province outside urban areas, and partly on Portion 1 & 2 of Farm No. 322 (Welgelegen), which are a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities The Facility Infrastructure is therefore currently both located within the extent (aa), and within 5km of the abovementioned private nature reserve (gg). In addition, and on the basis of the DFFE Screening Tool output identifying the study area within the "Protected Areas Expansion Strategy" (Low Priority - Mpumalanga Protected Area Expansion Strategy), the development activity occurs within NPAES focus area thereby triggering this activity (bb). Furthermore, and the development activity contemplated will require vegetation clearance or disturbance of, Eastern Highveld Grassland and Chrissiesmeer Panveld, both ecosystems of which are listed in the National List of Ecosystems That Are Threated And In Need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (cc). Similarly, the development activity contemplated will be located within, and will require vegetation clearance or disturbance within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA) (ee).
	Activity 10(f)(i)(aa)(bb)(cc)(ee)(gg)(hh) *The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.* *f. Mpumalanga* *i. Outside urban areas:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;*

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	(bb) National Protected Area Expansion Strategy Focus areas; *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(dd) Sites or areas identified in terms of an international convention;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(ff) Core areas in biosphere reserves;* *(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, where such areas comprise indigenous vegetation; or* *(hh) Areas within a watercourse or wetland, or within 100 metres of a watercourse or wetland;* **Description**: Dangerous goods product stores related to the operation of the Facility include Nitrogen, Oxygen, Hydrogen and Ammonia storage tanks (of varying sizes, pressures and temperatures) will be in excess of 500m^3. In addition, fuel, cement, transformer oil and other chemicals will be stored onsite. Collectively all storage and handling of dangerous goods on site will exceed 500m3 ,however individual component capacities may be between 30 -– 80m^3 each. The storage contemplated above will all occur within the Mpumalanga Province outside urban areas, and partly on Portion 1 & 2 of Farm No. 322 (Welgelegen), which are a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The storage contemplated is therefore currently both located within the extent (aa), and within 5km of the abovementioned private nature reserve (gg). In addition, and on the basis of the DFFE Screening Tool output identifying the study area within the "Protected Areas Expansion Strategy" (Low Priority - Mpumalanga Protected Area Expansion Strategy), the development activity occurs within NPAES focus area thereby triggering this activity (bb). Furthermore, storage contemplated above will be located within, and will require vegetation clearance or disturbance of, Eastern Highveld Grassland and Chrissiesmeer Panveld, both ecosystems of which are listed in the National List of Ecosystems That Are Threated And In Need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (cc). Similarly, storage contemplated above will be located within, and will require vegetation clearance or disturbance within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA)(ee) as well as being located within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site (hh). The exact footprint will be confirmed once final designs have been provided.
	Activity 12(f)(i)(ii)(iii) *The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *f. Mpumalanga*

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	i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; *ii. Within critical biodiversity areas identified in bioregional plans; or* *iii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning or proclamation in terms of NEMPAA.* **Description**: The clearance required for the Facility will be up to approximately 30ha (subject to finalisation based on technical, final design and environmental requirements) of indigenous vegetation. Such clearance will therefore be in excess of 300m^2 and be partly located within Eastern Highveld Grassland and Chrissiesmeer Panveld, both ecosystems of which are listed in the National List of Ecosystems That Are Threated And In Need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(i). Similarly, vegetation clearance required for the Facility and associated infrastructure will be located within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA), in excess of 300m2(ii). While Furthermore, the Facility and associated infrastructure is located partly on Portion 1 & 2 of Farm No. 322 (Welgelegen), which are a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940)(iii).), It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The exact values will be confirmed once final designs have been provided.
	Activity 14(ii)(a)(c)(f)(i)(aa)(bb)(dd)(ff)(hh) *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or* *(ii) infrastructure or structures with a Physical footprint of 10 Square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *f. Mpumalanga* *i. Outside urban areas:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) World Heritage Sites;* *(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(ee) Sites or areas identified in terms of an international convention;*

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	(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; *(gg) Core areas in biosphere reserves; or* *(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation;* **Description**: The physical footprint of internal and access roads, stormwater control infrastructure, electrical cabling and water supply pipelines related to the Facility will exceed 10m2 within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site. In addition, the Facility and associated infrastructure is located in the Mpumalanga Province outside urban areas, and partly on Portion 1 & 2 of Farm No. 322 (Welgelegen), which are a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The Facility and associated infrastructure is therefore currently both located within the extent (aa), and within 5km of the above mentioned private nature reserve(hh). In addition, and on the basis of the DFFE Screening Tool output identifying the study area within the "Protected Areas Expansion Strategy" (Low Priority - Mpumalanga Protected Area Expansion Strategy), the development activity occurs within NPAES focus area thereby triggering this activity (bb). Furthermore, the physical footprint of internal and access roads, stormwater control infrastructure, electrical cabling and water supply pipelines related to the Facility will exceed 10m2 within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site, which infrastructure will be located within Eastern Highveld Grassland and Chrissiesmeer Panveld, both ecosystems of which are listed in the National List of Ecosystems That Are Threated And In Need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(cc). Finally, the physical footprint of internal and access roads, stormwater control infrastructure, electrical cabling and water supply pipelines related to the Facility will exceed $10m^2$ within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site, located within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA)(dd). The exact footprint will be confirmed once final designs have been provided.
	Activity 15 (d)(ii) *The transformation of land bigger than 1000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, such land was zoned open space, conservation or had an equivalent zoning, on or after 02 August 2010.* *d. Mpumalanga* *i. Inside urban areas; or* *ii. A protected area identified in terms of NEMPAA, excluding conservancies.* **Description**: The Facility is considered a commercial and/or industrial development, and will require the transformation of land bigger than 1000 square metres in size (subject to finalisation based on technical, final design and environmental requirements) within several farm portions outside an

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	urban area, currently zoned for agriculture, while being partly located on Portion 1 & 2 of Farm No. 322 (Welgelegen), which is a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The Facility and associated infrastructure is therefore currently located within the extent (ii) of the above mentioned private nature reserve.
	Activity 18(f)(i)(aa)(bb)(cc)(ee)(gg) *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *f. Mpumalanga* *i. Outside urban areas:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(dd) Sites or areas identified in terms of an international convention;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(ff) Core areas in biosphere reserves; or* *(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation;* **Description**: Transport of large infrastructure components related to the Facility will require the widening of existing access and/or internal roads by more than 4 metres or in excess of 1km within the Mpumalanga Province and outside urban areas. Such widening will be occur partly on Portion 1 & 2 of Farm No. 322 (Welgelegen), which are a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The Facility and related infrastructure is therefore currently both located within the extent(aa), and within 5km of the above mentioned private nature reserve(gg). In addition, and on the basis of the DFFE Screening Tool output identifying the study area within the "Protected Areas Expansion Strategy" (Low Priority - Mpumalanga Protected Area Expansion Strategy), the development activity occurs within NPAES focus area thereby triggering this activity (bb). Furthermore, such widening will occur within Eastern Highveld Grassland and Chrissiesmeer Panveld, both ecosystems of which are listed in the National List of Ecosystems That Are Threated And In Need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(cc). Finally, such widening will be located within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA)(ee).

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	The exact footprint will be confirmed once final designs have been provided..
	Activity 23(ii)(a)(c)(f)(i)(aa)(bb)(cc)(ee)(gg) *The expansion of—* *(i) dams or weirs where the dam or weir is expanded by 10 square metres or more; or* *(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;* *where such expansion occurs —* *(a) within a watercourse;* *(b) in front of a development Setback adopted in the prescribed manner; or* *(c) if no development setback has been adopted,* *within 32 metres of a watercourse, measured* *from the edge of a watercourse;* *f. Mpumalanga* *i. Outside urban areas:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(dd) Sites or areas identified in terms of an international convention;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(ff) Core areas in biosphere reserves;* *(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation;* **Description**: The physical footprint of internal and access roads, stormwater control infrastructure, electrical cabling and water supply pipelines related to the Facility will exceed 10m2 within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site. In addition, the Facility and associated infrastructure is located in the Mpumalanga Province outside urban areas, and partly on Portion 1 & 2 of Farm No. 322 (Welgelegen), which are a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The Facility and associated infrastructure is therefore currently both located within the extent (aa), and within 5km of the above mentioned private nature reserve (gg). In addition, and on the basis of the DFFE Screening Tool output identifying the study area within the "Protected Areas Expansion Strategy" (Low Priority - Mpumalanga Protected Area Expansion Strategy), the development activity occurs within NPAES focus area thereby triggering this activity (bb). Furthermore, the physical footprint of internal and access roads, stormwater control infrastructure, electrical cabling and water supply pipelines related to the Facility will exceed 10m2 within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	on site, which infrastructure will be located within Eastern Highveld Grassland and Chrissiesmeer Panveld, both ecosystems of which are listed in the National List of Ecosystems That Are Threated And In Need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(cc). Finally, the physical footprint of internal and access roads, stormwater control infrastructure, electrical cabling and water supply pipelines related to the Facility will exceed 10m2 within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site, located within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA)(ee). The exact footprint will be confirmed once final designs have been provided
National Environmental Management: Waste Act (59 of 2008) (NEM:WA)	This Act provides for regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation. The Act also provides for the licensing and control of waste management activities through GNR. 921 (2013): List of Waste Management Activities that have, or are likely to have, a detrimental effect on the environment. The water treatment process is associated with the generation of concentrated wastes removed from the water, such as brine salt. Liquid brine can be made into a solid through several available technologies such as, settlement tanks, cooling water circuits, and forced crystallization. Given the proposed brine treatment and Zero Liquid Discharge system, as well as the use of a third-party contractor for the treatment and disposal of the produced salt cake, and the relatively small temporary storage facility envisaged and regular removal (< $80m^3$ at any one point in time), it is understood that no waste activities are triggered for either the treatment or storage of waste. It is however noted that the proponent will be required to comply with the general duties provided for at section 16 of NEM:WA relating to the management of waste as well as the legal requirements relating to the storage of waste as provided for at sections 21 and 22 respectively. The proposed project (Camden I GH&A Facility) does not constitute a Listed Activity requiring a Waste Management Licence (WML) as defined in GNR 921. The contents of this EIAr will include reasonable measures for the prevention of pollution and good international industry practice (GIIP).
National Environmental Management: Air Quality Act (Act 39 of 2004) (NEM:AQA)	Until 2004, South Africa's approach to air pollution control was driven by the Atmospheric Pollution Prevention Act 45 of 1965 (APPA) which was repealed with the promulgation of NEM:AQA . NEM:AQA represents a shift in South Africa's approach to air quality management, from source-based control to integrated effects-based management. The objectives of NEM:AQA are to: — Protect the environment by providing reasonable measures for: — The protection and enhancement of air quality; — The prevention of air pollution and ecological degradation; — Securing ecologically sustainable development while promoting justifiable economic and social development; and — Give effect to everyone's right "to an environment that is not harmful to their health and well-being" Significant functions detailed in NEM:AQA include: — The National Framework for Air Quality Management ; — Institutional planning matters, including: — The establishment of a National Air Quality Advisory Committee; — The appointment of Air Quality Officers (AQOs) at each level of government; and — The development, implementation and reporting of Air Quality Management Plans (AQMP) at national, provincial and municipal levels; — Air quality management measures including:

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	— The declaration of Priority Areas where ambient air quality standards are being, or may be, exceeded; — The listing of activities that result in atmospheric emissions and which have the potential to impact negatively on the environment and the licensing thereof through an Atmospheric Emissions License (AEL); — The declaration of Controlled Emitters; — The declaration of Controlled Fuels; — Procedures to enforce Pollution Prevention Plans or Atmospheric Impact Reporting for the control and inventory of atmospheric pollutants of concern; and — Requirements for addressing dust and offensive odours Ammonia production in excess of 100 tons per annum triggers listed activity Subcategory 7.1: Production and or use in Manufacturing of Ammonia, Fluorine, Fluorine Compounds, Chlorine and Hydrogen Cyanide of Government Notice Regulation 893 of 2013, promulgated in line with Section 21 of the NEM:AQA. As per Section 22 of NEM:AQA, all activities listed by Section 21 require an AEL. The activities for the proposed project therefore will require an AEL application which will be submitted once the EA is received.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) was promulgated in June 2004 within the framework of NEMA to provide for the management and conservation of national biodiversity. The NEMBA's primary aims are for the protection of species and ecosystems that warrant national protection, the sustainable use of indigenous biological resources, the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources. In addition, the NEMBA provides for the establishment and functions of a South African National Biodiversity Institute (SANBI). SANBI was established by the NEMBA with the primary purpose of reporting on the status of the country's biodiversity and conservation status of all listed threatened or protected species and ecosystems. The biodiversity assessment identifies CBAs which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. Based on the preliminary desktop assessment and the terrestrial ecology report, a significant part of the Project Area falls within CBA (Irreplaceable and Optimal) and a large wetland area adjacent and to the north of the Vaal River (near the southern part of the site) is mapped as an Ecological Support Area (ESA). According to the description for the MBSP Terrestrial Assessment categories, CBAs are areas that are required to meet biodiversity targets (for biodiversity pattern and ecological process features). The policy is that they should remain in a natural state. CBAs are areas of high biodiversity value which are usually at risk of being lost and usually identified as important in meeting biodiversity targets, except for Critically Endangered Ecosystems or Critical Linkages. CBAs in the Province can be divided into two sub-categories: — <u>Irreplaceable</u> (parts of the site are within this sub-category), and — <u>Optimal</u> (northern parts of the site are within this sub-category). Supplementary baseline terrestrial ecology studies will be undertaken during the EIA phase to inform the assessment of impacts and will include flora surveys of the project footprint to determine the presence of flora species of concern (SoC), and bird surveys of the area to define the potential risks to bird SoC. The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) Regulations with regards to alien and invasive species have been superseded by the National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004) – Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014. Specific management measures for the control of alien and invasive plants will be included in the Environmental Management Programme (EMPr).

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
National Environmental Management Protected Areas Act (No. 57 of 2003)	The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) was promulgated in June 2004 within the framework of NEMA to provide for the management and conservation of national biodiversity. The NEMBA's primary aims are for the protection of species and ecosystems that warrant national protection, the sustainable use of indigenous biological resources, the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources. In addition, the NEMBA provides for the establishment and functions of a South African National Biodiversity Institute (SANBI). SANBI was established by the NEMBA with the primary purpose of reporting on the status of the country's biodiversity and conservation status of all listed threatened or protected species and ecosystems. The biodiversity assessment identifies CBAs which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. Based on the preliminary desktop assessment and the terrestrial ecology report, a significant part of the Project Area falls within CBA (Irreplaceable and Optimal) and a large wetland area adjacent and to the north of the Vaal River (near the southern part of the site) is mapped as an Ecological Support Area (ESA). According to the description for the MBSP Terrestrial Assessment categories, CBAs are areas that are required to meet biodiversity targets (for biodiversity pattern and ecological process features). The management approach is that they should remain in a natural state. CBAs are areas of high biodiversity value which are usually at risk of being lost and usually identified as important in meeting biodiversity targets, except for Critically Endangered Ecosystems or Critical Linkages. CBAs in the Province can be divided into two sub-categories: — Irreplaceable (parts of the site are within this sub-category), and — Optimal (northern parts of the site are within this sub-category). Supplementary baseline terrestrial ecology studies will be undertaken during the EIA phase to inform the assessment of impacts and will include flora surveys of the project footprint to determine the presence of flora species of concern (SoC), and bird surveys of the area to define the potential risks to bird SoC. The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) Regulations with regards to alien and invasive species have been superseded by the National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004) – Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014. Specific management measures for the control of alien and invasive plants have been included in the Environmental Management Programme (EMPr).
The National Water Act (No. 36 Of 1998)	The National Water Act, 1998 (Act No. 36 of 1998) (NWA) provides the framework to protect water resources against over exploitation and to ensure that there is water for social and economic development, human needs and to meet the needs of the aquatic environment. The Act defines water source to include watercourses, surface water, estuary or aquifer. A watercourse is defined in the Act as a river or spring, a natural channel in which water flows regularly or intermittently, a wetland, lake or dam into which or from which water flows, and any collection of water that the Minister may declare a watercourse. Section 21 of the Act outlines a number of categories that require a water user to apply for a Water Use License (WUL) and Section 22 requires water users to apply for a General Authorisation (GA) with the Department of Water and Sanitation (DWS) if they are under certain thresholds or meet certain criteria. The list of water uses applicable to the proposed Project include: *a) Taking water from a water resource;* *c) Impeding or diverting the flow of water in a watercourse;* *g) Disposing of waste in a manner which may detrimentally impact on a water resource;*

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	i) Altering the bed, banks, course or characteristics of a watercourse; The DWS will make the final decision on water uses that are applicable to the project through a pre-application meeting after which a Water Use Authorisation Application (WUA) as determined by the risk assessment will be undertaken in compliance with procedural regulations published by the DWS within General Notice 267 (GN267). These regulations specify required information per water use and the reporting structure of required supporting technical information.
The National Heritage Resources Act (No. 25 Of 1999)	The National Heritage Resource Act (Act No. 25 of 1999) (NHRA) serves to protect national and provincial heritage resources across South Africa. The NHRA provides for the protection of all archaeological and palaeontological sites, the conservation and care of cemeteries and graves by the South African Heritage Resources Agency (SAHRA), and lists activities that require any person who intends to undertake to notify the responsible heritage resources agency and furnish details regarding the location, nature, and extent of the proposed development. Part 2 of the NHRA details specific activities that require a Heritage Impact Assessment (HIA) that will need to be approved by SAHRA. Parts of Section 35, 36 and 38 apply to the proposed project, principally: — Section 35 (4) - No person may, without a permit issued by the responsible heritage resources authority- — destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite; — destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite. — Section 38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as- — any development or other activity which will change the character of a site— (i) exceeding 5 000 m^2 in extent, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development. In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the proposed Camden I GH&A Facility, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668). A Heritage Impact assessment Report (**Appendix D**) has been carried out by a suitably qualified specialist, revealing: — no Stone Age or Iron Age archaeological sites are on record within the immediate study area but this could be due to a lack of focused research in the area. — no grave sites are indicated on archival maps or the genealogical society database within the impact areas, but burial sites can occur across the landscape and can be expected. — The study area is of low to moderate to high paleontological sensitivity and according to the South African Heritage Resources Information System (SAHRIS) palaeontological sensitivity map must be subjected to a palaeontological assessment in the impact assessment phase. — the study area forms part of a landscape characterised by wide scale cultivation and industrial facilities like power plants and mines. — the project area has been cultivated from prior to 1968 as indicated on historical maps and has remained under cultivation until present these activities would have impacted on surface indicators of heritage sites if any were ever present in the area. The proposed project will be loaded onto the SAHRIS portal for comment by SAHRA

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
Mineral and Petroleum Resources Development Act (No. 28 of 2002)	The aim of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) is to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources. Section 53(1) of the MPRDA provides that any person who intends to use the surface of any land in any way that may be contrary to any object of the MPRDA, or which is likely to impede any such object, must apply to the Minister of Mineral Resources (the Minister) for approval. Section 53 of the MPRDA provides a mechanism for ensuring that, inter alia, the mining of mineral resources is not detrimentally affected through the use of the surface of land and which may, for example, result in the sterilisation of a mineral resource. A Section 53 approval will be required due to the fact that the project is located on various mining right areas. The Amendment Regulations (GNR 420 of 27 March 2020) introduced a template for section 53 applications (Form Z) and the specific information that applicants will need to provide as part of a section 53 application.
Noise Control Regulations in terms of the Environmental Conservation, 1989 (Act 73 of 1989)	In South Africa, environmental noise control has been in place for three decades, beginning in the 1980s with codes of practice issued by the South African National Standards (formerly the South African Bureau of Standards, SABS) to address noise pollution in various sectors of the country. Under the previous generation of environmental legislation, specifically the Environmental Conservation Act 73 of 1989 (ECA), provisions were made to control noise from a National level in the form of the Noise Control Regulations (GNR 154 of January 1992). In later years, the ECA was replaced by the National Environmental Management Act 107 of 1998 (NEMA) as amended. The National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA) was published in line with NEMA and contains noise control provisions under Section 34: *(1) The minister may prescribe essential national standards –* *(a) for the control of noise, either in general or by specific machinery or activities or in specified places or areas; or* *(b) for determining –* *(i) a definition of noise; and* *(ii) the maximum levels of noise.* *(2) When controlling noise, the provincial and local spheres of government are bound by any prescribed national standards.* Under NEMAQA, the Noise Control Regulations were updated and are to be applied to all provinces in South Africa. The Noise Control Regulations give all the responsibilities of enforcement to the Local Provincial Authority, where location specific by-laws can be created and applied to the locations with approval of Provincial Government. Where province-specific regulations have not been promulgated, acoustic impact assessments must follow the Noise Control Regulations. Furthermore, NEMAQA prescribes that the Minister must publish maximum allowable noise levels for different districts and national noise standards. These have not yet been accomplished and as a result all monitoring and assessments are done in accordance with the South African National Standards (SANS) 10103:2008 and 10328:2008.
Conservation of Agricultural Resources Act (No. 43 of 1983)	The Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) provides for the implementation of control measures for soil conservation works as well as alien and invasive plant species in and outside of urban areas. In terms of the amendments to the regulations under the CARA, landowners are legally responsible for the control of alien species on their properties. Various Acts administered by the DFFE and the DWS, as well as other laws (including local by-laws), spell out the fines, terms of imprisonment and other penalties for contravening the law. Although no fines have yet been placed against landowners who do not remove invasive species, the authorities may clear their land of invasive alien plants and other alien species entirely at the landowners' cost and risk.

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	The CARA Regulations with regards to alien and invasive species have been superseded by NEMBA Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014.
Civil Aviation Act (No. 13 of 2009)	Civil aviation in South Africa is governed by the Civil Aviation Act (Act 13 of 2009). This Act provides for the establishment of a stand-alone authority mandated with controlling, promoting, regulating, supporting, developing, enforcing and continuously improving levels of safety and security throughout the civil aviation industry. This mandate is fulfilled by South African Civil Aviation Authority (SACAA) as an agency of the Department of Transport (DoT). SACAA achieves the objectives set out in the Act by complying with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organisation (ICAO), while considering the local context when issuing the South African Civil Aviation Regulations (SA CARs). The DEA Screening Tool Report identified Civil Aviation as having low sensitivity for the proposed Camden I GH&A Facility, and as being located between 8 and 15km of other civil aviation aerodrome. SACAA and ATNS have been included on the project stakeholder database. They will be informed of the proposed Project, and comment will be sought from these authorities as applicable.
Occupational Health and Safety Act (No. 85 of 1993)	The National Occupational Health and Safety Act (No. 85 of 1993) (OHSA) and the relevant regulations under the Act are applicable to the proposed project. This includes the Construction Regulations promulgated in 2014 under Section 43 of the Act. Adherence to South Africa's OHSA and its relevant Regulations is essential. The ammonia and hydrogen facilities as well as oxygen facilities will likely be Major Hazard Installations (MHI) and will require a fill quantitative risk assessment (QRA) and emergency response plan (ERP). Under the current MHI Regulations notification of various authorities and the public is required. Should the proposed new MHI Regulations be promulgated prior to commencement of construction of this facility it is possible that in addition to a QRA and ERP, the hydrogen, ammonia and oxygen facilities will necessitate an application for a Licence to Operate from the Department of Employment and Labour. There will likely be a requirement for implementation of a Process Safety Management Systems and submission of a Safety Report providing evidence of the effectiveness of this management system.

2.2 POLICIES AND PLANS

Table 2-2 summarised key policies and plans as an outline of the governance framework for the project.

Table 2-2: Applicable Regional Policies and Plans

APPLICABLE POLICY	DESCRIPTION OF POLICY
National Development Plan	The National Development Plan aims to eliminate poverty and reduce inequality by 2030. The NDP identifies a number of enabling milestones. Of relevance to the proposed development the NDP refers to the need to produce sufficient energy to support industry at competitive prices and ensure access for poor households, while reducing carbon emissions per unit of power by about one-third. In this regard the infrastructure is not just essential for faster economic growth and higher employment. It also promotes inclusive growth, providing citizens with the means to improve their own lives and boost their incomes. Infrastructure is essential to development. Chapter 3, Economy and Employment, identifies some of the structural challenges specific to South Africa, including an energy constraint that will act as a cap on growth and on options for industrialisation. The NDP notes that from an environmental perspective South

APPLICABLE POLICY	DESCRIPTION OF POLICY
	Africa faces several related challenges. The reduction of greenhouse gas emissions and shift to a green low-carbon economy, is one of these challenges. In terms of implementation the NDP identifies three phases. The first two are of specific relevance to the proposed project. The first phase (2012–2017) notes that ensuring the supply of energy and water is reliable and sufficient for a growing economy. The second phase (2018–2023) involves building on the first phase to lay the foundations for more intensive improvements in productivity. The provision of affordable and reliable energy is a key requirement for this to take place. Chapter 4, Economic infrastructure, notes that economic infrastructure provides the foundation for social and economic development. In this regard South Africa must invest in a strong network of economic infrastructure designed to support the country's medium- and long-term economic and social objectives. The plan envisages that, by 2030, South Africa will have an energy sector that promotes: — Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. — Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change. More specifically, South Africa should have adequate supply security in electricity and in liquid fuels, such that economic activity, transport, and welfare are not disrupted. The plan sets out steps that aim to ensure that, in 20 years, South Africa's energy system looks very different to the current situation. In this regard coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources, will play a much larger role.
Integrated Resource Plan 2010 – 2030	The IRP is an electricity capacity plan which aims to provide an indication of the country's electricity demand, how this demand will be supplied and what it will cost. On 6 May 2011, the then Department of Energy (DoE) released the Integrated Resource Plan 2010-2030 (IRP 2010) in respect of South Africa's forecast energy demand for the 20-year period from 2010 to 2030. The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development. The IRP recognises that the green hydrogen economy presents an opportunity to diversify the electricity mix and to utilise renewable electricity to further boost the economy in terms of clean hydrogen and ammonia production . Renewable technologies also present huge potential for the creation of new industries, job creation and localisation across the value chain.
New Growth Path	Government released the New Economic Growth Path Framework on 23 November 2010. The aim of the framework is to enhance growth, employment creation and equity. The policy's principal target is to create five million jobs over the next 10 years and reflects government's commitment to prioritising employment creation in all economic policies. The framework identifies strategies that will enable South Africa to grow in a more equitable and inclusive manner while attaining South Africa's developmental agenda. Central to the New Growth Path is a massive investment in infrastructure as a critical driver of jobs across the economy. In this regard the framework identifies investments in five key areas namely: energy, transport, communication, water, and housing.
National Infrastructure Plan	The South African Government adopted a National Infrastructure Plan (NIP) in 2012. The NIP aims to transform the South African economic landscape while simultaneously creating significant numbers of new jobs and strengthening the delivery of basic services. It outlines the challenges and enablers which needs to be addressed in the building and developing of infrastructure. The Presidential Infrastructure Coordinating Commission (PICC) was established by the Cabinet to integrate and coordinate the long-term infrastructure build. The plan also supports the integration of African economies. In terms of the plan Government will invest R827 billion over the next three years to build new and upgrade

APPLICABLE POLICY	DESCRIPTION OF POLICY
	existing infrastructure. The aim of the investments is to improve access by South Africans to healthcare facilities, schools, water, sanitation, housing and electrification. The plan also notes that investment in the construction of ports, roads, railway systems, ***electricity plants***, hospitals, schools and dams will contribute to improved economic growth.
Integrated Energy Plan	The development of a National IEP was envisaged in the White Paper on the Energy Policy of the Republic of South Africa of 1998 and, in terms of the National Energy Act, 2008 (Act No. 34 of 2008), the Minister of Energy is mandated to develop and, on an annual basis, review and publish the IEP in the Government Gazette. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. The IEP notes that South Africa needs to grow its energy supply to support economic expansion and in so doing, alleviate supply bottlenecks and supply-demand deficits. In addition, it is essential that all citizens are provided with clean and modern forms of energy at an affordable price. As part of the Integrated Energy Planning process, eight key objectives are identified, namely: — Objective 1: Ensure security of supply. — Objective 2: Minimise the cost of energy. — Objective 3: Promote the creation of jobs and localisation. — Objective 4: Minimise negative environmental impacts from the energy sector. — Objective 5: Promote the conservation of water. — Objective 6: Diversify supply sources and primary sources of energy. — Objective 7: Promote energy efficiency in the economy. — Objective 8: Increase access to modern energy. The IEP provides an assessment of current energy consumption trends within different sectors of the economy (i.e., agriculture, commerce, industry, residential and transport) and uses this information to identify future energy requirements, based on different scenarios. The scenarios are informed by different assumptions on economic development and the structure of the economy and also take into account the impact of key policies such as environmental policies, energy efficiency policies, transport policies and industrial policies, amongst others. Based on this information the IEP then determines the optimal mix of energy sources and technologies to meet those energy needs in the most cost-effective manner for each of the scenarios. The associated environmental impacts, socio-economic benefits and macroeconomic impacts are also analysed. The IEP is therefore focused on determining the long-term energy pathway for South Africa, taking into account a multitude of factors which are embedded in the eight objectives. As part of the analysis four key scenarios were developed, namely the Base Case, Environmental Awareness, Resource Constrained and Green Shoots scenarios: — The Base Case Scenario assumes that existing policies are implemented and will continue to shape the energy sector landscape going forward. It assumes moderate economic growth in the medium to long term. — The Environmental Awareness Scenario is characterised by more stringent emission limits and a more environmentally aware society, where a higher cost is placed on externalities caused by the supply of energy. — The Resource Constrained Scenario in which global energy commodity prices (i.e. coal, crude oil and natural gas) are high due to limited supply. — The Green Shoots Scenario describes an economy in which the targets for high economic growth and structural changes to the economy, as set out in the National Development Plan (NDP), are met. The IEP notes that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources. In terms of existing electricity generation capacity, the IEP indicates that existing capacity starts to decline notably from 2025, with significant plant retirement occurring in 2031, 2041 and 2048. By 2050 only

APPLICABLE POLICY	DESCRIPTION OF POLICY
	20% of the current electricity generation capacity remains. As a result, large investments are required in the electricity sector in order to maintain an adequate supply in support of economic growth. By 2020, various import options become available, and some new coal capacity is added along with new wind, solar and gas capacity. The mix of generation capacity technologies by 2050 is considerably more diverse than the current energy mix, across all scenarios. The main differentiating factors between the scenarios are the level of demand, constraints on emission limits and the carbon dioxide externality costs. In all scenarios the energy mix for electricity generation becomes more diverse over the period to 2050, with coal reducing its share from about 85% in 2015 to 15–20% in 2050 (depending on the scenario). Solar, wind, nuclear, gas and electricity imports increase their share. The Environmental Awareness and Green Shoots scenarios take on higher levels of renewable energy. An assessment of each scenario against the eight objectives with reference to renewable energy notes while all scenarios seek to ensure that costs are minimised within the constraints and parameters of each scenario, the Base Case Scenario presents the least cost followed by the Environmental Awareness, Resource Constrained and Green Shoots scenarios respectively when total energy system costs are considered. In terms of promoting job creation and localisation potential the Base Case Scenario presents the greatest job creation potential, followed by the Resource Constrained, Environmental Awareness and Green Shoots scenarios respectively. In all scenarios, approximately 85% of total jobs are localisable. For electricity generation, most jobs result from solar technologies followed by nuclear and wind, with natural gas and coal making a smaller contribution. The Environmental Awareness Scenario, due to its stringent emission constraints, shows the lowest level of total emissions over the planning horizon. This is followed by the Green Shoots, Resource Constrained and Base Case scenarios. These trends are similar when emissions are considered cumulatively and individually by type.
National Protected Area Expansion Strategy, 2010	The National Protected Area Expansion Strategy 2010 (NPAES) areas were identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine scale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities (NPAES, 2010). According to the NPAES, there are no areas within the study area that have been identified as priority areas for inclusion in future protected areas. The study area is therefore **outside the NPAES focus area**.

2.3 PROVINCIAL AND MUNICIPAL LEGAL AND REGULATORY FRAMEWORK

Table 2-3: Provincial Plans

APPLICABLE PLAN	DESCRIPTION OF PLAN
Mpumalanga Growth and Development Path	The primary objective of the Mpumalanga Economic Growth and Development Path (MEGDP) (2011) is to foster economic growth that creates jobs, reduce poverty and inequality in the Province. The MEGDP identifies supporting the development of clean forms of energy such as wind and hydro power generation opportunities, as well as opportunities including gas production from landfill and organic waste, as one of the key interventions to facilitate growth and job creation in the manufacturing sector. A focal point of the MEGDP is massive investments in infrastructure as a key driver of job creation

APPLICABLE PLAN	DESCRIPTION OF PLAN
	across the economy, with alternative energy production identified as one of the key opportunities in the Mpumalanga Economic sectors.
Mpumalanga Spatial Development Framework (MSDF), 2019	The Mpumalanga Spatial Development Framework (SDF) (2019) identifies that tourism is an important economic sector and has emerged as a robust driver of growth for emerging economies. The SDF also notes that a significant portion of Mpumalanga's land area is classified as Moderate to High-Very High agricultural potential which can be utilised for agricultural production. However, there are other factors affecting the agricultural sector including loss of agricultural land to other activities, availability of water, contamination of the water used for irrigation by other economic activities, and access to the market. The SDF further notes that mining is the largest economic sector in the province and has assisted other sectors such as manufacturing and power generation, to grow in the province. However, the mining sector has posed some key challenges, including soil and water contamination and environmental pollution, development of mines on good agricultural soil thus threatening food security, restriction of animal movement due to open cast mining thus affecting the ecosystem etc. It also notes that Mpumalanga's manufacturing plants and coal fired power plants are the key polluters of air, with climate change also identified as a key challenge in the province. Therefore, the province must carefully design interventions that provide a gradual shift from mining oriented sectors to the sustainable economic sectors to maintain sustained growth of the provincial economy. The SDF notes that a significant amount of the country's electricity comes from coal-fired stations in Mpumalanga. It also observes that there is a steady increase in the demand for electricity in the province, mostly attributed to residential, commercial and industrial development, including mining and heavy industry. The Provincial SDF also notes that the abundance of coal has led to the development of many coal-fired power stations in the province, however these coalfields are depleting, therefore making it necessary to consider renewable power sources in Mpumalanga. The SDF also recognises that Mpumalanga's Coal Mining and Coal Fired Power Plant region (mainly the Highveld area) will be under immense pressure for environmental considerations and as a result, the region will witness a possible decline in demand of coal and large-scale employment. The SDF proposes to diversify the regional economy and facilitate the gradual transition of economic activities in the region. The green economy aims to further contribute to this plan via job creation, skills development and energy production diversification on all projects. According to the SDF, power stations using renewable sources (such as wind and solar) can be developed on the unused fallow lands.
Mpumalanga Industrial Development Plan	In terms of industry, the purpose of the Mpumalanga Industrial Development Plan (MIDP) (2015) is to promote the establishment of new industries and promote growth of existing industries in the province. It is however noted that the Msukaligwa Municipality (within which the project falls under) is not directly impacted by the 2025 MIDP and its proposed priority hubs.
Mpumalanga Conservation Act (No. 10 of 1998)	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: — Various species are protected; — The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species. The Act provides lists of protected species for the Province. According to the Mpumalanga Nature Conservation Act, a permit is required for the removal of any species on this list.

Table 2-4: District and Local Municipality Plans

APPLICABLE PLAN	DESCRIPTION OF PLAN
Gert Sibande Municipality Integrated Development Plan	According to the Municipal Systems Act (Act 32 of 2000) (MSA), all municipalities have to undertake an Integrated Development Plan (IDP) process. The IDP is a legislative requirement thus it has legal status and supersedes all other plans that guide development at local government level. The Gert Sibande Municipality (GSM) IDP Review(2019/ 2020) and Final IDP (2020/2021) has identified the following development priorities: — Municipal Transformation and Organisational Development — Basic Service Delivery and Infrastructure Development — Local Economic Development — Municipal Financial Viability and Management — Good Governance and Public Participation — Spatial Development Analysis and Rationale The main goal and strategic objective of the Basic Service Delivery and Infrastructure Development priority is a reliable and sustainable service. One of the main strategic objectives for reaching the goal is the provision of basic services such as water and electricity to an approved minimum level of standards in a sustainable manner; as per the national guidelines.
Msukaligwa Local Municipality IDP	The Msukaligwa Local Municipality Revised IDP (2020/2021) has identified the following key Municipal priorities: — Revenue collection. — Access to basic services by communities. — Job creation and economic development. — Infrastructure maintenance and upgrading. — Community participation in the affairs of the municipality. — Fight against fraud and corruption. — Capable and responsive organizational structure. — Capabilities of the municipal ICT. — Integrated human settlements One of the main strategic objectives for the access to basic services priority is to provide sustainable and reliable services to communities. Most of the basic services are rendered within the municipality, however some rural areas are still faced with some challenges in the provision water, sanitation and electricity. The Municipality, through the IDP, aims to facilitate the provision of electricity, with a number of key projects planned to be implemented over the period of five years linked to the Municipal IDP.
Msukaligwa Spatial Development Framework	The Msukaligwa SDF is informed by a number of spatial objectives, including: — Providing a spatial structure that facilitates access to services for all communities. — Protecting strategic water sources and sensitive eco-systems. — Providing space for the diversification of the local economy. — Eliminating past spatial settlement patterns. The provision of space of the diversification of the local economy is of specific relevance to the proposed development. The SDF highlights the key role and spatial extent of mining in the Msukaligwa Municipality, including reference to the Camden coal-fired power station located in proximity to the proposed development. Over the longer term the rehabilitation of mining areas and a range of alternative peri-urban uses should be considered for the impacted areas in view of the decrease reliance on coal. Commercial Agriculture also represents a key economic activity in the Municipality.

2.4 INTERNATIONAL ENVIRONMENTAL AND SOCIAL STANDARDS

2.4.1 IFC PERFORMANCE STANDARDS

The International Finance Corporation (IFC) is an international financial institution that offers investment, advisory, and asset management services to encourage private sector development in developing countries. The IFC is a member of the World Bank Group (WBG) and is headquartered in Washington, D.C., United States. It was established in 1956 as the private sector arm of the WBG to advance economic development by investing in strictly for-profit and commercial projects that purport to reduce poverty and promote development.

The IFC's stated aim is to create opportunities for people to escape poverty and achieve better living standards by mobilizing financial resources for private enterprise, promoting accessible and competitive markets, supporting businesses and other private sector entities, and creating jobs and delivering necessary services to those who are poverty-stricken or otherwise vulnerable. Since 2009, the IFC has focused on a set of development goals that its projects are expected to target. Its goals are to increase sustainable agriculture opportunities, improve health and education, increase access to financing for microfinance and business clients, advance infrastructure, help small businesses grow revenues, and invest in climate health.

The IFC is owned and governed by its member countries but has its own executive leadership and staff that conduct its normal business operations. It is a corporation whose shareholders are member governments that provide paid-in capital and which have the right to vote on its matters. Originally more financially integrated with the WBG, the IFC was established separately and eventually became authorized to operate as a financially autonomous entity and make independent investment decisions. It offers an array of debt and equity financing services and helps companies face their risk exposures, while refraining from participating in a management capacity. The corporation also offers advice to companies on making decisions, evaluating their impact on the environment and society, and being responsible. It advises governments on building infrastructure and partnerships to further support private sector development.

The IFC's Sustainability Framework articulates the Corporation's strategic commitment to sustainable development and is an integral part of IFC's approach to risk management. The Sustainability Framework comprises IFC's Policy and Performance Standards on Environmental and Social Sustainability, and IFC's Access to Information Policy. The Policy on Environmental and Social Sustainability describes IFC's commitments, roles, and responsibilities related to environmental and social sustainability. IFC's Access to Information Policy reflects IFC's commitment to transparency and good governance on its operations and outlines the Corporation's institutional disclosure obligations regarding its investment and advisory services. The Performance Standards (PSs) are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires its clients to apply the PSs to manage environmental and social risks and impacts so that development opportunities are enhanced. IFC uses the Sustainability Framework along with other strategies, policies, and initiatives to direct the business activities of the Corporation to achieve its overall development objectives. The PSs may also be applied by other financial institutions (FIs).

The Project is considered a Category B project in terms of the IFC Policy on E&S Sustainability (2012), having the potential to cause limited adverse environmental or social risks and/or impacts that are few in number, generally site specific, largely reversible, and readily addressed through mitigation measures.

The objectives and applicability of the eight PSs are outlined in **Table 2-5**.

Table 2-5: IFC Performance Standards Applicability to the Project

REFERENCE	REQUIREMENTS		PROJECT SPECIFIC APPLICABILITY
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts			
Overview	Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders.		
Objectives	— To identify and evaluate environmental and social risks and impacts of the project. — To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. — To promote improved environmental and social performance of clients through the effective use of management systems. — To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. — To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.		
Aspects	1.1	Policy	The IFC Standards state under PS 1 (Guidance Note 23) that "*the breadth, depth and type of analysis included in an ESIA must be proportionate to the nature and scale of the proposed project's potential impacts as identified during the course of the assessment process*." This document is the final EIR deliverable from the Scoping and EIA process undertaken for the proposed Project. The impact assessment comprehensively assesses the key environmental and social impacts and complies with the requirements of the South African EIA Regulations. In addition, an EMPr (**Appendix I**) has been compiled during the EIA phase of the project. A formal project specific ESMS will be compiled in the event that the project is developed in the future. Management and monitoring plans outlines in the EMPr will serve as the basis for an ESMS for the proposed Project.
	1.2	Identification of Risks and Impacts	
	1.3	Management Programmes	
	1.4	Organisational Capacity and Competency	
	1.5	Emergency Preparedness and Response	
	1.6	Monitoring and Review	
	1.7	Stakeholder Engagement	
	1.8	External Communication and Grievance Mechanism	
	1.9	Ongoing Reporting to Affected Communities	
Performance Standard 2: Labour and Working Conditions;			
Overview	Performance Standard 2 recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers.		
Objectives	— To promote the fair treatment, non-discrimination, and equal opportunity of workers. — To establish, maintain, and improve the worker-management relationship. — To promote compliance with national employment and labour laws. — To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. — To promote safe and healthy working conditions, and the health of workers. — To avoid the use of forced labour.		

REFERENCE	REQUIREMENTS		PROJECT SPECIFIC APPLICABILITY
Aspects	2.1	— Working Conditions and Management of Worker Relationship — Human Resources Policy and Management — Working Conditions and terms of Engagement — Workers organisation — Non- Discrimination and Equal Opportunity — Retrenchment — Grievance Mechanism	The construction activities will require contractors for completion. A safe working environment and fair contractual agreements must be in place. The operational phase will have permanent employees for day-to-day activities as well as contractors who will all need a safe working environment and fair contractual agreements. Whilst PS2 will be applicable to the Project, it is not intended to be addressed in detail at this stage. Recommendations are provided concerning development of a detailed Human Resources (HR) and Occupational Health and Safety (OHS) system by the developer and its partners as the Project moves towards implementation. In addition, measures to address the Interim Advice for IFC Clients on Supporting Workers in the Context of COVID-19 are referenced. The EMPr (**Appendix I)** has incorporated the requirements for compliance with local and international Labour and Working legislation and good practice on the part of the contractors.
	2.2	— Protecting the Workforce — Child Labour — Forced Labour	
	2.3	Occupational health and Safety	
	2.4	Workers Engaged by Third Parties	
	2.5	Supply Chain	
Performance Standard 3: Resource Efficiency and Pollution Prevention			
Overview	Performance Standard 3 recognises that increased economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. There is also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. At the same time, more efficient and effective resource use and pollution prevention and GHG emission avoidance and mitigation technologies and practices have become more accessible and achievable in virtually all parts of the world.		
Objectives	— To avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities. — To promote more sustainable use of resources, including energy and water. — To reduce project related GHG emissions.		
Aspects	3.1	— Policy Resource Efficiency — Greenhouse Gases — Water Consumption	PS3-related impacts, such as the management of construction waste, hazardous substances, and stormwater are assessed in **Section 8** of this report. There are no material resource efficiency issues associated with the Project. The EMPr includes general resource efficiency measures. The project is not GHG emissions intensive and a climate resilience study or a GHG emissions-related assessment is not deemed necessary for a project of this nature. However, the Camden I GH&A Facility seeks to facilitate resource efficiency and pollution prevention by contributing to the South African green economy. Dust air pollution in the construction phase has been addressed in the **Section 6** of the EMPr (**Appendix I**). The Project will not result in the release of industrial effluents. Potential pollution associated with sanitary wastewater is low and mitigation measures have been included in **Section 6** the EMPr (**Appendix I**).
	3.2	— Pollution Prevention — Air Emissions — Stormwater — Waste Management — Hazardous Materials Management — Pesticide use and Management	

REFERENCE		REQUIREMENTS	PROJECT SPECIFIC APPLICABILITY
			Land contamination of the site from historical land use (i.e. low intensity agricultural / grazing) is not considered to be a cause for concern. The waste generation profile of the project is not complex. Waste mitigation and management measures have been included in **Section 7.1** of the EMPr (**Appendix I**). The ammonia and hydrogen facilities as well as oxygen facilities will likely be Major Hazard Installations and will require a full quantitative risk assessment (QRA) that complies with SANS 1461: MHI QRA as well as an emergency response plan (ERP) that complies with SANS 1514: MHI Emergency Response Planning. Under the current MHI Regulations notification of various authorities and the public is required. The EMPr (**Appendix I**) has taken this into account and recommend relevant mitigation and management measures in **Section 6** of the EMPr.
Performance Standard 4: Community Health, Safety, and Security			
Overview	Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts.		
Objectives	— To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. — To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.		
Aspects	4.1	— Community Health and Safety — Infrastructure and Equipment Design and Safety — Hazardous Materials Management and Safety — Ecosystem Services — Community Exposure to Disease — Emergency Preparedness and Response	The requirements included in PS 4 has been addressed in this S&EIA process and the development of the EMPr. During the construction phase there will be an increase in vehicular traffic along public roads, largely due to the need for importation of construction material. Pedestrian and road safety risks have been qualitatively evaluated in this S&EIA process and the clients' standard safety and security measures, as well as potential additional measures recommended by WSP, is detailed in **Section 6** of the EMPr (**Appendix I**).
	4.2	Security Personnel	
Performance Standard 5: Land Acquisition and Involuntary Resettlement			
Overview	Performance Standard 5 recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use.		
Objectives	— To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs. — To avoid forced eviction. — To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. — To improve, or restore, the livelihoods and standards of living of displaced persons.		

	— To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.		
Aspects	5.1	— Displacement — Physical Displacement — Economic Displacement — Private Sector Responsibilities under Government Managed Resettlement	PS5 is not applicable to the proposed Camden I GH&A Facility as no physical or economic displacement or livelihood restoration will be required. The proposed Camden I GH&A Facility is located on privately owned land that is utilised for agriculture by the landowners. The impact of the proposed development on the agricultural production capability of the site has been assessed by the Agriculture Specialist as being acceptable
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources			
Overview	Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.		
Objectives	— To protect and conserve biodiversity. — To maintain the benefits from ecosystem services. — To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.		
Aspects	6.1	Protection and Conservation of Biodiversity	The Project Area falls within CBAs (Irreplaceable and Optimal) and a large wetland area adjacent and to the north of the Vaal River (near the southern part of the site) is mapped as an ESA. A Biodiversity Impact Assessment (**Appendix H-3**) as well as an Avifaunal Impact Assessment (**Appendix H-2**) and Freshwater Ecology Impact Assessment (**Appendix H-4**) have been included in the proposed scope. The methodologies for the specialist assessments include a combination of literature review, in-field surveys and sensitivity mapping. This substantively complies with the PS 6 general requirements for baseline and impact assessment for determination of biodiversity and ecosystem services issues. The determination of habitat sensitivity was undertaken within the legal and best practice reference framework for South Africa. The prevalence of invasive alien species has been determined, and mitigation and management measures have been included in **Section 7.2** of the EMPr (**Appendix I**).
Performance Standard 7: Indigenous People			
Overview	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded.		
Objectives	— To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. — To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. — To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. — To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle.		

REFERENCE	REQUIREMENTS		PROJECT SPECIFIC APPLICABILITY
	— To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. — To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.		
Aspects	7.1	General — Avoidance of Adverse Impacts — Participation and Consent	As per the international instruments under the United Nations (UN) Human Rights Conventions, no indigenous peoples are present within the study area. The Project does not involve displacement. PS7 will not be triggered.
	7.2	Circumstances Requiring Free, Prior, and Informed Consent — Impacts on Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use — Critical Cultural Heritage — Relocation of Indigenous Peoples from Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use	
	7.3	Mitigation and Development Benefits	
	7.4	Private Sector Responsibilities Where Government is Responsible for Managing Indigenous Peoples Issues	
Performance Standard 8: Cultural Heritage			
Overview	Performance Standard 8 recognizes the importance of cultural heritage for current and future generations.		
Objectives	— To protect cultural heritage from the adverse impacts of project activities and support its preservation. — To promote the equitable sharing of benefits from the use of cultural heritage.		
Aspects	8.1	Protection of Cultural Heritage in Project Design and Execution	A Heritage impact assessment Report (**Appendix H-6**) has been carried out by a suitably qualified specialist, revealing that archaeological sites (Stone Age and Historic Archaeological), cultural heritage sites, burial grounds or isolated artifacts are unlikely to be present on the affected landscape. A Chance Find Procedure is included in **Section 7.14.1** of the EMPr (**Appendix I**)

2.4.2 WORLD BANK GROUP ENVIRONMENTAL HEALTH AND SAFETY GUIDELINES

In support of the Performance Standards, the World Bank Group (WBG) has published a number of Environmental Health and Safety (EHS) Guidelines. The EHS Guidelines are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimising, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility. The EHS Guidelines serve as a technical reference source to support the implementation of the IFC Performance Standards, particularly in those aspects related to PS3: Pollution Prevention and Abatement, as well as certain aspects of occupational and community health and safety.

Where host country regulations differ from the levels and measures presented in the EHS Guidelines, projects seeking international funding may be expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is required.

The following IFC / WBG EHS Guidelines have been generally consulted during the preparation of the EIA in order to aid the identification of EHS aspects applicable to the project:

— *Electric Power Transmission and Distribution (2007)* - information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas;
— *General EHS Guidelines* – this includes a section on a range of environmental, occupational health and safety, community health and safety, and construction activities that would apply to the project. The guideline also contains recommended guidelines adopted form the World Health Organisation (WHO) for ambient air and water quality, which are referred to in the relevant impact assessment sections in the ESIA report.
— *Section 1.1 - Air Emissions and Ambient Air Quality* - This guideline applies to facilities or projects that generate emissions to air at any stage of the project life-cycle. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for assessment and monitoring of impacts. It is also intended to provide additional information on approaches to emissions management in projects located in areas of poor air quality, where it may be necessary to establish project-specific emissions standards.
— *Section 1.5 - Hazardous Materials Management* - These guidelines apply to projects that use, store, or handle any quantity of hazardous materials (Hazmats), defined as materials that represent a risk to human health, property, or the environment due to their physical or chemical characteristics. Hazmats can be classified according to the hazard as explosives; compressed gases, including toxic or flammable gases; flammable liquids; flammable solids; oxidizing substances; toxic materials; radioactive material; and corrosive substances. Guidance on the transport of hazardous materials is covered in Section 8 of this document. The ammonia and hydrogen facilities as well as oxygen facilities will likely be Major Hazard Installations and will require a full quantitative risk assessment (QRA) that complies with SANS 1461: MHI QRA as well as an emergency response plan (ERP) that complies with SANS 1514: MHI Emergency Response Planning. Under the current MHI Regulations notification of various authorities and the public is required. The EMPr will take these anticipated hazardous materials into account and recommend relevant mitigation and management measures.
— *Section 2 - Occupational Health and Safety* - Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. This section provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities.
— *Section 3.5 - Community Health and Safety* – Transport of Hazardous Materials - This section complements the guidance provided in the preceding environmental and occupational health and safety sections, specifically addressing some aspects of project activities taking place outside of the traditional project boundaries, but nonetheless related to the project operations, as may be applicable on a project basis.

2.4.3 EQUATOR PRINCIPLES

The Equator Principles (EPs) is a risk management framework, adopted by financial institutions, for determining, assessing, and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making.

The EPs apply globally to all industry sectors and to five financial products 1) Project Finance Advisory Services, 2) Project Finance, 3) Project-Related Corporate Loans, 4) Bridge Loans and 5) Project-Related Refinance and Project-Related Acquisition Finance. The relevant thresholds and criteria for application is described in detail in the Scope section of the EP. Currently 125 Equator Principles Financial Institutions

(EPFIs) in 37 countries have officially adopted the EPs, covering the majority of international project finance debt within developed and emerging markets. EPFIs commit to implementing the EPs in their internal environmental and social policies, procedures and standards for financing projects and will not provide Project Finance or Project-Related Corporate Loans to projects where the client will not, or is unable to, comply with the EPs.

While the EPs are not intended to be applied retroactively, EPFIs apply them to the expansion or upgrade of an existing project where changes in scale or scope may create significant environmental and social risks and impacts, or significantly change the nature or degree of an existing impact. The EPs have greatly increased the attention and focus on social/community standards and responsibility, including robust standards for indigenous peoples, labour standards, and consultation with locally affected communities within the Project Finance market.

The EPs have also helped spur the development of other responsible environmental and social management practices in the financial sector and banking industry and have supported member banks in developing their own Environmental and Social Risk Management Systems.

The requirements and applicability of the EPs are outlined in **Table 2-6**.

It should be noted that Principles 8 and 10 relate to a borrower's code of conduct and are therefore not considered relevant to the S&EIA process and have not been included in this discussion.

Table 2-6: Requirements and Applicability of the Equator Principles

REQUIREMENT		PROJECT SPECIFIC APPLICABILITY
Principle 1: Review and Categorisation		
Overview	When a project is proposed for financing, the EPFI will, as part of its internal social and environmental review and due diligence, categorise such project based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the IFC. Using categorisation, the EPFI's environmental and social due diligence is commensurate with the nature, scale, and stage of the Project, and with the level of environmental and social risks and impacts. The categories are: — Category A: Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented; — Category B: Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and — Category C: Projects with minimal or no adverse environmental and social risks and/or impacts.	Based upon the significance and scale of the Project's environmental and social impacts, the proposed project is regarded as a Category B project i.e. a project with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
Principle 2: Environmental and Social Assessment		
Overview	For all Category A and Category B Projects, the EPFI will require the client to conduct an appropriate Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and scale of impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II). The Assessment Documentation should propose measures to minimise, mitigate, and where residual impacts remain, to compensate/ offset/ remedy	This document is the third deliverable (i.e. EIR) from the S&EIA process undertaken for the proposed Project. The assessment appropriately and comprehensively assessed the key environmental and social impacts and complies with the requirements of the South African EIA Regulations and this principle. In addition, an EMPr has been compiled and is included in **Appendix I**. A formal project specific ESMS will be compiled in the event that the project is

REQUIREMENT		PROJECT SPECIFIC APPLICABILITY
	for risks and impacts to Workers, Affected Communities, and the environment, in a manner relevant and appropriate to the nature and scale of the proposed Project. The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A, and as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialised studies may also need to be undertaken. For other Category B and potentially C Projects, a limited or focused environmental or social assessment may be appropriate, applying applicable risk management standards relevant to the risks or impacts identified during the categorisation process. The client is expected to include assessments of potential adverse Human Rights impacts and climate change risks as part of the ESIA or other Assessment, with these included in the Assessment Documentation.	developed in the future. Management and monitoring plans outlined in the EMPr will serve as the basis for an ESMS for the proposed Project.
Principle 3: Applicable Environmental and Social Standards		
Overview	The Assessment process should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. The EPFI's due diligence will include, for all Category A and Category B Projects globally, review and confirmation by the EPFI of how the Project and transaction meet each of the Principles. For Projects located in Non-Designated Countries, the Assessment process evaluates compliance with the then applicable IFC PS and WBG EHS Guidelines. For Projects located in Designated Countries, compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.	As South Africa has been identified as a non-designated country, the reference framework for environmental and social assessment is based on the IFC PS. In addition, this S&EIA process has been undertaken in accordance with NEMA (the host country's relevant legislation).
Principle 4: Environmental and Social Management System and Equator Principles Action Plan		
Overview	For all Category A and Category B Projects, the EPFI will require the client to develop or maintain an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree on an Equator Principles Action Plan (EPAP). The EPAP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards.	A formal project specific ESMS will be compiled in the event that the project is developed in the future. Management and monitoring plans outlines in the EMPr will serve as the basis for an ESMS for the proposed Project.
Principle 5: Stakeholder Engagement		
Overview	EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a	The S&EIA process includes an extensive stakeholder engagement process which complies with the South

REQUIREMENT		PROJECT SPECIFIC APPLICABILITY
	structured and culturally appropriate manner with Affected Communities Workers and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. To accomplish this, the appropriate assessment documentation, or non-technical summaries thereof, will be made available to the public by the borrower for a reasonable minimum period in the relevant local language and in a culturally appropriate manner. The borrower will take account of and document the process and results of the consultation, including any actions agreed resulting from the consultation. Disclosure of environmental or social risks and adverse impacts should occur early in the Assessment process, in any event before the Project construction commences, and on an ongoing basis. All Projects affecting Indigenous Peoples will be subject to a process of Informed Consultation and Participation, and will need to comply with the rights and protections for Indigenous Peoples contained in relevant national law, including those laws implementing host country obligations under international law.	African EIA Regulations. The process includes consultations with local communities, nearby businesses, and a range of government sector stakeholders (state owned enterprises, national, provincial and local departments). The stakeholder engagement process solicits interest from potentially interested parties through the placement of site notices and newspaper advertisements as well as written and telephonic communication. The stakeholder engagement process is detailed in **Section 4.3.**
Principle 6: Grievance Mechanism		
Overview	For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish effective grievance mechanisms which are designed for use by Affected Communities and Workers, as appropriate, to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The borrower will inform the Affected Communities and Workers about the grievance mechanism in the course of the stakeholder engagement process and ensure that the mechanism addresses concerns promptly and transparently, in a culturally appropriate manner, and is readily accessible, at no cost, and without retribution to the party that originates the issue or concern.	The EMPr (**Appendix I**) includes a *Grievance Mechanism Process for Public Complaints and Issues (***Section 7.16)**. This procedure effectively allows for external communications with members of the public to be undertaken in a transparent and structured manner.
Principle 7: Independent Review		
Overview	For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance.	This principle will only become applicable in the event that that the project is developed in the future necessitating Independent Review.
Principle 9: Independent Monitoring and Reporting		
Overview	To assess Project compliance with the Equator Principles after Financial Close and over the life of the loan, the EPFI will require independent monitoring and	This principle will only become applicable in the event that the project is developed in the future necessitating independent monitoring and reporting.

REQUIREMENT		PROJECT SPECIFIC APPLICABILITY
	reporting for all Category A, and as appropriate, Category B projects. Monitoring and reporting should be provided by an Independent Environmental and Social Consultant; alternatively, the EPFI will require that the client retain qualified and experienced external experts to verify its monitoring information, which will be shared with the EPFI in accordance with the frequency required.	

3 SCOPING PHASE SUMMARY

3.1 PROCEDURAL PROCESS

The application form was compiled and submitted to the MDARDLEA on **25 February 2022**. The MDARDLEA reference number allocated to this application is 1/3/1/16/1 G-242. This reference number will appear on all official correspondence with the authorities and the public regarding the Proposed Project.

The DSR was initially placed on public review for a period of 30 days from 25 February 2022 to 28 March 2022, at the Proposed Site. The report was also made available on the WSP website (https://www.wsp.com/en-ZA/services/public-documents)

It should thus be noted that not all comments have been received and that the report is incomplete. The comprehensive FSR including all comments received was submitted on the **8 April 2022**.

All registered stakeholders and authorising/commenting state departments were notified of the public review period as well as the locations of the FSRs via email and bulk SMS. The abovementioned plan, for notification and provision of reports, will also be utilised for the review of the FSR as well as the EIAR once the EIAR Phase has commenced.

The approval of the Final Scoping Report (FSR) and the plan of study for the environmental impact assessment was received on **26 May 2022** and is included in **Appendix G**.

3.2 AUTHORITY CONSULTATION

A pre-application meeting was held on 4 November 2021 with the MDARDLEA in order to discuss the proposed project. The minutes of this meeting are included in **Appendix K**. In addition, WSP notified a number of commenting authorities of the Proposed Project via a notification letter, these included:

- DMRE;
- DFFE: Biodiversity and Conservation;
- DFFE: Protected Areas;
- MDARDLEA;
- DWS;
- Vaal WMA Authority;
- SAHRA;
- MHRA;
- MTPA;
- CAA;
- ATNS;
- DD (SA Army);
- AMA;
- SAWS;
- SANRAL;
- Gert Sibande District Municipality;
- Msukaligwa Local Municipality; and
- Dr Pixley Ka Seme Local Municipality.

WSP received comments on the DSR from the MDARDLEA on **29 March 2022**. The comments and responses have been outlined in **Table 3-1** and included in the SER **(Appendix D)**. The responses to the MDARDLEA comments were applicable as at the time of final scoping submission and based on the project description included in the final scoping report. In addition to the above, WSP received comments on the FSR from the

MDARDLEA on 26 May 2022. The comments and responses have been outlined in **Table 3-1** and included in the SER (**Appendix D**).

A request for extension to the submission deadline of the FEIR was submitted to the MDARDLEA in terms of EIA Regulation 3(7). A 60-day extension was approved on **27 June 2022**.

Table 3-1: Comments received from the MDARDLEA regarding the DSR

COMMENT	RESPONSE
The final scoping report must provide proof that all potential and registered interested and affected parties, including organs of state, were provided with all access to and an opportunity to comment on the draft scoping report following the submission of the application form Regulation 30 (3)). The final scoping report must include an issue and response report, as well as copies of and responses to comments received from all interested and affected parties , including these comments.	The Final scoping report includes the stakeholder database of all registered interested and affected parties including organs or state that were informed about the project and provided access to the draft scoping report. Proof of availability and notification is included in this SER.
You must therefore demonstrate the provision of water, at the appropriate capacity, is available before the application of environmental authorisation for the development can be decided.	WSP acknowledges the comments, demonstrate the provision of water, at the appropriate capacity will be discussed in the EIA. Correspondence towards availability of water between the DWS and the proponent confirmed that the Department of Water and Sanitation have sufficient supply available from the Usutu bulk water supply scheme, contingent on a successful application for a water use license and abstraction point with the Department of Water and Sanitation.
You are reminded of the requirements of Regulation 21 (1), and that if such requirements is not met, the application will lapse in terms of the provisions of regulation 45.	The comment is hereby noted. WSP acknowledge that the requirements of Regulation 21 (1) are known and will be met.
Please draw the applicant's attention to the fact that the activity may not commence prior to an environmental authorisation being granted by the department and do not hesitate to contact this office if there are any enquires.	The comment is hereby noted. No activities will be undertaken prior to the granting of the environmental authorisation.

Table 3-2: Comments received from the MDARDLEA regarding the FSR

COMMENT	RESPONSE
At the final EIAR stage, the thresholds and descriptions of all activities applied for must be provided.	The final EIAR includes a complete list of all activities applied for with their descriptions and thresholds included. **See Section 2.1**
Please ensure that relevant activities applied for are specific and linked to the proposed development.	All activities applied for are relevant to the Camden I GH&A facility. **Refer to Section 2.1**
The coordinates of any watercourse that may be impacted must be provided in the final EIAR with recommendations. On the freshwater assessment mitigation measures must be outlined on how to avoid operations and disturbance of wetlands/watercourses.	WSP notes this comment, the final EIAR will have comprehensive impact assessment section on the surface water and the relative mitigation measures required See **Section 8.5 & refer to Appendix H-4 Specialist Aquatic Impact Assessment** for mitigation measure, no-go's and exceptions.

COMMENT	RESPONSE
Please ensure that at the final EIAR, the BESS preferred technology is assessed, and its risks are determined, impacts and mitigation measures are indicated.	WSP acknowledges this comment, the final EIAR will include the BESS technologies along with its risks determined, impacts and mitigation measures. See **Section 8.16**
The final EIA report must provide proof that all potential and registered I&APs. including organs of state. Mpumalanga Tourism and Parks Agency were provided with access to and an opportunity to comment on the scoping, as per the requirements of Regulation 40(3).	WSP acknowledges this comment, the final EIAR will have a comprehensive Stakeholder Engagement Report, proving that all I&APs were given access to and an opportunity to comment on the scoping report. **See Section 2 of SER (Appendix D)**
The final layout plan must clearly delineate all sensitive areas to be cleared including all buffer zones.	This comment is noted, the final layout will include all sensitive areas to be cleared including all buffer zones. (refer to **Appendix E** sensitivity map)

Table 3-3: Comments received from the MDARDLEA regarding the Draft EIAR

COMMENT	RESPONSE
Please ensure that all relevant listed activities are applied for, are specific and can be linked to the proposed development and its associated infrastructure and are assessed accordingly.	This comment is noted, all the relevant listed activities have been outlined in **Section 2** of the final EIAr, and is further assessed in **Section 8** of the final EIAr.
A layout map including all sensitivities must be incorporated in the final EIAR and it must have legends showing all sensitivities. environmental features and all no-go area.	This comment is duly noted, the final EIAr includes a consolidated Sensitivity map with a suitable legend indicating all sensitivities. environmental features and all no-go areas for the site. See **Section 10.2**
All proposed mitigation measures and recommendations made on the various specialists' studies must be included in the EMPr and must comply with Appendix 4 of the BA Regulations. 2014, as amended.	This comment is noted, all of the proposed mitigation measures by the appointed specialists have been included in Section 6 of the final EMPr and comply with Appendix 4 of the BA Regulations. 2014, as amended. See **Appendix I**
The final EIAR must provide proof that all potential and registered I&AP's. including the Organs of State were provided with access to and an opportunity to comment on the draft ElAR following submission of the application form (Regulation 40(3)).	This comment is acknowledged. The draft EIAr has been sent to all potential and registered I&AP's including the Organs of State, Appendix B of the final SER shows all the proof of notifications sent to all I&AP. See **Appendix D**
The final EIAR must include issues and responses of the report. as well as copies of and responses to comments received from all I&APs including these comments	This comment is noted, all comments and responses received from I&APs have been included in Appendix D and Section 2.3 of the Final SER. See **Appendix D**

3.3 STAKEHOLDER CONSULTATION

Section 41 of the 2017 EIA Regulations states that written notices must be given to identified stakeholders. Refer to **Appendix D** for proof of notification. Relevant authorities (Organs of State) have been automatically registered as I&APs. In accordance with the EIA Regulations, 2014 (as amended), all other persons must request in writing to be placed on the register, submit written comments or attend meetings in order to be registered as stakeholders and included in future communication regarding the project.

Stakeholder engagement comprises 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 process. Effective stakeholder engagement requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the proposed project.

The objectives of the stakeholder engagement process can be summarised as follows:

- Identify relevant individuals, organisations and communities who may be interested in or affected by the Proposed Project;
- Clearly outline the scope of the Proposed Project, including the scale and nature of the existing and proposed activities;
- Identify viable proposed project alternatives that will assist the relevant authorities in making an informed decision;
- Identify shortcomings and gaps in existing information;
- Identify key concerns, raised by Stakeholders that should be addressed in the subsequent specialist studies;
- Highlight the potential for environmental impacts, whether positive or negative; and
- To inform and provide the public with information and an understanding of the proposed project, issues and solutions.

In accordance with the NEMA, GNR 326, Chapter 6, the following activities have taken place or are proposed to take place within the DSR review period or beyond.

Stakeholders were identified and will continue to be identified through several mechanisms. These include:

- Utilising existing databases from other projects in the area;
- Networking with local business owners, non-governmental agencies, community based organisations, and local council representatives;
- Field work in and around the project area;
- Advertising in the press;
- Placement of community notices;
- Completed comment sheets; and
- Attendance registers at meetings.

All Stakeholders identified to date have been registered on the project stakeholder database. The EAP endeavoured to ensure that individuals/organisations from referrals and networking were notified of the Proposed Project. Stakeholders were identified at the horizontal (geographical) and vertical extent (organisations level).

A list of stakeholders captured in the project database is included in Appendix A of the SER (**Appendix D**).

Table 3-4 provides a breakdown of stakeholders currently registered on the database while **Figure 3-1** illustrates the number of stakeholders per representative sector.

Table 3-4: Breakdown of Stakeholders currently registered on the database

REPRESENTATIVE SECTOR	FURTHER EXPLANATION	NO. STAKEHOLDERS
Government Departments	All tiers of government, namely, national, provincial, local government and parastatal organisations including:	84

REPRESENTATIVE SECTOR	FURTHER EXPLANATION	NO. STAKEHOLDERS
	— Department of Mineral Resources and Energy (DMRE); — DFFE: Biodiversity and Conservation; — DFFE: Protected Areas; — Mpumalanga Department Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA); — Department of Water and Sanitation (DWS); — Vaal Water Management Area (WMA) Authority; — South African Heritage Resource Agency (SAHRA); — Mpumalanga Heritage Resources Authority (MHRA); — Mpumalanga Tourism and Parks Agency (MTPA); — Civil Aviation Authority (CAA); — Air Traffic and Navigation Services (ATNS); — Department of Defence (SA Army) (DD); — Astronomy Management Authority (AMA); — South African Weather Services (SAWS); — South African National Roads Agency Limited (SANRAL); — Gert Sibande District Municipality; — Msukaligwa Local Municipality; and — Dr Pixley Ka Seme Local Municipality	
Business and consultants	Local and neighbouring businesses in the area. Representatives of consulting organisations that provide services in the area. Prospecting/Mineral rights holders within the broader project area which may have an interest in the development These include: — Langcarel (Pty) Ltd (Mooiplaats Colliery) MC Mining — ANKER COAL — Exxaro Coal Mpumalanga — South 32 — KANGRA COAL — Hoyohoyo Mining (Pty) Ltd — Bulemin Resources	14
Non-governmental organisations (NGOs) and community based organisations	Agricultural unions, churches, and environmental NGOs	24
General public	Local communities, farmers, and other such individuals who may have an interest in the project	5

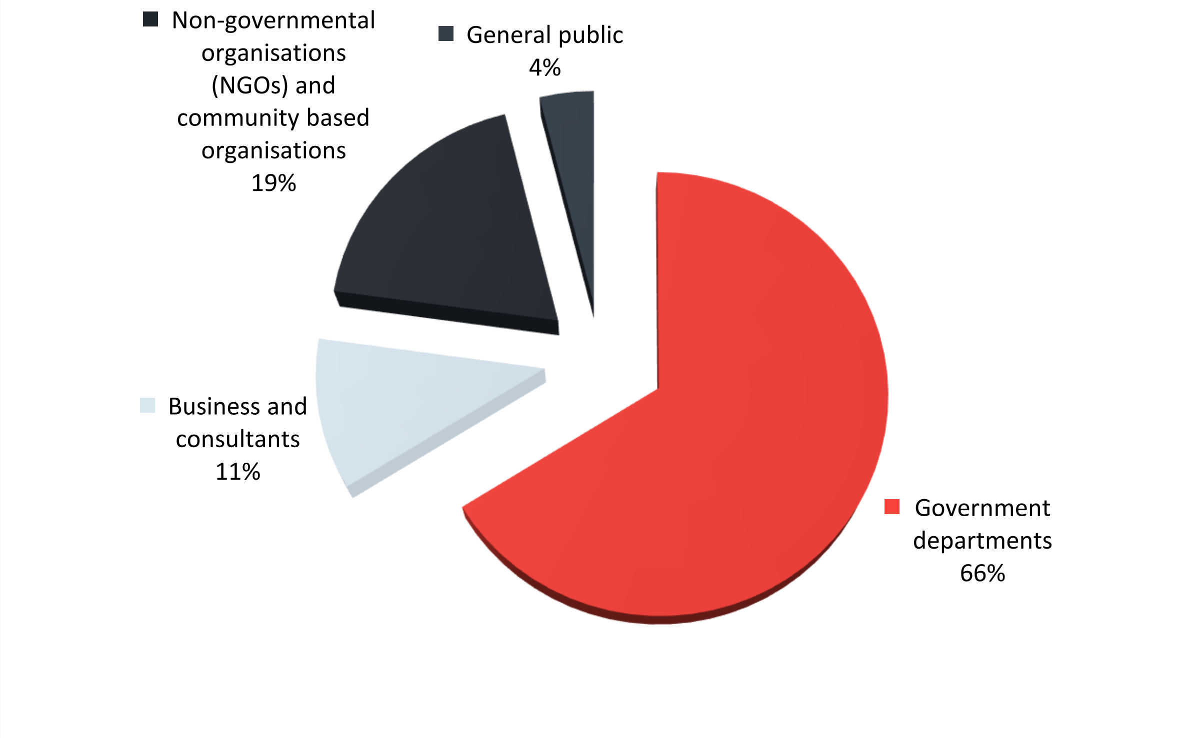


Figure 3-1: Pie chart showing the breakdown of the stakeholder currently registered on the database

All concerns, comments, viewpoints and questions (collectively referred to as 'issues') received to date have been documented and responded to in a SER included in **Appendix D**. The following key issues were highlighted during the scoping phase:

- Job creation for local residents; and
- Impacts on the biodiversity of the area with specific reference to Critical Biodiversity Areas and Langcarel Private Nature Reserve.

3.3.1 STAKEHOLDER NOTIFICATION

DIRECT NOTIFICATION

Notification of the proposed Project was issued to potential Stakeholders, via direct correspondence (i.e., site notices and e-mail) on **25 February 2022**. The notification letter circulated is included in Appendix B-3 of the SER (**Appendix D**). Proof of notification is included in the SER (i.e. **Appendix D**).

NEWSPAPER ADVERTISEMENTS

In accordance with the requirements of GNR 982, as amended, the proposed project was advertised in two local newspapers. The purpose of the advertisement was to notify the public about the proposed project and to invite them to register as stakeholders. A copy of the advertisements are included in Appendix B-1 of the SER (**Appendix D)**. The relevant scoping phase advertisement dates are listed in **Table 3-5**.

Table 3-5: Dates on which the Adverts were published

NEWSPAPER	PUBLICATION DATE	LANGUAGE
Standerton Advertiser	25 February 2022	English and Zulu

Highvelder	25 February 2022	Afrikaans

SITE NOTICES

The official site notices were erected as per GNR 982, as amended, on the boundary fence of the proposed site. In addition, general project notices, announcing the Proposed Project and inviting stakeholders to register, were be placed at various locations in and around the project area. A copy of the site notice is included in Appendix B-2 of the SER (**Appendix D**).

3.4 SCOPING STUDY FINDINGS

The scoping phase identified a number of impacts associated with the proposed Camden I GH&A Facility. The findings of the preliminary significance ratings undertaken during the scoping phase for the construction phase, operational phase and initial cumulative impacts are included in **Table 3-6**, **Table 3-7** and **Table 3-8** respectfully.

Table 3-6: Construction Phase Impacts

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Air Quality	Dust Emissions	Negative	3	1	**Low**	**No**
Noise and Vibrations	Noise and Vibration Emissions	Negative	3	1	**Low**	**No**
Topography, & Geology	Constructability	Negative	3	1	**Low**	**No**
Soils, Land Capability and Agricultural Potential	Loss of agricultural potential by soil degradation	Negative	4	3	**High**	**Yes**
	Loss of agricultural potential by occupation of land	Negative	4	3	**High**	
Surface water	Loss of aquatic species of special concern	Negative	3	3	**Medium**	**Yes**
	Damage or loss of riparian and wetlands systems and disturbance of the waterbodies during construction	Negative	3	3	**Medium**	
	Potential impact on localised surface water quality	Negative	3	3	**Medium**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
	Impact on habitat change and fragmentation related to hydrological regime changes	Negative	3	3	**Medium**	
Groundwater	Ground Contamination	Negative	3	1	**Low**	**No**
Hazardous Substances and Pollutants	Soil, groundwater and surface water contamination	Negative	3	3	**Medium**	**No**
Waste Generation	Generation of General Waste	Negative	3	2	**Medium**	**No**
	Generation of Hazardous Waste	Negative	3	2	**Medium**	
	Sanitation Waste	Negative	3	2	**Medium**	
Biodiversity	Loss and Fragmentation of Vegetation and Habitat	Negative	4	3	**High**	**Yes**
	Impacts on CBAs and broad-scale ecological processes	Negative	4	3	**High**	
	Loss and Displacement of Fauna	Negative	4	3	**High**	
	Proliferation of alien invasive plant species	Negative	4	3	**High**	
Avifauna	Displacement due to disturbance during the Construction Phase	Negative	4	3	**High**	**Yes**
Visual and Landscape	Potential visual intrusion resulting from large construction vehicles and equipment	Negative	3	2	**Medium**	**Yes**
	Potential visual effect of construction laydown areas and material stockpiles.	Negative	3	2	**Medium**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
	Potential impacts of increased dust emissions from construction activities and related traffic	Negative	3	2	**Medium**	
	Potential visual scarring of the landscape as a result of site clearance and earthworks	Negative	3	2	**Medium**	
	Potential visual pollution resulting from littering on the construction site	Negative	3	1	**Low**	
Heritage and Cultural Resources	Disturbance to known Cultural Resources	Negative	3	2	**Medium**	**Yes**
	Chance Find of Cultural Resources	Negative	3	2	**Medium**	
Palaeontology	Chance Find of Palaeontological resources	Negative	3	2	**Medium**	**Yes**
Traffic	Increased traffic generation around the study area by construction vehicles	Negative	3	1	**Low**	**Yes**
	Deterioration of the surrounding road network due to an increase of traffic around the site	Negative	3	2	**Medium**	
	Transportation of abnormal loads during the construction phase	Negative	4	1	**Medium**	
Socio-Economic	Creation of local employment, training, and business opportunities	Positive	2	3	**Medium**	**Yes**
	Impact of construction workers on local communities	Negative	3	3	**Medium**	
	Influx of job seekers	Negative	3	3	**Medium**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
	Risk to safety, livestock, and farm infrastructure	Negative	3	3	**Medium**	
	Increased risk of grass fires	Negative	3	3	**Medium**	
	Nuisance impacts associated with construction related activities	Negative	3	3	**Medium**	
	Impacts associated with loss of farmland	Negative	3	3	**Medium**	
Climate Change	Greenhouse Gas Emissions	Negative	2	1	**Very Low**	**No**
	Climate Risks & Vulnerabilities	Negative	2	1	**Very Low**	

Table 3-7: Operational Phase Impacts

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Air Quality	Bulk Storage Tank Emissions		2	2	**Low**	**Yes**
	Storage of NH_3		2	2	**Low**	
Noise and Vibrations	Noise Emissions	Negative	3	3	**Medium**	**Yes**
Soils, Land Capability and Agricultural Potential	Enhanced agricultural potential through increased financial security for farming operations	Positive	3	3	**Medium**	**Yes**
	Prevention of crop spraying by aircraft over land occupied by turbines.	Negative	4	3	**High**	
	Interference with farming operations	Negative	4	3	**High**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Surface Water	Increased runoff, sedimentation and erosion	Negative	3	3	**Medium**	**Yes**
Groundwater	Ground Contamination	Negative	3	1	**Low**	**No**
Hazardous Substances and Pollutants	Soil, groundwater and surface water contamination	Negative	3	3	**Medium**	**No**
	Major Hazardous Installation	Negative	3	3	**Medium**	**Yes**
Waste Generation	Generation of General Waste	Negative	3	2	**Medium**	**Yes**
	Generation of Hazardous Waste	Negative	3	3	**Medium**	
	Sanitation Waste	Negative	3	2	**Medium**	
Biodiversity	Proliferation of alien invasive plant species	Negative	3	3	**Medium**	**Yes**
Avifauna	Electrocution	Negative	4	3	**Medium**	**Yes**
	Collisions	Negative	4	3	**Medium**	
Visual	Potential alteration of the visual character of the area;	Negative	4	3	**High**	**Yes**
	Potential visual intrusion resulting from the various components of the Facility	Negative	4	3	**High**	
	Potential visual clutter caused by substation and other associated infrastructure on-site	Negative	3	3	**Medium**	
	Potential visual effect on surrounding farmsteads	Negative	4	3	**High**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
	Potential alteration of the night time visual environment	Negative	3	3	**Medium**	
Social	Produce green hydrogen and ammonia for the South Africa economy	Positive	3	3	**Medium**	**Yes**
	Creation of employment and business opportunities	Positive	3	3	**Medium**	
	Generate income for affected landowners	Positive	3	3	**Medium**	
	Benefits associated with the socio-economic development contributions	Positive	3	3	**Medium**	
	Visual impact and impact on sense of place	Negative	4	3	**High**	
	Potential impacts associated with noise and odours	Negative	3	3	**Medium**	
	Potential health and safety risks associated with plant incidents	Negative	3	3	**Medium**	
Climate Change	Reduced GHG Emissions	Positive	4	3	**High**	**No**

Table 3-8: Initial Cumulative Impacts

RECEPTOR	DESCRIPTION	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Noise and Vibrations	Cumulative Noise Emissions	Negative	3	3	**Medium**	**Yes**

RECEPTOR	DESCRIPTION	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Soils, Land Capability and Agricultural Potential	Cumulative Agricultural Impacts	Negative	4	3	**High**	**Yes**
Biodiversity	Cumulative impacts on biodiversity	Negative	4	3	**High**	**Yes**
Avifauna	Cumulative Collision impacts	Negative	4	3	**Medium**	**Yes**
	Cumulative Electrocution Impacts	Negative	4	3	**Medium**	
Visual	Combined visual impacts from mining, industrial, infrastructural and renewable energy development in the broader area could potentially alter the sense of place and visual character of the area	Negative	4	3	**High**	**Yes**
	Combined visual impacts from mining, industrial, infrastructural and renewable energy development in the broader area could potentially exacerbate visual impacts on visual receptors	Negative	4	3	**High**	
Social	Cumulative impact on sense of place	Negative	4	3	**High**	**Yes**

3.5 SCOPING RECOMMENDATIONS

The scoping report identified and evaluated the feasibility of a range of site options. **Table 3-9** provides a summary of the scoping phase alternatives assessment.

Table 3-9: Alternatives Summary

ALTERNATIVE CATEGORY	ALTERNATIVE IDENTIFIED IN SCOPING	ASSESSMENT IN EIA PHASE (YES / NO)
Project Alternatives	**Site Alternative 1**	Yes

ALTERNATIVE CATEGORY	ALTERNATIVE IDENTIFIED IN SCOPING	ASSESSMENT IN EIA PHASE (YES / NO)
	— Site Substation & BESS (Alternative 1) — GH&A Plant (Alternative 1) — 400kV Powerline (Alternative 2) — Pipeline Alternative 2: Alternate Site to Camden Power Station Confluence (~9.4km); — Pipeline Alternative 3: Alternate Site to Usutu Scour 2 (~8.5km)	
	Site Alternative 2-Preferred — Site Substation & BESS (Alternative 2) — GH&A Plant (Alternative 2) — 400kV Powerline (Alternative 1) — Pipeline Alternative 1: Preferred Site to Usutu Scour 2 (~3.3km) — Pipeline Alternative 4: Preferred Site to Camden Power Station Confluence (~4.2km).	Yes

4 EIA METHODOLOGY

The EIA process was initiated in accordance with Appendix 3 of GNR 982 pertaining to applications subject to an S&EIR process.

4.1 DETAILED ENVIRONMENTAL ASSESSMENT

4.1.1 SPECIALIST STUDIES

Table 4-1 provides a list of the Specialist Studies that have been undertaken. The Specialist Declaration are included in **Appendix C**.

Table 4-1: Details of the Specialists

SPECIALIST STUDY	SPECIALIST	COMPANY	APPENDIX
Agriculture	Johann Lanz	Independent consultant	**Appendix H-1**
Avifauna	Chris van Rooyen	Chris van Rooyen Consulting	**Appendix H-2**
Terrestrial, Plant and Animal Ecology	David Hoare	David Hoare Consulting (Pty) Ltd	**Appendix H-3** **Appendix H-15** **Appendix H-14**
Aquatic	Brian Colloty	EnviroSci Pty Ltd	**Appendix H-4**
Bats	Werner Marais, Diane Smith & Caroline Bell	Animalia Consultants	**Appendix H-5**
Heritage	Jaco van der Walt	Beyond Heritage	**Appendix H-6**
Palaeontology	Marion Bamford	Beyond Heritage	**Appendix H-7**
Socio-economic	Tony Barbour	Tony Barbour Environmental Consulting	**Appendix H-8**
Traffic	Christo Bredenhann	WSP Group Africa (Pty) Ltd	**Appendix H-9**
Visual	Kerry Schwartz	SiVEST SA (Pty) Ltd / SLR Consulting (Pty) Ltd	**Appendix H-10**
Noise	Kirsten Collet	WSP Group Africa (Pty) Ltd	**Appendix H-11**
Air Quality	Loren Dyer	WSP Group Africa (Pty) Ltd	**Appendix H-12**
SHE Risk	Debra Mitchel	Ishecon cc	**Appendix H-13**
Desktop Geotechnical	Muhammad Osman	SLR Consulting (South Africa) (Pty) Ltd	**Appendix H-16**

4.1.2 CUMULATIVE ASSESSMENT

The specialist assessments include a detailed cumulative environmental impact statement. The cumulative impact statement is provided in **Section 9**.

4.2 IMPACT ASSESSMENT METHODOLOGY

The EIR uses a methodological framework developed by WSP to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014, as amended (GN No. 326) (the "EIA Regulations").

As required by the EIA Regulations (2014) as amended, 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.

4.2.1 METHODOLOGY

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct, indirect, secondary as well as cumulative impacts. A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e., residual impact). The significance of environmental aspects is determined and ranked by considering the criteria presented in **Table 4-2**.

Table 4-2: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

4.2.2 IMPACT MITIGATION

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 proposed development'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. 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 report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan. The mitigation sequence/hierarchy is shown in **Figure 4-1** below.

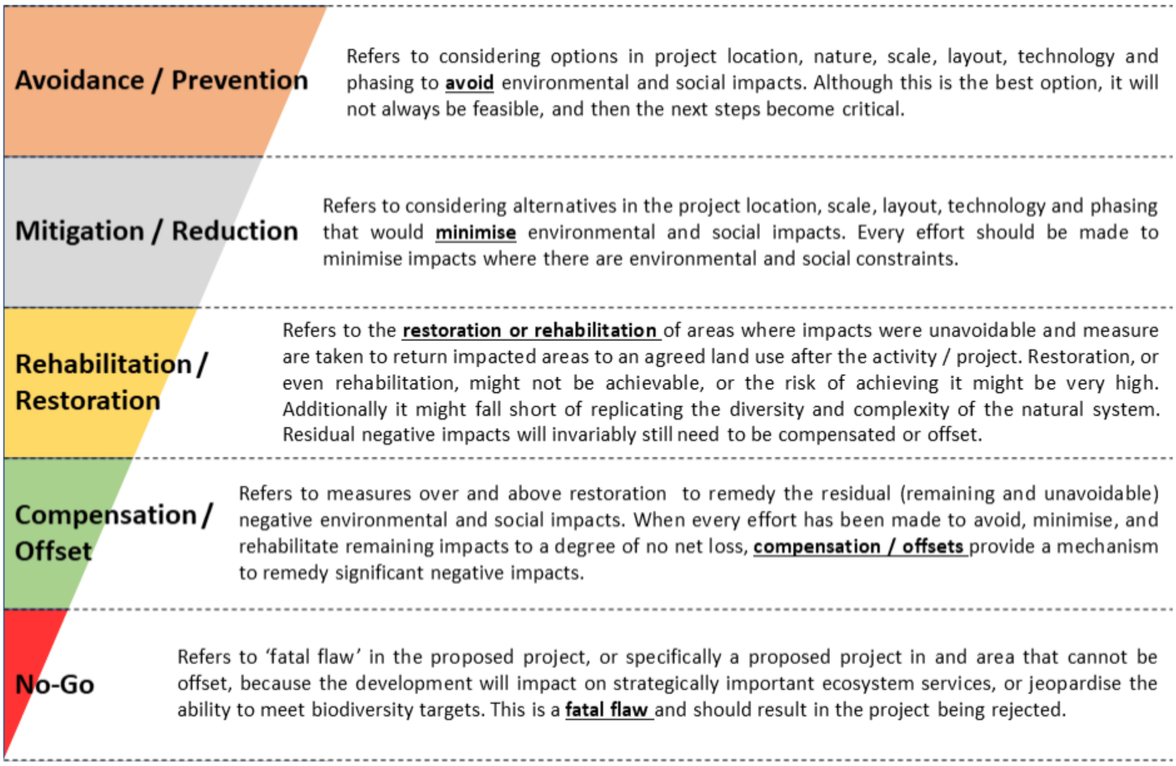


Figure 4-1: Mitigation hierarchy

4.3 STAKEHOLDER ENGAGEMENT

Stakeholder engagement (public participation) is a requirement of the S&EIA 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&EIA decision-making process. Effective engagement requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the proposed project. The objectives of the stakeholder engagement process can be summarised as follows:

- Identify relevant individuals, organisations and communities who may be interested in or affected by the proposed project;
- Clearly outline the scope of the proposed project, including the scale and nature of the existing and proposed activities;
- Identify viable proposed project alternatives that will assist the relevant authorities in making an informed decision;
- Identify shortcomings and gaps in existing information;
- Identify key concerns, raised by Stakeholders that should be addressed in the specialist studies;
- Highlight the potential for environmental impacts, whether positive or negative; and

— To inform and provide the public with information and an understanding of the proposed project, issues, and solutions.

It is important to note that since the proposed individual projects associated with the Camden Renewable Energy Complex, subject to a S&EIA Process, are located within the same geographical area, an integrated stakeholder engagement process (public participation) is being undertaken for these projects. A SER (**Appendix D**) has been compiled and included in the Final EIR detailing the projects' compliance with Chapter 6 of the NEMA EIA Regulations 2014, as amended.

4.3.1 STAKEHOLDER AND AUTHORITY CONSULTATION

There will continue to be ongoing communication between WSP and stakeholders throughout the S&EIR process. These interactions include the following:

- Interactions with stakeholders will be recorded in the comment and response report;
- Feedback to stakeholders will take place both individually and collectively;
- Written responses (email, faxes or letters) will be provided to stakeholders acknowledging issues and providing information requested (dependent on availability) and
- A letter will sent out to all registered stakeholders notifying them of the outcome of the environmental authorisation process

As per the GNR 982, particular attention will be paid to landowners, and neighbouring communities, specifically where literacy levels and language barriers may be an issue.

4.3.2 PUBLIC REVIEW

The Draft EIR was placed on public review for a period of 30 days from **7 September 2022 to 10 October 2022.**, at the following public places:

- Gert Sibande District Municipality;
- Ermelo Public Library;
- Thusiville Public Library;
- Msukaligwa Local Municipality Ermelo Office;
- WSP website (https://www.wsp.com/en-ZA/services/public-documents); and
- Datafree Website (https://wsp-engage.com/).

All registered stakeholders and authorising/commenting state departments were notified of the public review period as well as the locations of the draft EIR via email and SMS.

4.3.3 COMMENT AND RESPONSE REPORT

All concerns, comments, viewpoints and questions (collectively referred to as 'issues') will continue to be documented and responded to adequately in the Comment and Response Report. The Comment and Response Report records the following:

- List of all issues raised;
- Record of who raised the issues;
- Record of where the issues were raised;
- Record of the date on which the issue was raised; and
- Response to the issues.

The updated Comment and Response Report has been included in the SER in **Appendix D**.

4.3.4 SUBMISSION AND DECISION MAKING

The EAP must submit the final EIR to the competent authority within 106 days of the acceptance of the scoping report. A request for extension to the submission deadline of the FEIR was submitted to the MDARDLEA in terms of EIA Regulation 3(7). A 50-day extension was approved on 24 June 2022. The final EIR is due to the MDARDLEA on 23 October 2022. Once submitted, the delegated competent authority (i.e. the MDARDLEA) will be allocated 107 days to review the final EIR in order to either grant or refuse and environmental authorisation.

The final EIR will be placed on stakeholder review for a reasonable time period during the MDARDLEA's final review and decision-making process. All comments on the Final EIR should be submitted directly to MDARDLEA. The delegated competent authority must issue their decision within this specified timeframe. It must be noted that the final reports will not be open to further comment and the commenting period as regulated will have closed by then, but that comments can be forwarded to the case relevant officer.

4.3.5 NOTIFICATION OF ENVIRONMENTAL AUTHORISATION

All stakeholders will receive a letter at the end of the process notifying them of the authority's decision, thanking them for their contributions, and explaining the appeals procedure as outlined in the national Appeal Regulations, 2014 (GNR 993 of 2014).

4.4 DFFE WEB-BASED ENVIRONMENTAL SCREENING TOOL

DFFE has developed the National Web-based Environmental Screening Tool in order to flag areas of potential environmental sensitivity related to a site as well as a development footprint and produces the screening report required in terms of regulation 16 (1)(v) of the EIA Regulations (2014, as amended). The *Notice of the requirement to submit a report generated by the national web-based environmental screening tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended* (GN 960 of July 2019) states that the submission of a report generated from the national web-based environmental screening tool, as contemplated in Regulation 16(1)(b)(v) of the EIA Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, is compulsory when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the EIA Regulations, 2014 as of 04 October 2019.

The Screening Report generated by the National Web-based Environmental Screening Tool contains a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development footprint as well as the most environmentally sensitive features on the footprint based on the footprint sensitivity screening results for the application classification that was selected.

A screening report for the proposed Camden I GH&A facility was generated on 15 September 2021 and is attached as **Appendix E**. The Screening Report for the project identified various sensitivities for the site. The report also generated a list of specialist assessments that should form part of the S&EIA based on the development type and the environmental sensitivity of the site. Assessment Protocols in the report provide minimum information to be included in a specialist report to facilitate decision-making.

Table 4-3 below provides a summary of the sensitivities identified for the development footprint.

Table 4-3: Sensitivities identified in the screening report

THEME	VERY HIGH SENSITIVITY	HIGH SENSITIVITY	MEDIUM SENSITIVITY	LOW SENSITIVIY
Agricultural Theme	✓			
Animal Species Theme		✓		

THEME	VERY HIGH SENSITIVITY	HIGH SENSITIVITY	MEDIUM SENSITIVITY	LOW SENSITIVIY
Aquatic Biodiversity Theme	✓			
Archaeological and Cultural Heritage Theme				✓
Civil Aviation Theme				✓
Defence Theme				✓
Palaeontology Theme	✓			
Plant Species Theme			✓	
Terrestrial Biodiversity Theme	✓			

Based on the selected classification, and the environmental sensitivities of the proposed development footprint, the following list of specialist assessments have been identified for inclusion in the assessment report as determined by the screening tool (please refer to Section 4.4.1 below for the EAP motivation applicable to this list):

— Agricultural Impact Assessment
— Archaeological and Cultural Heritage Impact Assessment
— Palaeontology Impact Assessment
— Landscape/Visual Impact Assessment
— Terrestrial Biodiversity Impact Assessment
— Freshwater Impact Assessment
— Avifauna Impact Assessment
— Social Impact Assessment
— A Geotechnical Assessment
— Plant Species Assessment
— Animal Species Assessment

4.4.1 MOTIVATION FOR SPECIALIST STUDIES

The report recognises that "it is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the footprint situation."

As summarised in **Table 4-3** above, the following specialist assessments have been commissioned for the project based on the environmental sensitivities identified by the Screening Report:

— Soils and Agricultural Potential Assessment;
— Archaeological and Cultural Heritage Assessment;
— Palaeontology Impact Assessment;
— Visual Impact Assessment;
— Biodiversity Impact Assessment (inclusive of terrestrial biodiversity, plant species and animal species);
— Freshwater Assessment;

- Avifauna Impact Assessment;
- Environmental Acoustic (Noise) Impact Assessment;
- Social Impact Assessment;
- Qualitative Risk Assessment (specific to the BESS);
- Desktop Geotechnical Assessment; and
- Desktop Traffic Assessment.

Four of the identified specialist studies will not be undertaken as part of the S&EIA process for the proposed Camden I GH&A facility. Motivation for the exclusion of these specialist studies is provided below:

- **Detailed Geotechnical**

  A desktop Geotechnical Assessment has been commissioned and has been incorporated into this report (**Section 7.1.4** and **Appendix H-16**). No geotechnical fatal flaws were identified. However, a detailed Geotechnical Assessment will not be undertaken as part of the S&EIA Process as this will be undertaken during the detailed design phase.
- **RFI Assessment**

  A RFI Study will not be undertaken as it was not identified as a required theme in the screening tool. The proposed development area is not located within any Astronomy Advantage Area. The South African Weather Service (SAWS) and relevant telecommunications stakeholders will be engaged with as part of the Public Participation Process.
- **Civil Aviation**

  According to the DFFE Screening Tool Report, civil aviation is regarded as having low sensitivity. A compliance statement is therefore not required. The proposed development site is located between 8 and 15 km of civil aviation aerodromes. A formal Civil Aviation Assessment will not be undertaken as part of the S&EIA Process. Nevertheless, the relevant Authorities will be included on the project stakeholder database
- **Defence**

  According to the DFFE Screening Tool Report, defence is regarded as having low sensitivity. A compliance statement is therefore not required. The Department of Defence has been included on the project stakeholder database. They have been informed of the proposed Project and provided comment. (Refer to Stakeholder engagement report **Appendix D**)

5 NEED AND JUSTIFICATION

In October 2021, at the second Sustainable Infrastructure Development Symposium, President Cyril Ramaphosa said that green energy had the potential to drive industrialisation and establish a whole new industrial reality. Furthermore, the President stated that "We stand ready to be a major exporter in this market, to use hydrogen to rapidly decarbonise our existing industries, and attract industrial investment from across the globe seeking to meet new standards of green power in the production process".

The proposed development of the Camden I GH&A Facility directly addresses the President's statements and the need to implement renewable energy technologies and green fuels and/or products in Mpumalanga.

Renewable energy development is regarded as an important contribution to meeting international and national targets of reducing reliance on fossil fuels, such as coal, which contribute towards greenhouse gas emissions and resultant climate change. The need and desirability of proposed Camden I GH&A facility has been considered from an international, national and regional perspective.

5.1.1 *WHAT IS GREEN HDROGEN AND AMMNOIA PRODUCTION*

Green hydrogen is hydrogen fuel that is created using renewable energy instead of fossil fuels. It has the potential to provide clean power for manufacturing, transportation, and more and its only by-product is water.

Hydrogen energy is very versatile, as it can be used in gas or liquid form, be converted into electricity or fuel, and there are many ways of producing it. Approximately 70 million metric tons of hydrogen are already produced globally every year for use in oil refining, ammonia production, steel manufacturing, chemical and fertilizer production, food processing, metallurgy, and more.

Hydrogen is the most abundant chemical in the universe. Two atoms of hydrogen paired with an atom of oxygen creates water. Alone, though, hydrogen is an odourless and tasteless gas, and highly combustible.

There are three types of Hydrogen, namely brown, grey, and green hydrogen. These are named based on the process used to make them, and the emissions each process emits:

— **Brown hydrogen** requires the burning of fossil fuels (coal) in order to complete the gasification process. This process releases vast greenhouse gases (GHG) emissions into the atmosphere.

— **Grey hydrogen** is extracted from natural gases through a process known as steam reforming. This process also releases GHG emissions into the atmosphere.

— **Green hydrogen and ammonia production** differs from traditional production technologies in that the process relies exclusively on renewable resources (renewable energy) and for input air and water (feedstock), to produce commercially usable green hydrogen and ammonia. This method has **no associated GHG emissions.**

WHAT ARE HYDROGEN AND AMMONIA USED FOR?

Commercially, hydrogen is used as a fuel for transport in hydrogen fuel cells. Alternatively, hydrogen is used for welding and in the production of other chemicals such as methanol and hydrochloric acid and also has other commercial uses like the filling of balloons. It is also a primary input to the production of ammonia. Ammonia in turn is primarily used in the production of ammonium nitrate (fertiliser) and is also used as refrigerant gas and the manufacture of plastics, explosives, textiles, pesticides and other chemicals. Ammonia can also be used as a stable 'carrier' of hydrogen, allowing hydrogen to be readily stored and transported.

ADVANTAGES AND DISADVANTAGES OF GREEN HYDROGEN[2]

The green hydrogen energy source has advantages and disadvantages that we must be aware of. The most notable advantages include:

[2] https://www.iberdrola.com/sustainability/green-hydrogen

— **100 % sustainable:** green hydrogen does not emit polluting gases either during combustion or during production.
— **Storable**: hydrogen is easy to store, which allows it to be used subsequently for other purposes and at times other than immediately after its production.
— **Versatile:** green hydrogen can be transformed into electricity or synthetic gas and used for domestic, commercial, industrial or mobility purposes.
— **Transportable:** it can be mixed with natural gas at ratios of up to 20 % and travel through the same gas pipes and infrastructure - increasing this percentage would require changing different elements in the existing gas networks to make them compatible.

However, green hydrogen also has negative aspects, including:

— **High cost**: energy from renewable sources, which are key to generating green hydrogen through electrolysis, is more expensive to generate, which in turn makes hydrogen more expensive to obtain.
— **High energy consumption**: the production of hydrogen in general and green hydrogen in particular requires more energy than other fuels.
— **Safety issues**: hydrogen is a highly volatile and flammable element and extensive safety measures are therefore required.

5.1.2 GREEN ECONOMY

THE PARIS AGREEMENT

Climate change is a global emergency that goes beyond national borders. It is an issue that requires international cooperation and coordinated solutions at all levels. To tackle climate change and its negative impacts, world leaders at the UN Climate Change Conference (COP21) in Paris reached a breakthrough on 12 December 2015: the historic Paris Agreement.

The Agreement sets long-term goals to guide all nations:

— substantially reduce global greenhouse gas emissions to limit the global temperature increase in this century to 2 degrees Celsius while pursuing efforts to limit the increase even further to 1.5 degrees;
— review countries' commitments every five years;
— provide financing to developing countries to mitigate climate change, strengthen resilience and enhance abilities to adapt to climate impacts.

The Agreement is a legally binding international treaty. It entered into force on 4 November 2016. Today, 192 Parties (191 countries plus the European Union) have joined the Paris Agreement.

The Agreement includes commitments from all countries to reduce their emissions and work together to adapt to the impacts of climate change, and calls on countries to strengthen their commitments over time. The Agreement provides a pathway for developed nations to assist developing nations in their climate mitigation and adaptation efforts while creating a framework for the transparent monitoring and reporting of countries' climate goals.

The Paris Agreement provides a durable framework guiding the global effort for decades to come. It marks the beginning of a shift towards a net-zero emissions world. Implementation of the Agreement is also essential for the achievement of the Sustainable Development Goals.

Most experts agree that green hydrogen will be essential to meeting the goals of the Paris Agreement, since there are certain portions of the economy whose emissions are difficult to eliminate such as transportation, electricity generation and industry.

NATIONAL PERSPECTIVE

The Project will aid in the increase of exports from South Africa through the production of green hydrogen that has become popular globally. Hydrogen has become one of the latest buzzes for meeting the world's growing energy needs and a vital component for meeting the global decarbonization goals. Hydrogen is a clean fuel; however, the manufacturing of hydrogen fuel is energy-intensive and traditionally uses fossil fuels to power the production plant. There are four types of hydrogen and are classified in the manufacturing process. These types are brown, blue, grey and green hydrogen. Brown hydrogen is created through coal gasification, blue hydrogen uses carbon capture and storage for the greenhouse gases produced in the creation of grey hydrogen, producing grey hydrogen from natural gas produces carbon waste, and green hydrogen production uses renewable energy to create hydrogen fuel without carbon input.

The Project will produce green hydrogen of which can be used for various purposes and products which include fertilizers, shipping fuel, aviation fuel, and green steel. The Project can help contribute towards South Africa's exports and tap into the emerging multi-billion market, which is predicted to grow exponentially over the next few decades. The production of green hydrogen also requires a large solar and wind power input (both at the Project site). It is estimated that with the growth of the green hydrogen industry half a million jobs in the solar and wind industry will be created. Furthermore, in South Africa, green hydrogen has been identified by the Presidency as the first of the five "Big Frontier' strategic investment opportunities and will be involved in the finalization of the much anticipated 'Hydrogen Strategy and investor Roadmap'. It has been estimated that the green hydrogen industry in South Arica will be producing more than 3.8-million tonnes per anum and reducing the countries greenhouse gas emissions by 75%- by 2050 and could support the creation of around 370 000 additional direct and indirect jobs.

Studies have shown that the manufacturing and use of hydrogen, using the available low-carbon technologies, will substantially support South Africa to progress to deeper decarbonization than current policies envisage. The production of green hydrogen will support greater domestic decarbonization and allow the country to meet its international obligations by (not limited to):

- Reforming carbon dioxide emissions in coal- and gas-to-liquids synthetic fuels refineries in Mossel Bay and Secunda and potentially supporting the use of biogenic, non-fossil, or direct-air-capture sources of CO_2 to be used to source sustainable synthetic fuels;
- Replacing the use of coking and other coal in steel production;
- Displacing the existing unabated gas use for chemicals and refinery hydrogen;
- Supporting the roll-out of fuel cells for remote and heavy-duty vehicles where battery solutions are not viable; and
- Fuelling industrial processes where electrification cannot meet the specific combustion or heat needs.

With South Africa being ranked in the top ten globally for its wind and solar potential- there is high potential for green hydrogen production. South Africa has excellent resources of land, wind, and sun that are fundamental to the large-scale development of renewable electricity— and are also the key inputs for green hydrogen. Based on having these key resources allowing for the construction of the hydrogen facility will ensure the country is taking the right steps towards the Presidency 2050 aspirations. This Project will serve as one of the anchor or foundation projects to the establishment of the South African green hydrogen industry

5.1.3 DESIRABILITY OF THE SITE

ENVIRONMENT

The environment is a key factor when it comes to the development of its projects. It is critical to ensure that its projects are developed in a sustainable manner. All the environmental factors were considered in the area when potential sites were being considered. After a thorough evaluation of the regional farms, the specific farms were selected because they were already heavily disturbed by agricultural and coal mining activities. Thus, it was concluded that the development of these farms would have a minimal impact on the region's flora, fauna and water resources.

TOPOGRAPHY AND SITE ACCESS

The surrounding landscape has a rolling hill topography which is suitable for the development of a GH&A facility. The Project site can be accessed easily via either the tarred N2 and N11 national roads which run along the eastern and western boundaries of the site. There is an existing road that goes through the land parcels to allow for direct access to the project development area. The site is also situated close to the renewable energy projects that are being proposed in parallel with this facility and therefore, the GH&A facility will be close to a reliable source of electricity.

LAND AVAILABILITY

With this region being home to some of the biggest coal power stations in the country (Komati and Camden among many others), most land parcels have been given mining rights for coal beneficiation to provide fuel stock supply these power stations. Thus, there is very limited land available for the development of the GH&A facility. However, sufficient land has been secured for the development of the proposed project with landowners within the respective cadastral portions comprising the development footprint indicating their support and willingness for the project to proceed to development via entering into agreement with the developer.

5.1.4 NEED AND DESIRABILITY FOR GREEN HYDROGEN AND AMMONIA

Sustainable energy conversion requires zero emissions of greenhouse gases and criteria pollutants using primary energy sources that the earth naturally replenishes quickly, like renewable resources. Solar and wind power conversion technologies have become cost effective recently, but challenges remain to manage electrical grid dynamics and to meet end-use requirements for energy dense fuels and chemicals.

Renewable hydrogen provides the best opportunity for a zero emissions fuel and is the best feedstock for production of zero emission liquid fuels and some chemical and heat end-uses. Renewable hydrogen can be made at very high efficiency using electrolysis systems that are dynamically operated to complement renewable wind and solar power dynamics.

Hydrogen can be stored within the existing natural gas system to provide low-cost massive storage capacity that (1) could be sufficient to enable a 100% zero emissions grid; (2) has sufficient energy density for end-uses including heavy duty transport; (3) is a building block for zero emissions fertilizer and chemicals; and (4) enables sustainable primary energy in all sectors of the economy.

5.1.5 NEED AND DESIRABILITY FOR RENEWABLE ENERGY

As the Camden I GH&A facility will be powered by renewable energy, the need and desirability of renewable energy is therefore linked to the project as a whole. The GH&A Facility will serve to support these proposed neighbouring renewable facilities through guaranteed off-take.

Renewable energy development is regarded as an important contribution to meeting international and national targets of reducing reliance on fossil fuels, such as coal, which contribute towards greenhouse gas emissions and resultant climate change. The need and desirability of proposed Camden I GH&A Facility has been considered from an international, national and regional perspective.

INTERNATIONAL PERSPECTIVE

The proposed project will align with internationally recognised and adopted agreements, protocols and conventions. This includes the Kyoto Protocol (1997) which calls for countries internationally to reduce their greenhouse gas emissions through cutting down on their reliance on fossil fuels and investing in renewable energy technologies for electricity generation.

The project will also greatly contribute to the countries' efforts to reduce their carbon emissions and play their role as part of the Paris Climate Accord. The Paris Agreement is a legally binding international treaty signed by 196 countries at the COP 21 in Paris, on the 12th of December 2015 to combat climate change. The goal of the Paris Accord is to limit global warming to well below 2 degrees Celsius, compared to industrial levels to avoid catastrophic natural disasters which are driven by the global temperature increase. Therefore, to achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate-neutral world by 2050.

The authorization of the Project will further align with South Africa's National Climate Response White Paper which outlines the countries efforts to manage the impacts of climate change and to contribute to the global efforts to stabilize the Greenhouse gases concentrations in the atmosphere.

NATIONAL PERSPECTIVE

The South African Government, through the IRP, has set a target to secure 17 800 MW of renewable energy by 2030. This is an effort to diversify the country's energy mix in response to the growing electricity demand and promote access to clean sources of energy.

The National Development Plan (NDP) is aimed at reducing and eliminating poverty in South Africa by 2030. The NDP also outlines the need to increase electricity production by 2030, with 20 000 MW of electricity capacity generated from renewable sources in order to move to less carbon-intensive electricity production. The Plan also envisages that South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates, while supporting economic growth through job creation.

The authorisation of the Camden I GH&A Facility will further align with South Africa's National Climate Response White Paper which outlines the countries efforts to manage the impacts of climate change and to contribute to the global efforts to stabilize the greenhouse gases concentrations in the atmosphere.

The proposed Camden Renewable Energy Complex, which includes the Camden I GH&A Facility, will pave the way for the Just Energy Transition (JET)[3] in South Africa and promote the transition from a fossil fuel-based economy to a low carbon economy. The proposed Camden Renewable Energy Complex aims towards the aforementioned national energy targets of diversification of energy supply and the promotion of clean energy. Wind and solar energy developments contribute to reduced emissions and subsequently climate change whilst promoting industrial development and job creation.

In addition, the Council for Scientific and Industrial Research (CSIR) reported that renewable energy assisted in relieving pressure on the constrained South African power system during load shedding in the first quarter of 2019. This indicates that renewable energy is a key factor in ensuring that the country does not face further load shedding in the future.

REGIONAL AND LOCAL PERSPECTIVE

JUST ENERGY TRANSITION

Coal power stations and the coal mining industry play a vital component in the economic and social components of the local Mpumalanga economy. Shifting to a low carbon economy will thus need to offset or exceed the benefits being realized by fossil fuels in the province. Thus, a key factor to ensuring the success of the Just Energy Transition is not only to focus on the transition from fossil fuels to renewable energy resources but to simultaneously ensure the Just Transition of jobs and skills.

The transition towards renewable energy will improve the socio-economic conditions of the Gert Sibande District Municipality. The Gert Sibande District Municipality recorded an unemployment rate of 26.7% in 2017, with the majority of its employed in the trade and community services sectors. The Project will aid in solving two of the leading challenges faced by the Gert Sibande District Municipality, namely the cost of electricity and lack of adequate employment opportunities. As various career opportunities are presented by the wind industry, and these are divided into four pillars that are aligned with the value chain. These four pillars are project development, component manufacturing, construction, and operation & maintenance as shown in **Figure 5-1**

[3] The Just Transition is described as the transition towards a low-carbon and climate-resilient economy that maximizes the benefits of climate action while simultaneously improving the welfare of the workers and their communities.

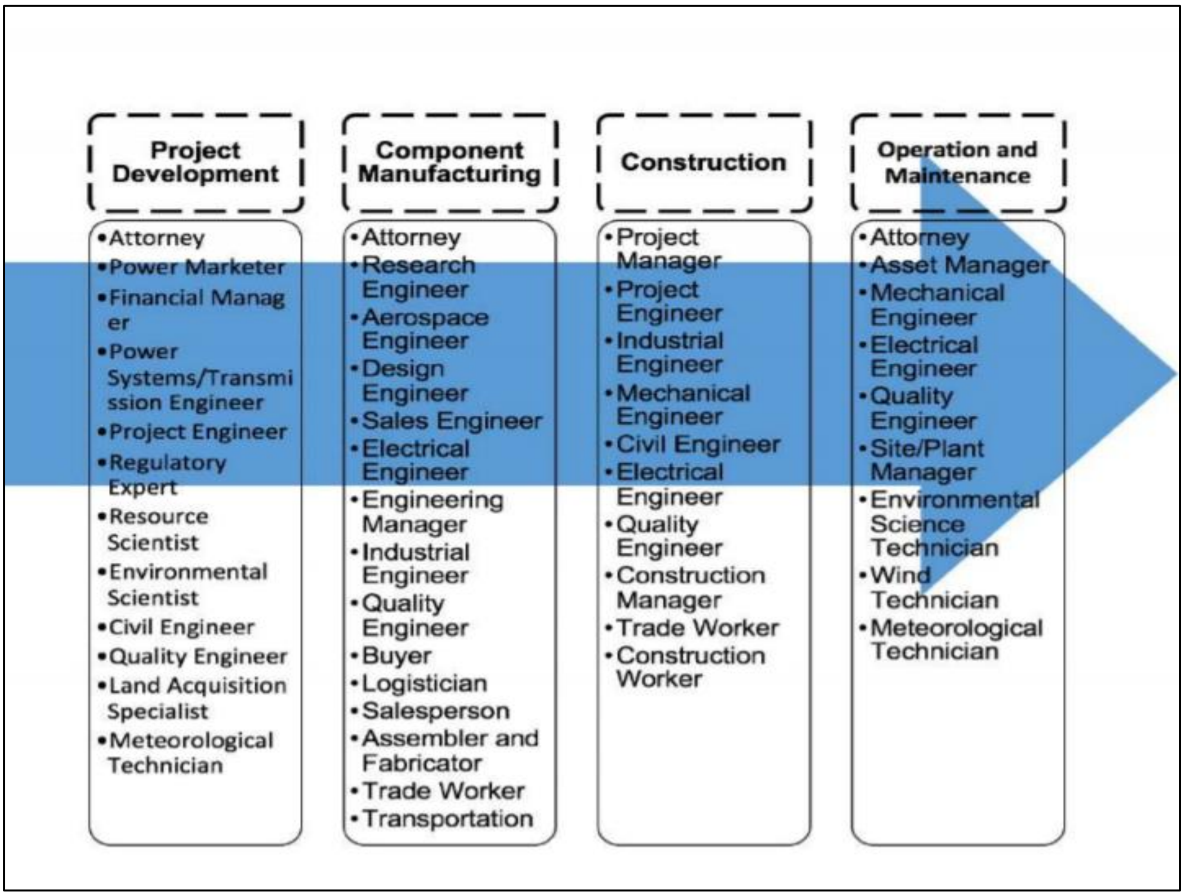


Figure 5-1: Career Opportunities presented by the Wind Industry (Source: https://www.res4africa.org/wp-content/uploads/2020/09/RES4Africa-Foundation-A-Just-Energy-Transition-in-South-Africa.pdf)

Figure 5-1 shows that the wind industry will create job opportunities throughout the supply chain. The wind industry will contribute to the Just transition in South Africa to ensure that there are no job losses but rather job transfers and skill exchange. For these opportunities to arise, renewable energy projects need to be approved in Mpumalanga to ensure that the transition from fossil fuels to renewable energy happens gradually and takes off effectively.

6 PROJECT DESCRIPTION

6.1 SITE LOCATION

The proposed Camden I GH&A Facility will be developed in an area of approximately 25 hectares (ha) south-west of Ermelo, in Mpumalanga. The proposed Camden I GH&A Facility falls within the Msukaligwa Local Municipality of the Gert Sibande District Municipality.

The eight projects of the Camden Renewable Energy Complex are located within the same geographical area and are inevitably linked and integrated. As such, the overall locality of the Camden Renewable Energy Complex is included in **Figure 6-1**. The Camden I GH&A Facility (project under consideration for this EIAR) project site, including associated alternatives, is indicated in **Figure 6-2**.

It must be noted that that the linear features (pipeline most importantly) are assessed in corridors of 500m wide so as to allow for micro siting and minor modification withing the corridor to fit sensitives and on-site conditions.

The details of the properties associated with the proposed Camden I GH&A Facility, including the 21-digit Surveyor General (SG) codes for the cadastral land parcels are outlined in **Table 6-1** and **Table 6-2** below.

Table 6-1: Camden I GH&A Affected Farm Portion

FARM NAME	21 DIGIT SURVEYOR GENERAL CODE OF EACH CADASTRAL LAND PARCEL
Alternative 1	
Portion 2 of Welgelegen Farm No. 322	T0IT00000000032200002
Alternative 2 (Preferred)	
Portion 1 of Welgelegen Farm No. 322	T0IT00000000032200001

Table 6-2: Water pipeline alternative affected farm portions

It should be noted that these pipelines are within corridors for assessment of 500m wide for the purposes of micro siting, the same applies for proposed 132kV grids lines – line is indicative but can be located anywhere in the assessment corridor pending walkdowns and micro-siting.

21DIGIT SURVEYOR GENERAL CODE OF EACH CADASTRAL LAND PARCEL	FARM NAME
Alternative 1	
T0IT00000000029200002	Portion 2 of Uitkomst, farm no. 292
T0IT00000000029000014	Portion 14 of Mooiplaats Farm No. 290
T0IT00000000032200001	Portion 1 of Welgelegen Farm No. 322
Alternative 2	

T0IT00000000029000014	Portion 14 of Mooiplaats Farm No. 290
T0IT00000000032200001	Portion 1 of Welgelegen Farm No. 322
T0IT00000000032200002	Portion 2 of Welgelegen Farm No. 322
Alternative 3	
T0IT00000000029200002	Portion 2 of Uitkomst, farm no. 292
T0IT00000000029000014	Portion 14 of Mooiplaats Farm No. 290
T0IT00000000032200001	Portion 1 of Welgelegen Farm No. 322
T0IT00000000032200002	Portion 2 of Welgelegen Farm No. 322
Alternative 4	
T0IT00000000029000014	Portion 14 of Mooiplaats Farm No. 290
T0IT00000000032200001	Portion 1 of Welgelegen Farm No. 322

It should be noted that that the proposed pipelines are within corridors of 500m wide for assessment for the purposes of micro siting, the same is applied for the proposed 132kV grid lines – line is indicative but it can be located anywhere in the assessment corridor pending walkdowns and micro-siting.

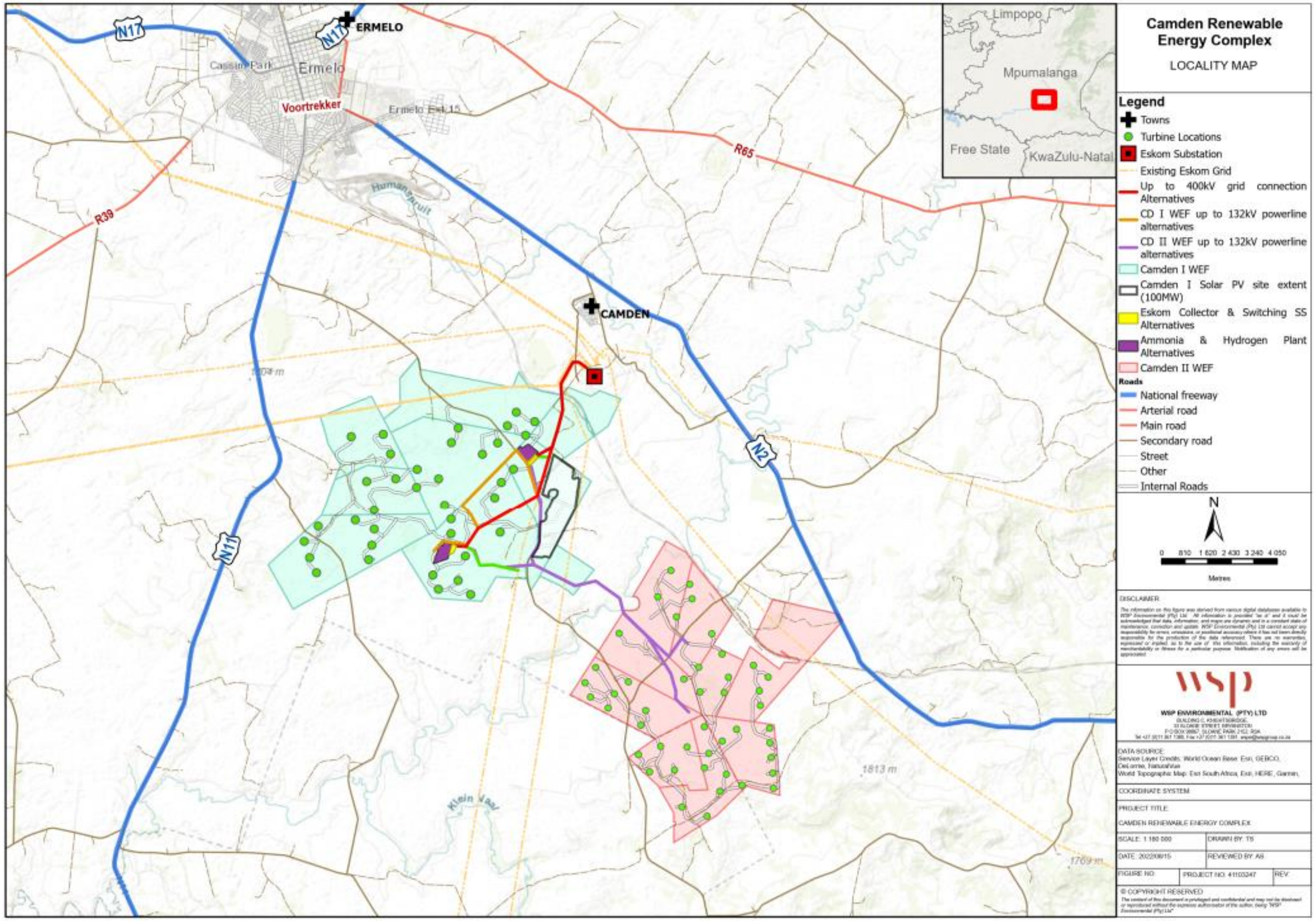


Figure 6-1: Locality map for the proposed Camden Renewable Energy Complex, near Camden in the Mpumalanga Province, showing the location and proximity of the respective projects to each other

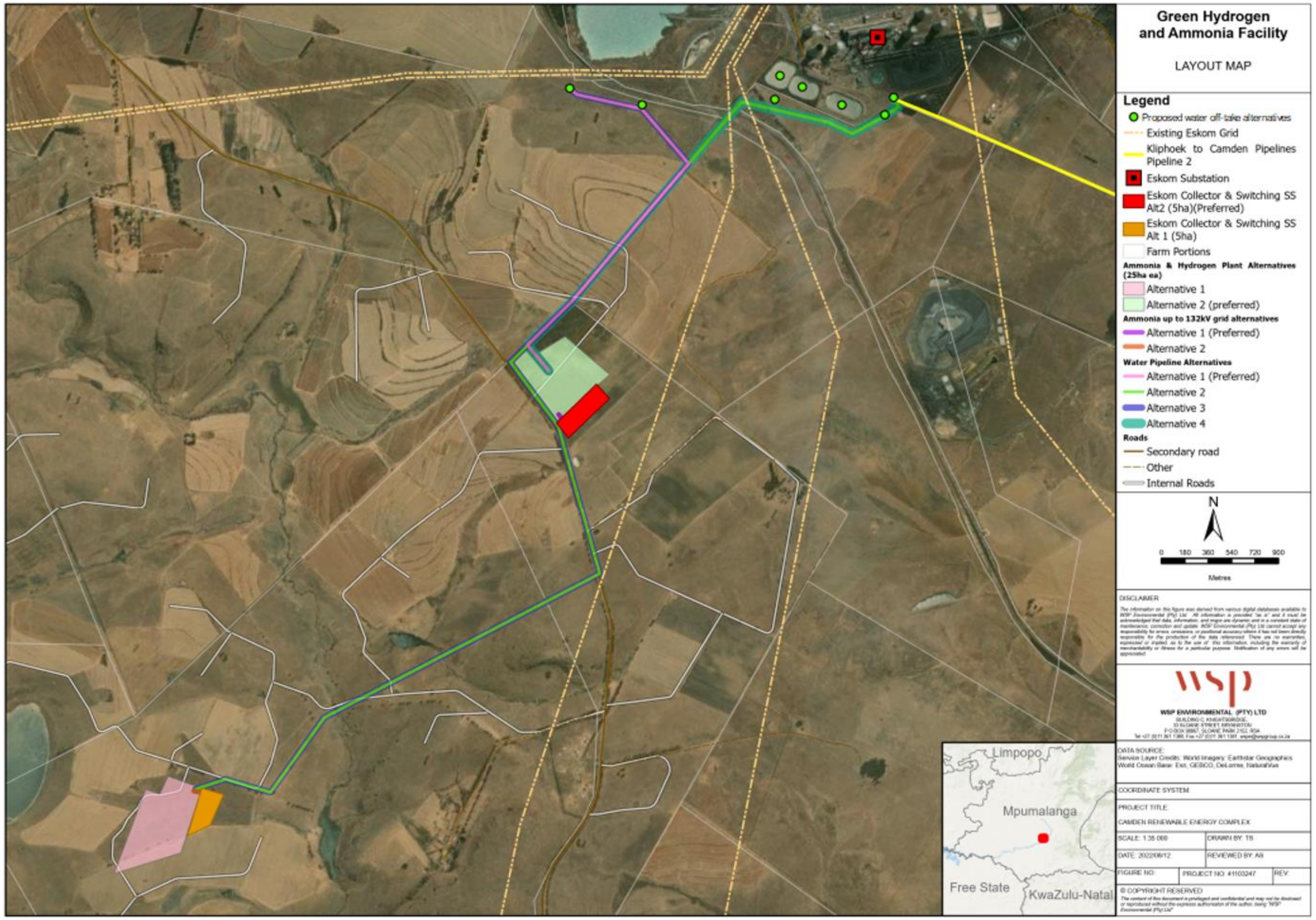


Figure 6-2: Proposed Camden I GH&A Facility and associated main components

6.2 GREEN HYDROGEN AND AMMONIA PROCESS

ENERTRAG developed its first green hydrogen facility, Hybridkraftwerk, in Germany which is powered by wind energy. The Hybridkraftwerk was commissioned in October 2011 and produces 94 tons of hydrogen per year (**Figure 6-3** and **Figure 6-4**).

Camden Green Energy (RF) Pty Ltd, a SPV, will be established for the sole purpose of developing, owning and operating the proposed up to 150MW GH&A facility.

Figure 6-3: Enertrag Germany's Hybridkraftwerk

Figure 6-4: Closer View of Electrolyser Housing and Storage Tanks

‘Green Ammonia’ is ammonia (NH_3) made using renewable energy, air and water (**Figure 6-5**). The process uses electrolysis (direct electric current to drive an otherwise non-spontaneous chemical reaction) and air separation to split water and air into its primary components i.e. hydrogen (H) and oxygen (O_2) from water, and nitrogen (N) and oxygen from air. NH_3 is then synthesised from the separated components using the Haber-Bosch method (the standard industrial process used to make ammonia). The Haber-Bosch process combines stoichiometric amounts of hydrogen and nitrogen in a moderate temperature (~ 400 – 500 °C), high pressure (100 barg) reactor. The process requires a catalyst (usually iron-based) promoting NH_3 mixture equilibrium. The NH_3 gas generated is rapidly cooled to form anhydrous (liquid) NH_3 for easy and safe storage and transport. Any unreacted nitrogen and hydrogen is recycled back into the reactor.

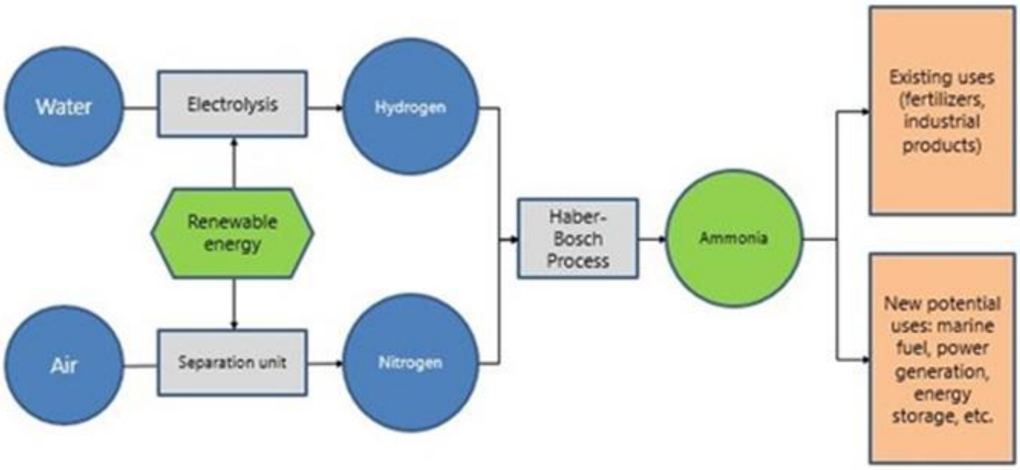


Figure 6-5: Green ammonia production and end uses

Anhydrous NH_3 is easily stored in bulk tanks and used widely as an agricultural fertilizer as well as in industrial processes. When powered by renewable energy sources (i.e. wind or solar generated electricity) the production process is 100% carbon-free. NH_3 can also be used as a fuel in combustion engines (releasing nitrogen and water vapour as opposed to harmful emissions associated with the combustion of fossil fuels) or it can be cracked back into its components and the separated hydrogen used in other applications e.g. a fuel cell for charging battery powered electric vehicles. Hydrogen derived from renewable sources is also a viable substitute for fossil fuels, however, is difficult to store and transport in bulk. NH_3 is an effective and safe storage medium for hydrogen. Green Ammonia as a hydrogen carrier, thus presents an opportunity to capture renewable energy in a form that can be stored, safely transported and used in multiple applications.

The only solid waste stream is the production of brine from the water treatment plant. Ammonia spillages may occur however these will be accidental and mitigation measures will be developed and implemented, including amongst others suitable containment related to storage and emergency response measures.

A gaseous ‘waste’ (oxygen) is generated from the electrolyses process. Another source of gaseous ‘wastes’ is from the Air Separation Unit. This is where nitrogen is removed from the air and the other natural gases as expelled back to the environment.

A simplified flow process diagram is shown in **Figure 6-6** and **Figure 6-7**

The production, storage and transport of hydrogen and ammonia is an industry undergoing in-depth research and developments. Consequently, technological solutions are constantly being improved and changing. Thus, the below Facility description is based on available technological solutions, however, the underlying fundamentals will remain.

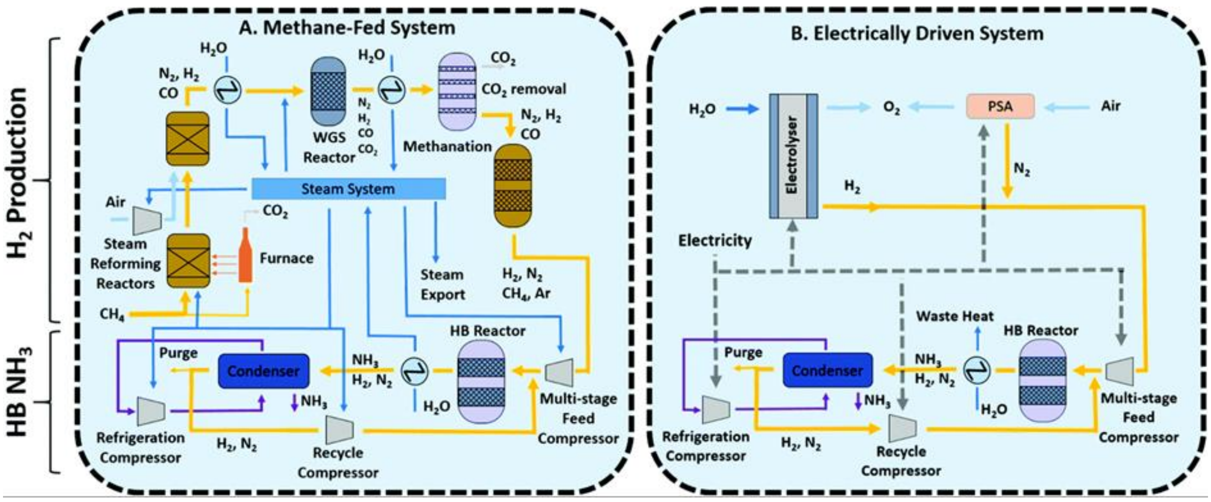


Figure 6-6: Simplified process flow diagram- traditional ammonia vs green ammonia production

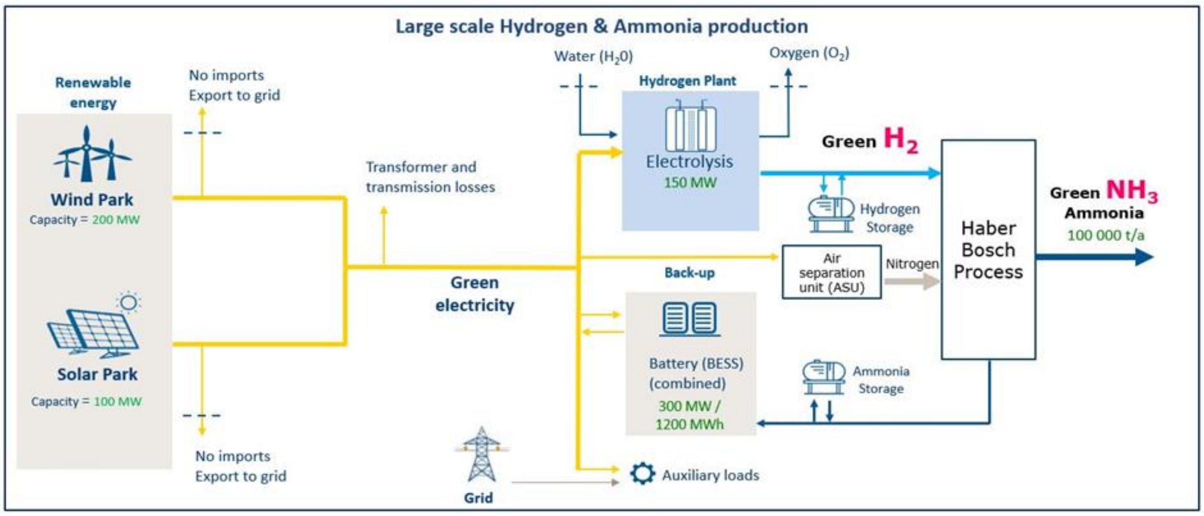


Figure 6-7: Simplified green hydrogen and ammonia production life cycle example

6.3 PROJECT INFRASTRUCTURE

The facility comprises the following components as summarised in **Table 6-3**, where the footprint and capacities are presented. An indicative block layout of the GH&A Facility is illustrated in **Figure 6-8**.

These parameters on based on the assumption that an up to 150MW electrolyser is installed (maximum). These components are detailed further below, but comprise the following general components:

— Water treatment.
— Electrolyser.
— Air separator.
— Ammonia processing unit.
— Liquid air energy system (LAES) for nitrogen storage.
— Feedstock and product storage.
— Utilities.
— Gantry and loading bay.

— Up to 132kV overhead powerline from the substation to the facility

Associated infrastructure further includes:

— Electrical infrastructure required for power supply to the facility, including battery energy storage system (BESS). The Battery Energy Storage System (BESS) footprint will be up to 5 ha. The BESS storage capacity will be up to 100MW/400megawatt-hour (MWh) with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology however the specific technology will only be determined following Engineering, Procurement, and Construction (EPC) procurement. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers. The BESS components will arrive on site pre-assembled.
— Temporary and permanent laydown areas required for temporary storage and assembly of components and materials.
— Access road/s to the site and internal roads between project components, with a width of up to up to 8mt wide respectively.
— A temporary concrete batching plant (if necessary).
— Temporary staff accommodation.
— Fencing and lighting.
— Lightning protection.
— Telecommunication infrastructure.
— Stormwater channels.
— Water pipelines.
— Offices.
— Operational control centre.
— Operation and Maintenance Area / Warehouse / workshop.
— Ablution facilities.
— A gate house.
— Control centre, offices, warehouses.
— Security building.

Access to the site is possible primarily via an unnamed gravel road immediately off the N11 (south of Ermelo town). Existing roads will be used where feasible and practical.

Table 6-3: Summary of Facility Components

NO.	COMPONENT	APPROXIMATE FOOTPRINT (HA)	STORAGE CAPACITY (M^3 / TONS)	MAXIMUM THROUGHPUT (M^3 / TONS PER ANNUM)	NOTE
1	Water Reservoir	2	6 800 / 6 800	800 / 800	Process and utilities water
2	Water Treatment Unit	1.5	N/A	1 161 100 / 1 161 100	Process and utilities water
3	Electrolyser Unit	1	N/A	(1 239 157 – 301 932 367) / 20 000	Hydrogen Output Oxygen Output
4	Air Separation Unit	0.5	N/A	92 905 405 / 110 000	Nitrogen Input
5	Ammonia Processing Unit	2	N/A	149 253 / 100 000	Ammonia Output

NO.	COMPONENT	APPROXIMATE FOOTPRINT (HA)	STORAGE CAPACITY (M^3 / TONS)	MAXIMUM THROUGHPUT (M^3 / TONS PER ANNUM)	NOTE
6	Liquid Air Storage System (LAES)	1	3 983/ 3 505	460 227 / 405 000	Nitrogen Storage
7	Liquid Ammonia Storage Tank	2	2 273/ 1 523	261 194 / 175 000	
8	Hydrogen and Oxygen Storage Tank Farm	12	59 566/ 800	5 576 208 / 90 000	Hydrogen and Oxygen storage (combined tank farm), i.e. feedstock storage
9	Ancillary infrastructure	3	n/a	n/a	Includes temporary and permanent laydown areas, parking, offices and other related infrastructure.
	Total Footprint	~ 25			

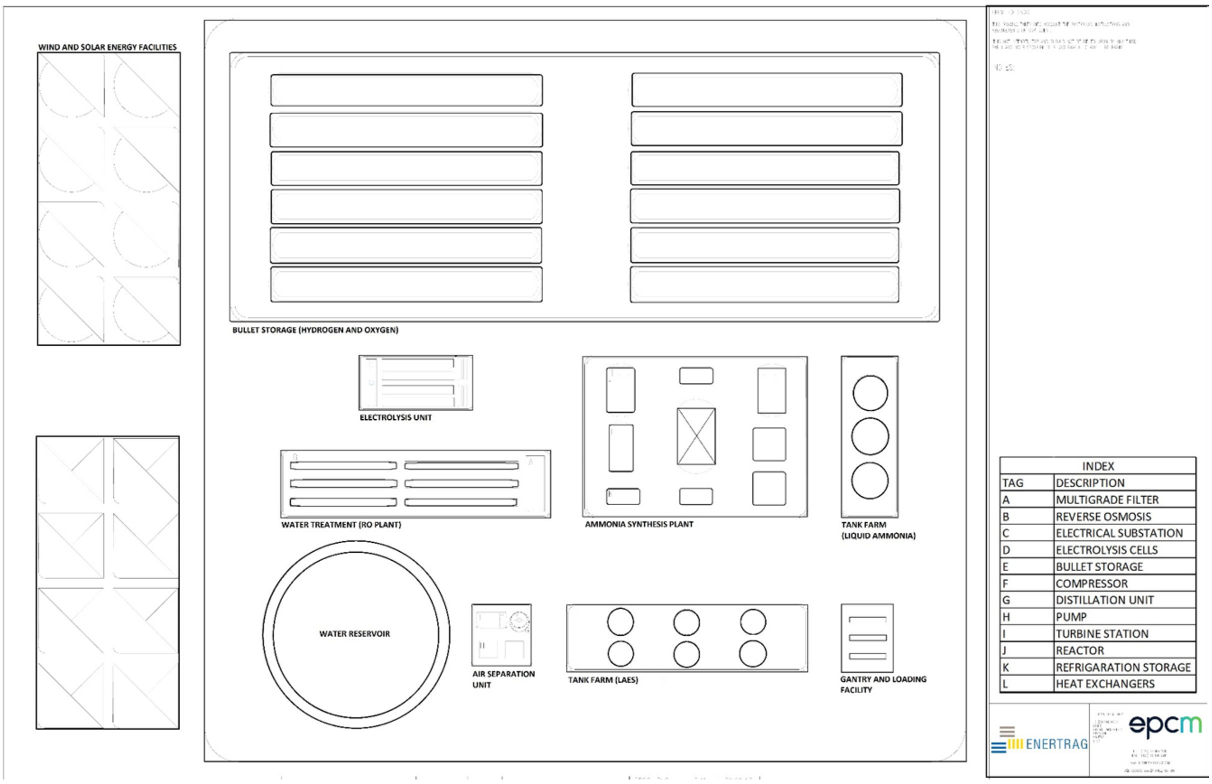


Figure 6-8: Indicative block layout of the proposed hydrogen and ammonia plant

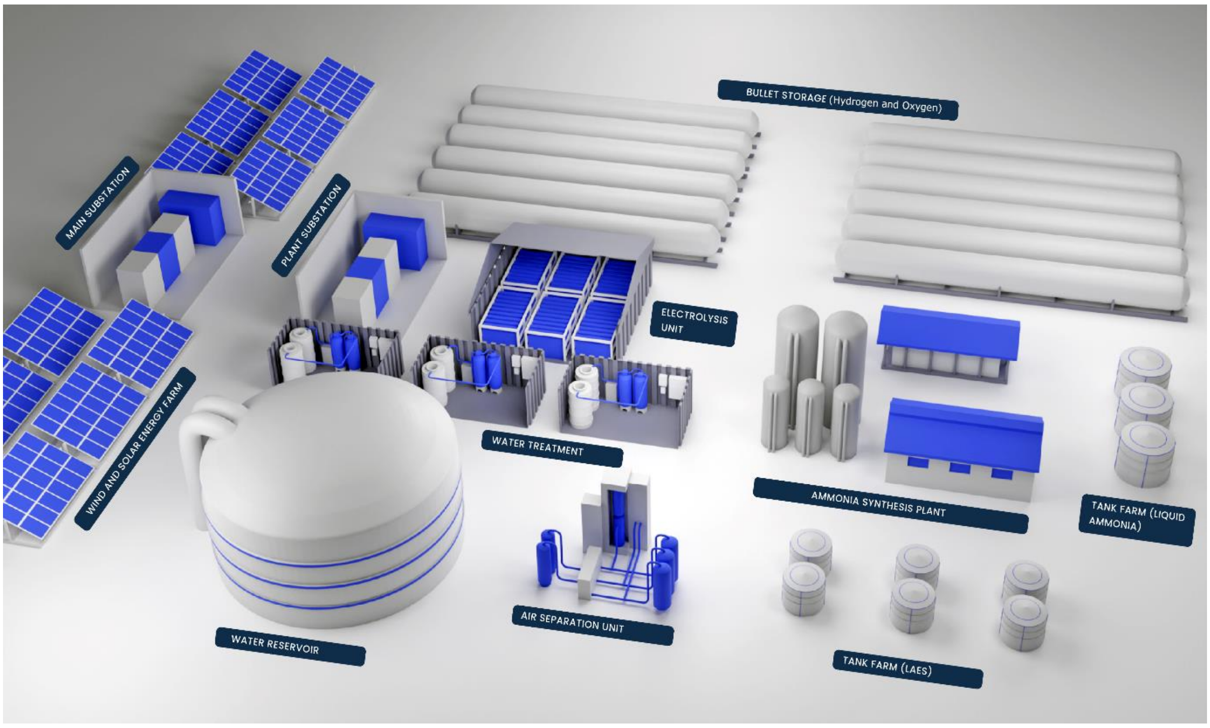


Figure 6-9: Possible Green Hydrogen and Ammonia plant layout

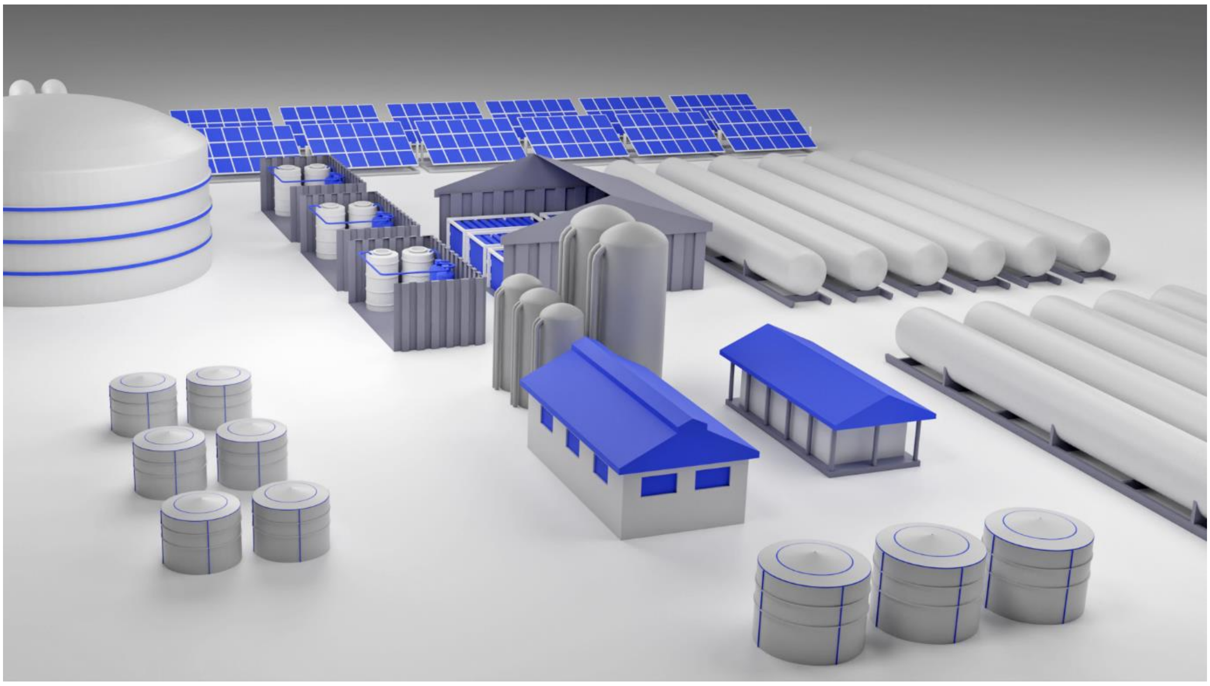


Figure 6-10: Possible Green Hydrogen and Ammonia plant layout

6.3.1 WATER RESERVOIR

Water is required for the production of hydrogen and for heating and cooling purposes. Feedstock water will be stored in a water reservoir with a footprint of up to 1.5ha and a capacity of approximately 6800 m^3. It is proposed that three water reservoirs will be located on site. Each reservoir will have a diameter of up to 25m and a height of 6m (maximum height up to 15m), pending detailed design. The water reservoirs will consist of either reinforced concrete or steel cylindrical tanks (**Figure 6-11**). The precise design will be determined during the detailed design engineering phase.

A variety of water sources are being investigated for the broader development, and include the following:

- Groundwater: Various boreholes may be utilised across the project site for extraction of construction and operational water requirements.
- Municipal water: Where available, water may be sourced for construction and operation from municipal reticulation.
- Purified wastewater: Wastewater from nearby commercial or mining facilities could be sourced to provide the facility with water. This would depend on availability of suitable quality wastewater and agreements with the respective entities involved. It is also possible that water may be sourced from existing surrounding mining operations that are experiencing or anticipating mine water decant from their operations.
- Usutu pipeline (preferred option): Bulk water infrastructure currently feeding the surrounding coal mines and power stations (specifically Eskom Camden Power Station) may be utilised for construction and operational water. Initial water results indicate good quality supply in sufficient quantities is available. This option is the preferred water sourcing for the development
- Correspondence towards availability of water between the DWS and the proponent confirmed that the Department of Water and Sanitation have sufficient supply available from the Usutu bulk water supply scheme, contingent on a successful application for a water use license and abstraction point with the Department of Water and Sanitation.

Figure 6-11: Typical water reservoir (left - concrete, right - steel)

WATER PIPELINE

As mentioned above, the preferred water source will be to connect to the Usutu Pipeline. Therefore, an above or below ground water pipeline will be constructed for the continuous or intermittent supply of water to the GH&A facility.

The pipeline will comprise a concrete pressure pipe, ductile iron pipe, galvanised iron or steel pipe, GRP/GRE pipe, Poly Vinyl Chloride Pipes, High Density Poly Ethylene pipes or other suitable material as required by the detailed design phase, situated (where buried) within a trench of up to 3m wide and up to 2m deep. Where required for the avoidance of obstacles, horizontal directional drilling may be utilised for installation. The pipe will carry raw water of up to 1 161 100 m^3 per annum at a throughput of up to 37 litres per second (usage requirements varying between the construction and operational phases). The pipeline inner diameter will be up to 200mm. Major components will include:

- Pipeline segments comprising pipeline length of up to 9.5km.
- Concrete supports (where pipeline is located above ground)
- Pumps (including pump, electrical or oil engine and panel board) housed in pump house for security and safety
- Mains and sumps (if needed)
- Manholes for inspection, with concrete covers. To be spaced no further than 100 metres apart.
- Valves (various, for example sluice, air, scour etc.) as required

— Water and flow meters
— Pipe fitting pieces, joints, clamps, adaptors and couplings as needed
— Bedding material as needed (concrete, sand, tamped down soil) where trenched
— Electrical source for pumps
— Protection systems (pipeline inner liner and outer coating), cathodic protection, pressure meters).

Four water supply pipeline alternatives are being considered, as follows:

— Alternative 1: Preferred Site to Usutu Scour 2 (~3.3km);
— Alternative 2: Alternate Site to Camden Power Station Confluence (~9.4km);
— Alternative 3: Alternate Site to Usutu Scour 2 (~8.5km); and
— Alternative 4: Preferred Site to Camden Power Station Confluence (~4.2km).

The surface area required for the trenching, assuming a 3m wide trench for the full length of the entire pipeline will be up to 3 ha.

6.3.2 WATER TREATMENT

Water is required for the production of hydrogen and for heating and cooling purposes. The water treatment facility will be housed in a warehouse with a footprint of 1 ha. The feedstock water will be treated using reverse osmosis (RO) to remove wastes such as brine salt.

The RO system consumes between 10 - 16 litres of water per kg - of hydrogen produced, however water consumption ultimately depends on the quality of the feed water and the amount of cooling water required in the electrolysis process. The water treatment facility is estimated to consume up to 1 161 100 tons per annum (tpa) of water per annum, which includes an estimated 2 000 tpa for utilities related to general running of the plant. This may increase, depending on the water source and quality obtained as well as the cooling water required, to between 500 420 m^3 per annum and up to 1 161 100 m^3 per annum.

Purified water from the water treatment facility is the main input to the next step in the process, namely the electrolyser.

BRINE HANDLING

Water treatment is associated with the generation of concentrated wastes removed from the water, such as brine salt. The quantity of brine produced is directly related to the quality of the feedwater and efficiency of the RO process. Based on standard tap water, it can be assumed that for every 10 litres of purified water there will be 4 litres of bine produced. Liquid brine can be made into a solid through several available technologies such as, settlement tanks, cooling water circuits, and forced crystallization.

Based on the water samples taken to date and the quality of the Usutu pipeline feedwater, a total dissolved solids content of around 100-200mg/l is anticipated. Should the plant consume up to 192 000 tons of water, this would result in a maximum of 38 tons of solid salt being created per year (~105kg per day) assuming all salts are removed. This may increase, depending on the water source and qualities obtained, to approximately 232 tons per annum = 636kg per day (0.74m^3 of salt per day). This represents the worst-case scenario.

Liquid brine can be dewatered to recycle water and reduce the need for new input water. This dewatered, solid brine can be stored onsite in waste skips and can be readily disposed at the nearest suitably licenced waste disposal facility.

Alternatively, the wastewater can be used for irrigation water for the local famers by diluting the concentrated liquid brine with additional fresh water, or where possible re-used process water from the RO plant.

In addition, should sufficient quantities of feed water be available, brine can be diluted with fresh feedwater and used for Solar PV panel washing, dust suppression or similar use.

CRYSTALLIZATION

Crystallization is the production of a solid (crystal or precipitate) formed from a homogeneous, liquid which is concentrated to supersaturation levels (concentration > solubility) at that temperature. The crystallization processes utilised has not been selected and will be determined at detailed designed phase based on likely permeate constituents and concentration levels, however, may comprise any of the following:

— Supersaturation by cooling the solution with trivial evaporation;
— Supersaturation by evaporation of the solvent with little cooling;
— Evaporation by a combination of cooling and evaporation in adiabatic evaporators (vacuum crystallizers).

In addition, various crystaliser technologies may be utilised including steam driven, thermocompression driven, vapour compression cycling and calandria crystallisers, amongst others, depending on the final design.

Crystallisation essentially comprises three broad steps:

— Pre-concentration: Electrical, concentration-gradient or temperature gradient driven permeable membrane concentration step, which increases the TDS of the feedwater.
— Evaporation: Flash evaporation, multiple distillation or increased vapor pressure condensation of the concentrated brine to reduce the water content of the brine.
— Crystallization: achieving and promoting crystal development in the brine via heating or spray drying the until supersaturation is achieved.

Crystallisers typically comprise various interconnected modules placed on contained skid systems, which house heaters, vaporators, vapor washers, compressors, motors and zero liquid discharge packages. Ancillary equipment include pumps, platforms and decking, instrumentation, control panels, insulation, valving, electrical systems and wiring, piping, and starter motors (if required). **Figure 6-12** and **Figure 6-13** provide a 3D rendering and simplified flow diagram of a typical Zero Liquid Discharge system respectively.

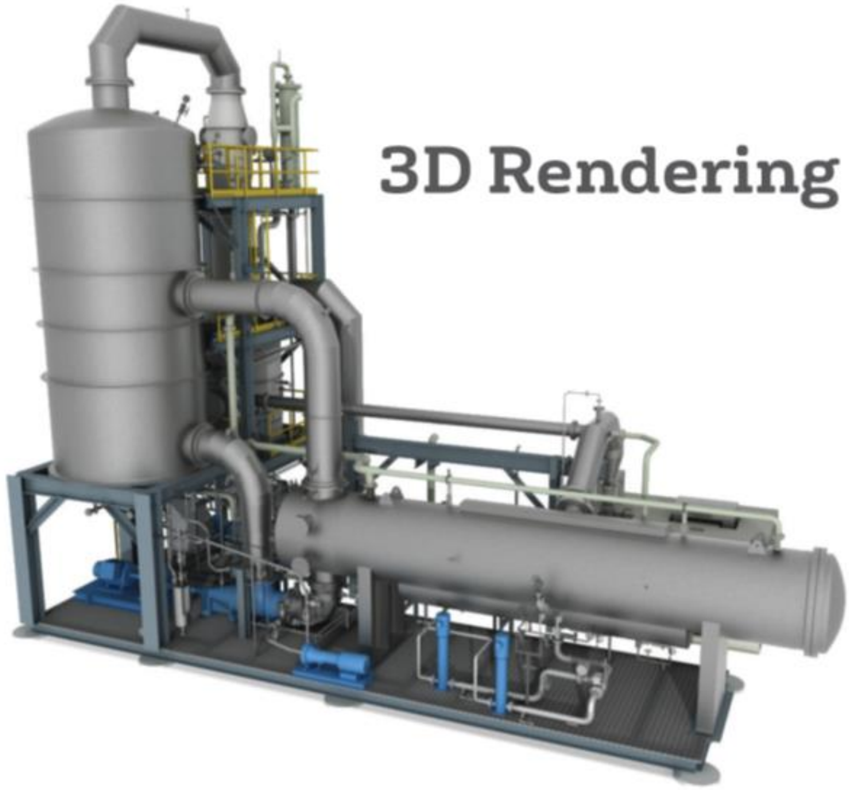


Figure 6-12: 3D Rendering of a typical Crystalliser (Source: Veolia)

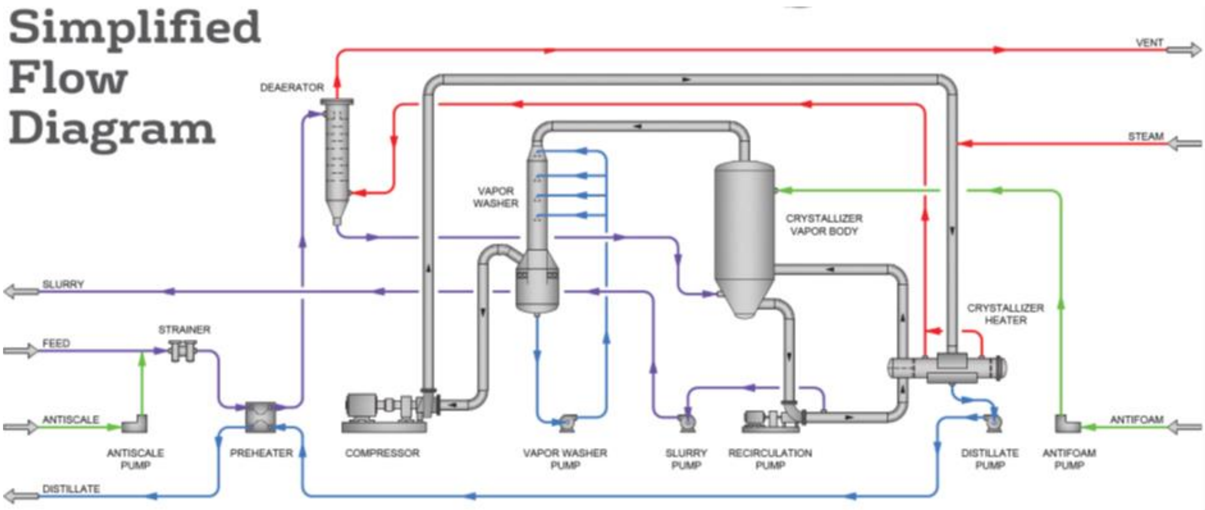


Figure 6-13: Simplified Flow Diagram of a typical Crystalliser (Source: Veolia)

The product of this zero liquid discharge (ZLD) crystallisation process is a salt ‘cake’ (i.e. solid block of typically mixed minerals and trace metals crystals of various sizes). The resulting cake is typically about 10% moisture. This can be somewhat controlled by adjusting the filtering and drying cycle times, reducing moisture content down to approximately 5%.

The resulting salt cake is then temporarily stored in a hazardous waste skip within a bund on-site which is then removed at regular intervals (no longer than two-weekly) by a third-party waste management company. This third-party waste management company will be suitably licenced for disposal and treatment of both general and hazardous waste. The waste contractor will take the necessary steps to treat the salt cake should it be required, prior to disposal. The third-party waste management company will provide a disposal certificate from a licenced landfill site that is authorised to accept and dispose of such waste.

6.3.3 ELECTROLYSER (UP TO 150MW)

The up to 150MW electrolyser will be housed in a warehouse building and will have a footprint of up to 1ha.

Purified water from the treatment plant will be fed through the electrolyser using electric current (renewable energy provided from the WEF) to separate water molecules ($2H_2O$) through a reduction-oxidation process, into hydrogen gas ($2H_2$ on that cathode side) and oxygen gas (O_2 on the anode side). Electrolysers are modular and currently range in size from 5MW – 20MW. It is proposed that 15 sets of 10 MW electrolysers (150 MW in total) be installed with the capacity to produce 20,000 tonnes per annum (tpa) of ‘green’ hydrogen and 100,000 tpa of ‘green’ ammonia. Each electrolyser unit will be powered through its own set of transformers and rectifiers. Oxygen will either be released to atmosphere or stored and sold as a by-product. Hydrogen will either be directed to the ammonia production plant or sold directly to interested parties

Two electrolysis technologies may be considered, namely alkaline- and polymer electrolyte membrane electrolysis (‘PEM’) (**Figure 6-14**). The most likely technology to be used in the PEM, however this will only be confirmed once detailed engineering design has been completed and EPC contractual arrangements concluded.

Figure 6-14: Example of an Electrolyser Unit (Nel Proton PEM)

6.3.4 AIR SEPARATOR UNIT

The air separation until will occupy a footprint of up to 0.5ha and the intake tower will have a maximum height of up to 40m (due to the height of the 'cold box' – the tallest vertical component of the air separation unit) (**Figure 6-15**).

Air from the atmosphere (approximately 78% nitrogen, 21% oxygen and 1% trace gases) is separated into mainly nitrogen and oxygen using cryogenics (air compression and temperature manipulation), pressure swing adsorption (pressure control) and membrane separation. The air separation unit will have a capacity of 110,000 tpa.

Alternative technologies exist (including Pressure Swing Adsorption (PSA) and Membrane Separation Technologies) and are being evaluated; the most efficient process will be implemented in the final project design.

Figure 6-15: Example of an Air Separation Unit (Linde ECOGAN Containerized System)

6.3.5 LIQUID AIR ENERGY SYSTEM (LAES) FOR NITROGEN PRODUCTION

The LAES will be used to store excess nitrogen collected from the air separation unit. Nitrogen will be cooled and stored in liquid form in insulated vessels at low pressure. The LAES will double as a backup energy source when needed. The system uses pressure changes from the superheating and evaporation of liquified air to turn gas turbines and generate electricity.

Components in the LAES include compressors, ambient and cryogenic heat exchangers, expansion valves, storage vessels, pumps, small turbines and generators.

6.3.6 AMMONIA PROCESSING UNIT

Nitrogen from the air separation unit and hydrogen from the electrolyser will be reacted over a bed of catalyst to form ammonia – as per the standard Haber-Bosch method. This is where stoichiometric amounts of nitrogen and hydrogen are reacted to produce ammonia. The conversion is typically achieved at 100 barg and between 400 - 500 °C to favour the formation of ammonia at equilibrium. A catalyst is also used to favour the production of ammonia.

The ammonia gas will be rapidly cooled to form anhydrous ammonia. Unreacted nitrogen and hydrogen will be recycled back to the reactor. At full capacity, the facility will produce up to 100,000 tpa of Green Ammonia for market.

Typical components of an ammonia production plant include compressors, filters, reactor chamber and beds, heat exchangers, water storage vessels, condensers, separators, circulators, absorbers and gas release valves (**Figure 6-16**).

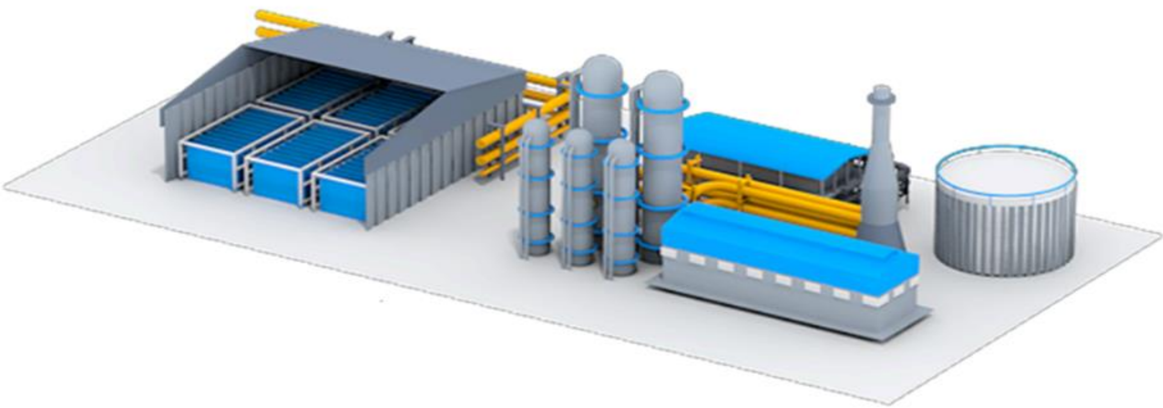


Figure 6-16: Example of integrated hydrogen and ammonia complex (ThyssenKrupp)

6.3.7 STORAGE TANKS -GENERAL

Storage Tanks can be stored in pressurised as or gas in liquid form through the utilisation of a variety of specialised tanks. There are different kinds of storage tanks designs to store anhydrous ammonia, these include but are not limited to:

— *Fixed roof tanks:* Fixed roof storage tanks are cylindrical storage containers that have flat or conical roofs joined to the shell. These storage tanks are often used to store large quantities of petroleum distillates, petrochemicals, and other liquid chemicals at atmospheric pressure. When the level of fluid in the tank rises and falls, air and vapor are pushed out and drawn into the tank headspace. Consequently, the vapor is lost into the atmosphere during the process of emptying the tank. A double-walled tank is designed to provide secondary containment by enhancing the protection against tank failure. It can be customized by adding ultrasonic level indicators, leak detectors, and tank ladder assemblies to identify and monitor in case of any leakage. Below are examples of fixed roof storage tanks

— *Floating roof tanks*: The roof of floating roof tanks floats above the liquid stored at atmospheric pressure. The roof rises and falls as the fluid does. Consequently, floating roof tanks reduce vapor loss, fire, and tank collapse hazards of fixed roof storage tanks.
— *Low-temperature storage tanks*: Low-pressure storage tanks are insulated tanks. These kinds of tanks are more suitable to store volatile liquids for atmospheric storage. They are often used to store ammonia, and liquified gases such as butane at a pressure set by their vapor pressure at the working temperature.
— *Pressure tanks:* Pressure tanks are horizontal-welded pressure vessels with elliptical or hemispherical heads known as bullet tanks (**Figure 6-17**). A bullet tank is a storage container that stores natural gas liquids. Bullet tanks are used for high-pressure fluids. Pressure tanks also include spherical pressure tanks known as Horton Spheres and are used to store large quantities of high-pressure fluids.

Figure 6-17: Bullet storage tank (ammonia/hydrogen storage)

6.3.8 STORAGE REQUIREMENTS FOR THE DEVELOPMENT

NITROGEN

Nitrogen will be stored (7-14 days) as a liquid with in large cylindrical cryogenic storage tanks with a combine volume of approximately 4 100 tons of nitrogen. A storage tank is usually considered to have 85% usable capacity, this is to allow 15% vapor space to allow for expansion. It is proposed that the facility will house up to two cylindrical cryogenic storage tanks. Each tank will have a diameter of up to 14m and a height of up to 15m with a capacity of up to 2032 tons.

AMMONIA

Green ammonia will be stored as anhydrous liquid ammonia, using similar storage equipment as that utilised for storage of Liquid Natural Gas (LNG), i.e. in a storage tank farm (**Figure 6-18**). Ammonia storage tanks are containers used to store ammonia as liquid or compressed gases. Anhydrous ammonia (gas or liquid) is a colourless gas with a sharp smell under atmospheric conditions. The temperature of anhydrous ammonia increases with the increase of surrounding temperature resulting in the vapor pressure in the tank to increase. Thus, it is important to store anhydrous ammonia in containers that can withstand the physical and chemical properties of the liquid form.

Figure 6-18: An example of a Liquid Ammonia Storage System (Source: Energas)

Anhydrous ammonia will be stored within large cylindrical cryogenic storage tanks with a combined volume of 3 750 tons of ammonia. A storage tank is usually considered to have 85% usable capacity, this is to allow 15% vapor space to allow for expansion.

It is proposed that the facility will house up to three cylindrical cryogenic storage tanks. Each tank will have a diameter of up to 14m and a height of up to 15m with a capacity of up to 1250 tons each.

HYDROGEN

Hydrogen is stored in vertical or horizontal storage bullets **(Figure 6-19**). Compressed hydrogen can be storage as a gas or in liquid form. Compressed hydrogen can be stored at ambient temperature. Up to 800 tons of hydrogen will be stored at the facility, in conjunction with that of the oxygen stored on site, in a tank farm of up to 12 ha. The facility will house up to 20 horizontal pressure bullets for the storage of hydrogen. Each bullet will have a diameter of up to 4m and a length of up to 15m.

Figure 6-19: Example of a compressed Hydrogen Storage – horizontal tank

OXYGEN

Oxygen will be stored in vertical or horizontal storage bullets and stored under high-pressures. The tanks have a vacuum-insulated double wall consisting of two concentric vessels, a steel inner tank and an outer jacket in carbon steel. Up to 800 tons of oxygen will be stored at the facility, in conjunction with that of the hydrogen stored on site, in a tank farm of up to 12 ha. It is proposed that the facility will house up to 16 vertical cryogenic storage bullets for the storage of oxygen. Each bullet will have a diameter of up to 4m and a length of up to 15m.

6.3.9 GANTRY AND LOADING BAY

Ammonia is easily transported by truck and rail as a pressurized liquid. Three loading gantries were assumed where international organisation for standardisation (ISO) containers can be filled with anhydrous ammonia and trucked to an export port location, or similar consumer or off-take point (for example nearby railroad sidings). The following equipment forms part of these gantries:

- Custody transfer metering.
- Loading arm with coupling.
- Control valve.
- Control unit.

6.3.10 BESS

The BESS facilities will run 7 days a week for 24 hours a day. Although the system will be largely automated with a battery management systems and electronic operator interface etc, it will still require attention from operators and maintenance staff. The facility will need routine checking / preventative and breakdown maintenance / grass cutting / security etc. During normal operations there could be approximately 5 persons on site during the day depending on the activities taking place and possibly one or two operators as well as security personnel at night.

Two types of battery energy storage systems are being investigated. One of the types of battery technology being considered for the BESS would be vanadium redox flow batteries (VRF). The project will employ utility scale batteries. These energy storage systems can be supplied either as containerized units or as a fixed installation within a building etc. Due to the proposed size of the facility (200MW) the Camden facility is currently envisioned as having units housed within a large battery building.

The other type of battery technology being considered for each BESS would be a Solid-State Battery which consists of multiple battery cells that are assembled together to form modules. Each cell contains a positive electrode, a negative electrode and an electrolyte. The BESS will comprise of multiple battery units or modules housed in shipping containers and/or an applicable housing structure which is delivered pre-assembled to the project site. Containers are usually raised slightly off the ground and layout out is rows. They can be stacked if required although this may increase the risk of events in one container spreading to another container. Supplementary infrastructure and equipment may include substations, power cables, transformers, power converters, substation buildings & offices, HV/MV switch gear, inverters and temperature control equipment that may be positioned between the battery containers. The solid-state batteries that are being considered are Lithium-ion systems.

VANADIUM REDOX FLOW BATTERY

All electrochemical energy storage systems convert electrical energy into chemical energy when charging, and the process is reversed when discharging. With conventional batteries, the conversion and storage take place in closed cells. With redox flow batteries, however, the conversion and storage of energy are separated.

Redox flow batteries differ from conventional batteries in that the energy storage material is conveyed by an energy converter. This requires the energy storage material to be in a flowable form. In redox flow batteries, charging and discharging processes can take place in the same cell. Redox flow batteries thus have the distinguishing feature that energy and power can be scaled separately. The power determines the cell size, or the number of cells and the energy is determined by the amount of the energy storage medium. In theory, there is no limit to the amount of energy that can be produced and/or stored thereby allowing for scalability of these systems.

Figure 6-20 shows the general operating principle of redox flow batteries. The energy conversion takes place in an electrochemical cell which is divided into two half cells. The half cells are separated from each other by an ion-permeable membrane or separator, so that the liquids of the half cells mix as little as possible. The separator ensures a charge balance between positive and negative half cells, ideally without the negative and positive active materials coming into direct contact with each other. In fact, however, separators are not perfect so some cross-over of the active materials always occurs and this leads to the self-discharge effect.

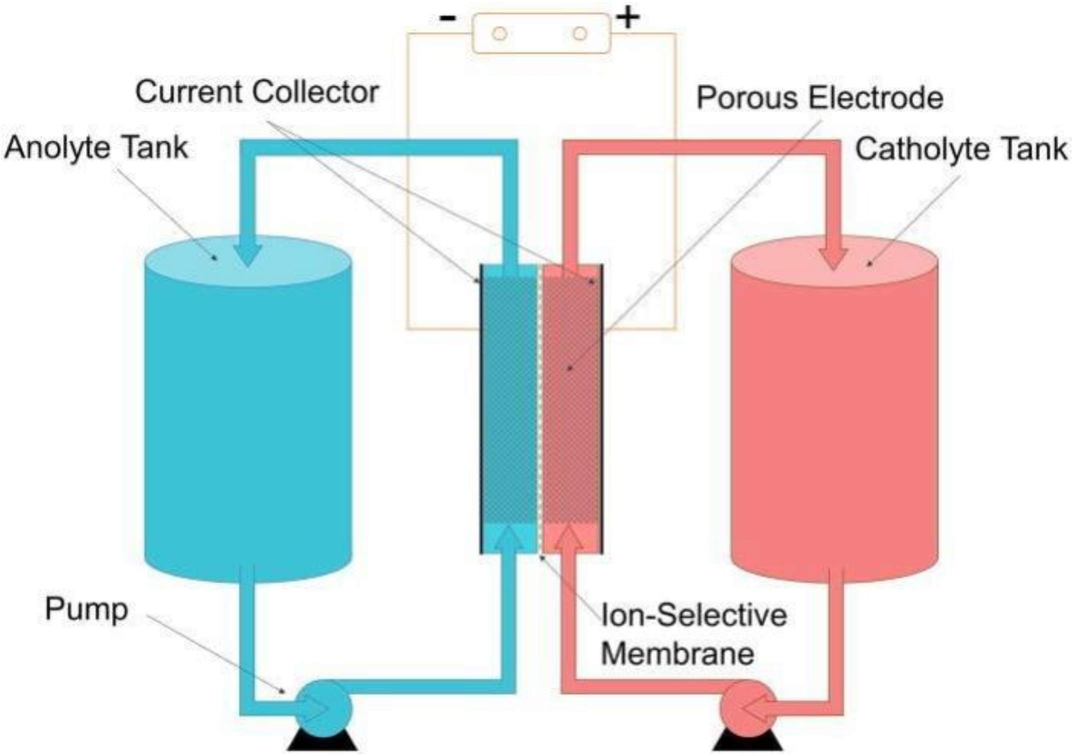


Figure 6-20: Schematic Diagrams of Redox Flow BESS Systems

The vanadium redox battery (VRB), also known as the vanadium flow battery (VFB) or vanadium redox flow battery (VRFB), is a type of rechargeable flow battery that employs vanadium ions in different oxidation states to store chemical potential energy. The vanadium redox battery exploits the ability of vanadium to exist in solution in four different oxidation states and uses this property to make a battery that has just one electroactive element instead of two. In redox flow batteries, the electrodes should not participate in the reactions for energy conversion and should not cause any further side reactions (e.g. undesirable gas formation). Most redox flow batteries are therefore based on carbon electrodes.

The redox pair VO2+/VO2+ are at the positive electrode and the redox pair V2+/V3+ at the negative electrode. The use of the same ions in the positive and negative electrolytes permits relatively high concentrations of active material. It also overcomes the cross-contamination degradation issues which plague other flow type batteries. The energy storage solution consists primarily of vanadium sulphate in a diluted (2mol/L) sulphuric acid (possibly containing a low concentration of phosphoric acid) and is therefore roughly comparable to the acid of lead/acid batteries. The energy density is limited by the concentration of the pentavalent + VO2.

The vanadium redox flow battery is without doubt the best investigated and most installed redox flow battery. For several reasons, including their relative bulkiness, most vanadium batteries are currently used for grid energy storage, i.e., attached to power plants or electrical grids. Currently, there are over 100 VRFB installations globally with an estimated capacity of over 209,800 kWh of energy and the use of vanadium in energy storage applications has doubled to 2.1% of the global vanadium consumption in 2018.

SOLID STATE LITHIUM BATTERY

One of the battery types being considered by the project proposes is lithium-ion based solid state batteries. Lithium-ion based battery systems are becoming one of the dominant technologies for utility systems in Europe and America. For this reason, this assessment assumes that lithium-based batteries will be used in the Camden BESS facilities. Should sodium-based batteries be used, the hazards are likely to be similar at a high level but different in their details, and therefore the risk assessment may need to be reviewed.

Primary (non-rechargeable) batteries use lithium metal anodes. Lithium is one of the lightest and most reactive metallic elements and is highly reactive towards water and oxygen. Exposure of lithium metal to water even as humidity can decompose exothermically to produce flammable hydrogen gas and heat. These lithium metal batteries are not used in BESS systems. However, if secondary batteries discussed below are charged at temperatures below 0 deg C, then lithium can plate out onto the anode surface and in this manner lithium metal could be present even in lithium-ion batteries.

Secondary, rechargeable lithium batteries as used in bulk battery energy storage systems, use cathodes that contain lithium in the crystal structure of the cathode coating and/or lithium salts in an electrolyte that is in the battery. These are called lithium -ion batteries. Lithium-ion batteries operate at room temperature and have significant limitations outside the 0 – 50 deg range. The exact lithium-ion composition of the batteries can vary with suppliers. In addition, the technology allows for many combinations of chemistry to suit the particular application.

The lithium in the batteries is usually in the form of lithium salts dissolved in an electrolyte solution that is absorbed within the electrodes and/or lithium plated onto the surface of the electrode. These are referred to as solid state batteries because electrolyte liquid is not freely available in a form that can easily leak or be extracted. The electrolytes are typically ethylene carbonate or di-ethyl carbonate. The flash points of these carbonates can vary from 18 – 145 deg C which means they can be highly flammable (FP < 60 deg C) or merely combustible if involved in an external fire (FP > 60 deg C). Some of the lithium compound in the electrolyte include lithium hexafluorophosphate, lithium perchlorate, lithium cobalt oxide etc.

It is important to note that the selection of specific technology will only be determined following EPC (i.e. no technology preference is specified and implementation of both are considered reasonable and feasible), therefore both types of battery technologies have been considered in the EIA. The potential risks and impacts of the proposed BESS have been assessed as part of this EIA. Both BESS technologies were assessed and no fatal flaws were identified. However, the SSL technology is preferred.

6.3.11 TRANSPORT

Liquid Ammonia may readily be transported via road, rail or a combination of the two

Standard 40ft pressurised road tanker trucks or ISOtainer (20ft length each) are being considered. Volumes will be up to 24 tons per truck load depending on pressured tanker or Isotainer, therefore 12 daily 24ton ISOtainer trucks envisaged. Depending on the final volumes transported, technical and financial feasibility, between 1 – 24 ton road tankers (pressured tanker trucks or ISOtainers) may be utilised.

Railway transport options are also being investigated.

6.3.12 UP TO 132KV POWERLINE

The proposed project will comprise the following key components:

- 1 x up to 132kV transmission line (either single or double circuit) between the Camden Green Hydrogen Facility and the onsite substation.
- The length of the preferred up to 132kV powerline is approximately 100.
- The servitude width for 1x up to 132kVA transmission line is 32m.
- For up to 132kV structures, concrete foundation sizes may vary depending on design type up to 80m^2 (10m by 8m), with depths reaching up to 3.5m typically in a rectangular 'pad' shape. The actual number of structures required will vary according to the final route alignment determined. A working area of approximately 100m x 100m.

6.4 GENERAL CONSTRUCTION ACTIVITIES

The construction process will follow industry standard methods and techniques. Key activities associated with the construction phase are described in **Table 6-4.**

Table 6-4: Construction Activities

ACTIVITY	DESCRIPTION
Site preparation and establishment	Site establishment will include clearing of vegetation and topsoil at the authorised site, including laydown area and access routes. The temporary laydown area will be constructed, including establishment of the construction camp (temporary offices, storage containers, concrete batching plant etc). Site establishment will also entail the installation and/or connection of services (sanitation, electricity etc).
Transport of components and equipment to site	Bulk materials (aggregate, steel etc.), infrastructure components, lifting and construction equipment (excavators, trucks, compaction equipment etc.) will be sourced and transported to site via suitable National and provincial routes and designated access roads. The infrastructure components may be defined as abnormal loads in terms of the Road Traffic Act (Act 29 of 1989) due to their large size and abnormal lengths and loads for transportation. A permit may be required for the transportation of these loads on public roads.
Excavation and earthworks	Subject to the determination of founding specifications, earthworks will be required. This is likely to entail: — Excavation necessary for concrete foundations — Levelling of the plant area, construction camp area, substation area, and O&M building area, and excavation of foundations prior to construction. — Excavation of trenches for the installation of underground cables and material pipelines as needed.
Construction of GH&A facility	A large lifting crane will be required to lift the various components into place. The lifting crane/s will be brought on site.
Establishment of ancillary infrastructure	Ancillary infrastructure will include construction site office, temporary laydown area and workshop area for contractor's equipment.
Rehabilitation	Once all construction is completed on site and all equipment and machinery has been removed from the site, the site will be rehabilitated.

6.5 ALTERNATIVES

The EIA Regulations of 2014 (as amended) require that the S&EIA process must identify and describe alternatives to the proposed activity that were considered, or motivation for not considering alternatives. Different types or categories of alternatives could be considered including different locations, technology types, and project layouts. At the scoping level the evaluation of alternatives is provided at a high level in the absence of detailed environmental comparators for each alternatives; due to the two-staged nature of the S& EIA process it is more suitable to identify and describe the potential alternatives on a high level basis within scoping, and to perform a more detailed analysis of alternatives (with environmental comparators) in the EIA phase of the project. As such, the S&EIA will holistically assess the impacts and risks of each alternative in a comparative way, as suggested by Appendix 2 of the EIA Regulations of 2014 (as amended).

6.5.1 SITE ALTERNATIVES

There are two site alternatives for the Camden I GH&A Facility within the Camden I project area (**Figure 6-21**). Both sites will be investigated in this EIA phase. The corner co-ordinates for the preferred site are outlined in **Table 6-5.**

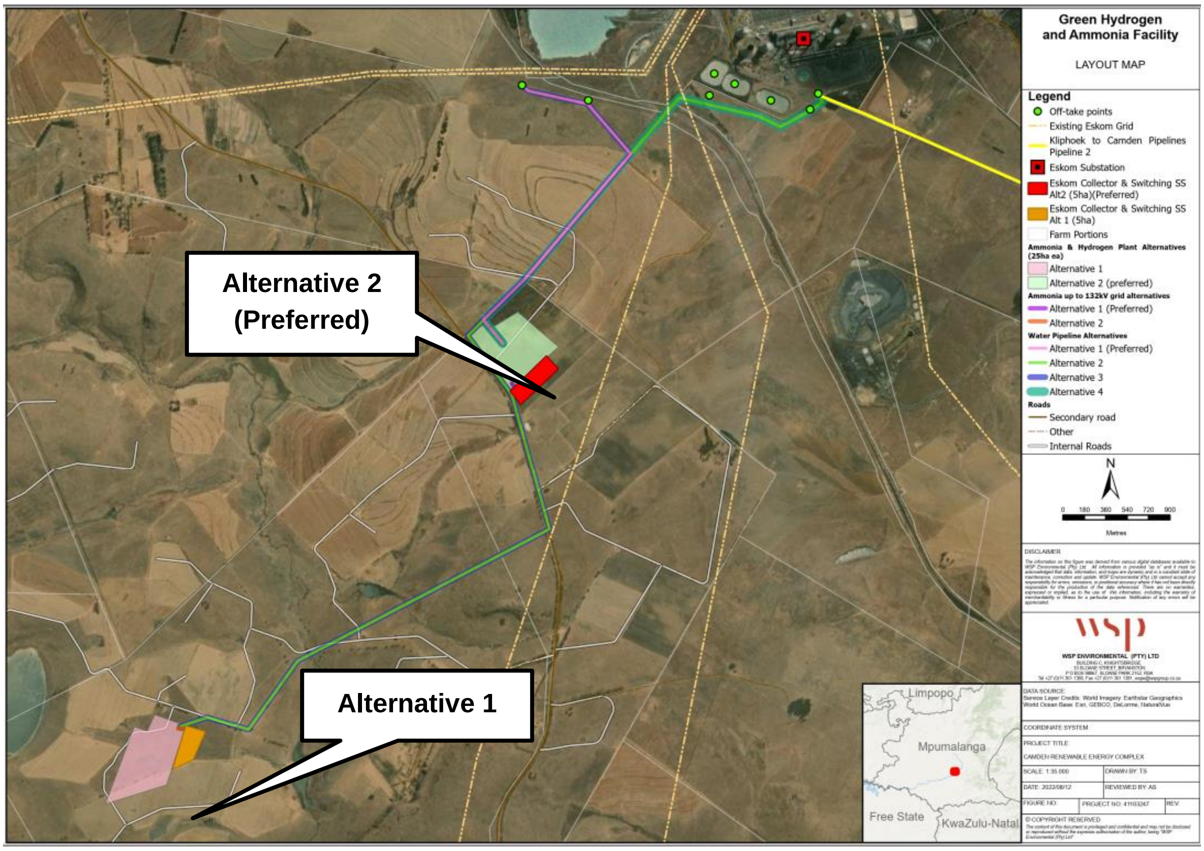
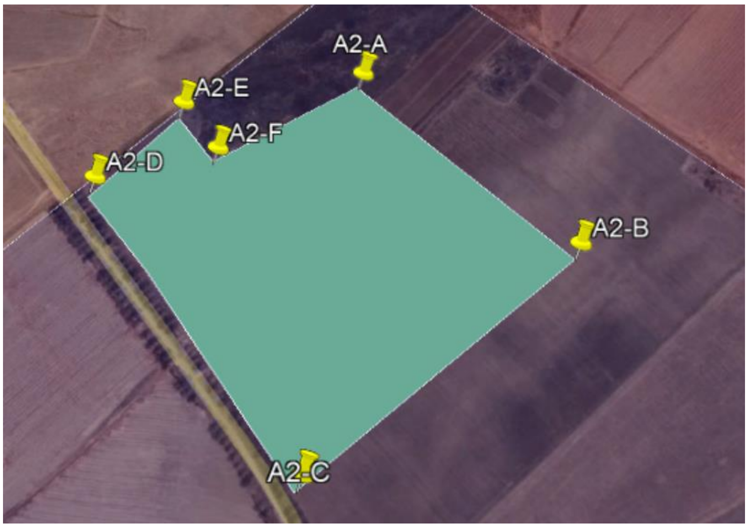


Figure 6-21: Camden I GH&A Alternative Sites

Table 6-5: Camden I GH&A Alternative Site Co-ordinates

POINT	LATITUDE	LONGITUDE
Alternative 1		
		
A1-A	26°40'24.75"S	30° 2'14.10"E

POINT	LATITUDE	LONGITUDE
A1-B	26°40'27.59"S	30° 2'23.60"
A1-C	26°40'43.88"S	30° 2'18.22"E
A1-D	26°40'49.48"S	30° 1'59.69"E
A1-E	26°40'28.21"S	30° 2'7.93"E
Alternative 2- Preferred		
		
A2-A	26°38'32.33"S	30° 4'1.48"E
A2-B	26°38'41.63"S	30° 4'14.16"E
A2-C	26°38'54.03"S	30° 3'59.34"E
A2-D	26°38'39.31"S	30° 3'46.55"E
A2-E	26°38'34.55"S	30° 3'51.22"E
A2-F	26°38'36.98"S	30° 3'53.46"E

6.5.2 LINEAR ALTERNATIVES

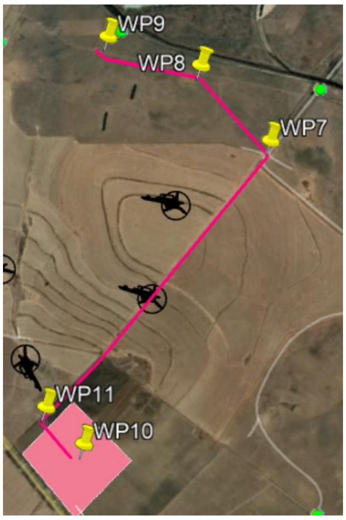
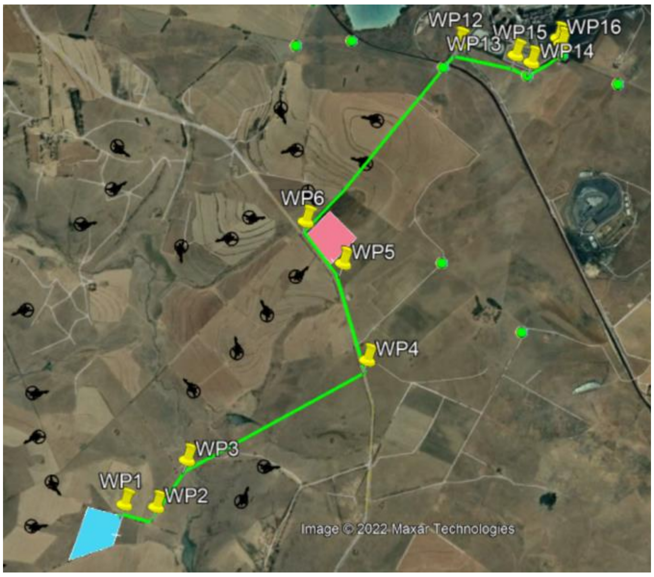
There are four water pipeline alternatives being considered for the supply of water to the Camden I GH&A Facility (**Figure 6-22**). The alternatives being considered are as follows:

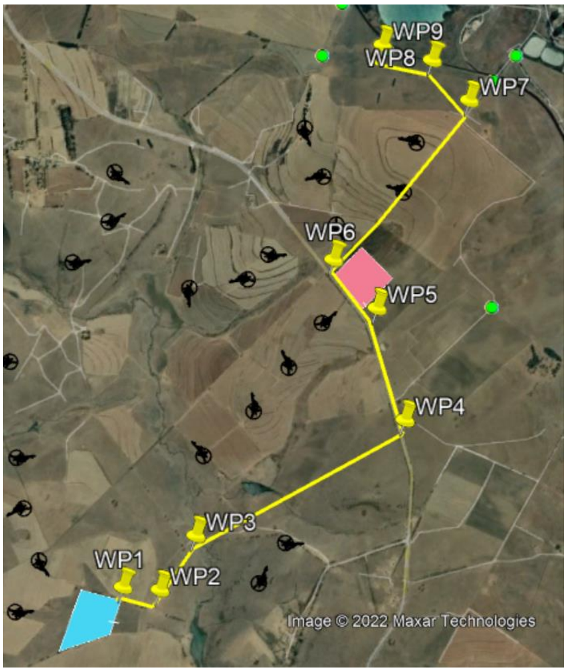
— Alternative 1: Preferred Site to Usutu Scour 2 (~3.3km) (Preferred Alignment);
— Alternative 2: Alternate Site to Camden Power Station Confluence (~9.4km);
— Alternative 3: Alternate Site to Usutu Scour 2 (~8.5km); and
— Alternative 4: Site to Camden Power Station Confluence (~4.2km).

All four alignments have been investigated in the EIA phase. The co-ordinates for the alignments are outlined in **Table 6-6**.

Figure 6-22: Camden I GH&A Water Pipeline Alternative Alignments

Table 6-6: Camden I GH&A Alternative Site – Co-ordinates

POINT	LATITUDE	LONGITUDE
Alternative 1 (Preferred)		
		
WP10	26°38'40.97"S	30° 3'58.68"E
WP11	26°38'34.67"S	30° 3'51.33"E
WP7	26°37'48.45"S	30° 4'34.26"E
WP8	26°37'35.50"S	30° 4'20.72"E
WP9	26°37'30.69"S	30° 4'2.75"E
Alternative 2		
		

POINT	LATITUDE	LONGITUDE
WP1	26°40'26.95"S	30° 2'30.15"E
WP2	26°40'27.77"S	30° 2'43.54"E
WP3	26°40'10.14"S	30° 2'56.36"E
WP4	26°39'32.22"S	30° 4'11.77"E
WP5	26°38'56.03"S	30° 4'1.36"E
WP6	26°38'40.44"S	30° 3'45.49"E
WP12	26°37'33.14"S	30° 4'49.22"E
WP13	26°37'37.40"S	30° 5'13.24"E
WP14	26°37'40.09"S	30° 5'19.93"E
WP15	26°37'32.95"S	30° 5'32.56"E
WP16	26°37'30.92"S	30° 5'31.14"E
Alternative 3		
		
WP1	26°40'26.95"S	30° 2'30.15"E
WP2	26°40'27.77"S	30° 2'43.54"E

POINT	LATITUDE	LONGITUDE
WP3	26°40'10.14"S	30° 2'56.36"E
WP4	26°39'32.22"S	30° 4'11.77"E
WP5	26°38'56.03"S	30° 4'1.36"E
WP6	26°38'40.44"S	30° 3'45.49"E
WP7	26°37'48.45"S	30° 4'34.26"E
WP8	26°37'35.50"S	30° 4'20.72"E
WP9	26°37'30.69"S	30° 4'2.75"E
Alternative 4		
		
WP10	26°38'40.97"S	30° 3'58.68"E
WP11	26°38'34.67"S	30° 3'51.33"E
WP12	26°37'33.14"S	30° 4'49.22"E
WP13	26°37'37.40"S	30° 5'13.24"E
WP14	26°37'40.09"S	30° 5'19.93"E
WP15	26°37'32.95"S	30° 5'32.56"E
WP16	26°37'30.92"S	30° 5'31.14"E

6.5.3 132KV POWERLINE ALTERNATIVES

Each alternative site is accompanied with an up to 132kV grid connection line from the GH&A facility to the on-site substation, **Table 6-7** shows the alternatives proposed and the coordinates.

Table 6-7: 132kV Powerline alternatives

POINT	LATITUDE	LONGITUDE
Alternative 1 (Preferred)		

POINT	LATITUDE	LONGITUDE
PS_A (Start)	26°38'51.84"S	30° 4'0.18"E
PS_B (Finish)	26°38'54.29"S	30° 4'2.35"E
Alternative 2		

POINT	LATITUDE	LONGITUDE
AS_A (Start)	26°40'28.75"S	30° 2'21.24"E

POINT	LATITUDE	LONGITUDE
AS_B (Finish)	26°40'29.27"S	30° 2'24.91"E

6.5.4 TECHNOLOGY ALTERNATIVES

The project is being developed on the basis that a GH&A facility will be established on this site. Therefore, no technology alternatives are being considered for this project. The motivation behind the development of this facility is outlined in **Section 5:Need and Justification.**

ENVIRONMENT

The environment is a key factor when it comes to the development of its projects. It is critical to ensure that its projects are developed in a sustainable manner. All the environmental factors were considered in the area when potential sites were being considered. After a thorough evaluation of the regional farms, the specific farms were selected because they were already heavily disturbed by agricultural and coal mining activities. Thus, it was concluded that the development of these farms would have a minimal impact on the region's flora, fauna and water resources.

TOPOGRAPHY AND SITE ACCESS

The surrounding landscape has a rolling hill topography which is suitable for the development of a GH&A facility. The Project site can be accessed easily via either the tarred N2 and N11 national roads which run along the eastern and western boundaries of the site. There is an existing road that goes through the land parcels to allow for direct access to the project development area. The site is also situated close to the renewable energy projects that are being proposed in parallel with this facility and therefore, the GH&A facility will be close to a reliable source of renewable electricity.

LAND AVAILABILITY

With this region being home to some of the biggest coal power stations in the country (Komati and Camden among many others), most land parcels have been given mining rights for coal beneficiation to provide fuel stock supply these power stations. Thus, there is very limited land available for the development of the GH&A facility. However, sufficient land has been secured for the development of the proposed project with landowners within the respective cadastral portions comprising the development footprint indicating their support and willingness for the project to proceed to development via entering into agreement with the developer.

BESS

There are two technology alternatives which will be considered for the battery energy storage system. These are Vanadium Redox flow batteries (VRFB) and Solid-state Lithium-ion batteries. Both options have been investigated in **Section 6.3.10** and **Section 7.3.7** of this report, and assessed in **Section 8.16**. From a SHE perspective no fatal flaws were found with the proposed VRFB or Lithium Solid-state BESS installations.

6.5.5 LAYOUT ALTERNATIVES

Two conceptual site layouts of the Camden I GH&A Facility has been compiled and is included in **Figure 6-21** above. These layouts are likely to be updated and refined as the project engineering progresses and depending on the sensitivity and technical inputs from the specialists during this EIA phase. The developed site layouts of the Camden I GH&A Facility will only be finalised during detailed engineering design. Outlined below are the proposed layouts/sites alternatives for the facility and its associated infrastructure:

<u>Alternative 1:</u>

- Site Substation & BESS (Alternative 1)
- GH&A Plant (Alternative 1)
- 400kV Powerline (Alternative 1)
- Pipeline Alternative 2: Alternate Site to Camden Power Station Confluence (~9.4km);

— Pipeline Alternative 3: Alternate Site to Usutu Scour 2 (~8.5km)

Alternative 2 (Preferred):

— Site Substation & BESS (Alternative 2)
— GH&A Plant (Alternative 2)
— 400kV Powerline (Alternative 2)
— Pipeline Alternative 1: Preferred Site to Usutu Scour 2 (~3.3km)
— Pipeline Alternative 4: Preferred Site to Camden Power Station Confluence (~4.2km).

Table 6-8: Advantages and Disadvantages of layout alternatives

ADVANTAGES	DISADVANTAGES
Site Alternative 1	
— The only advantage this site has is that it is further from homesteads and the road.	— The closest occupied farmhouse complex is approximately 1.2 km east southeast of the Camden I Green Hydrogen and Ammonia alternative 1 — This site is closer to the pan which is sensitive from avifaunal, bat, ecology and freshwater perspective. — Both Pipeline routes, 2 & 3, cross a watercourse, and are significantly longer (9.4km & 8.5km respectively) therefore, creating a bigger impact and larger footprint. — This location of the BESS (either technology) presents hazards namely, possible loss of containment of electrolyte and possible fires producing toxic smoke and fire fighting which may result in contaminated of firewater runoff. This alternative is closer to a watercourse, therefore increasing the risk of contamination in the event of an emergency.
Site Alternative 2-Preferred	
— The closest formal residential area is at the Camden Power station 5km to the east of the Camden I Green Hydrogen and Ammonia alternative 2. — Site alternative 2 of the Facility is preferred, as it is located in an agricultural habitat and will not have an impact on high quality grassland. — Site alternative 2 is at least 2.2km from the closest occupied facilities, i.e. the Mooiplaats Colliery. — This site alternative has a shorter connection to the preferred collector substation. — In terms of potential impacts, the impacts on Welgelegen 322/1 are unavoidable given its location relative to Eskom Camden substation. However, minimizing the impacts on 322/2 would reduce the potential cumulative impacts and land fragmentation. As such, Alternative 2 located on 322/1 adjacent to Collector Substation Alternative 1 is the preferred option. — Both pipeline alternatives (1&4) have a shorter route connection, 3.3km and 4.2km respectively, ultimately contributing to a smaller footprint and impacted area. — There are no major rivers located close to the site alternative 2 — Pipeline alternative 4 does not affect any natural habitat.	— Water pipeline crosses under 400kV Powerline (Alternative 1) route

ADVANTAGES	DISADVANTAGES
— This site is closer to an existing access road , which allow for less development.	

6.5.6 TRANSPORT ALTERNATIVES

Rail transport

Rail transportation of the ammonia will reduce the traffic loading on the greater road network. The closest rail facility to the potential ammonia plant site is located outside of Ermelo. This rail facility is primarily used to load coal for transport to the Richards Bay coal terminal. There may be an opportunity to load ammonia at this facility, however this has not been assessed. It is assumed that the ammonia will have to be transported via road from site to the Ermelo railway facility.

The option to build a rail loading facility on the railway line outside Camden Power Station, closer to the ammonia plant, is not regarded as feasible due to the cost. Therefore, the impact on the district roads and sections of the N2 and/or N11 to transport the ammonia to the Ermelo rail facility or the greater market will be high, depending on the type of road tankers that will be utilised, refer to **Appendix H-9 Traffic impact Assessment** for further information.

Road transport - ISOtainers

ISOtainers can transport 12 tons of ammonia per 20ft pressurised tank, 2 tanks per vehicle. For a production capacity of 100 000 tons per annum, approximately 8 334 two-way trips are required per annum. If the ammonia is transported during workdays only, 251 days a year, a total of 34 trips (Total IN & out) will be required per day. These trips may occur on any of the district roads, therefore the total per route will be even less, with a lower impact per road.

This very low daily trip generation is expected to have a negligible impact on the Provincial district and National roads. It should be noted that the unsurfaced district roads from the plant to the N11 and/or the N2 may require more regular maintenance. Given these low volumes the Provincial Road authority should be responsible for this routine maintenance. **Road transport – standard pressurised tankers**

Standard pressurised road tankers can transport 1.1 tons of ammonia per 40ft pressurised tank, with 1 tank per vehicle. For a production capacity of 100 000 tons per annum, approximately 181 818 two-way trips are required per annum. If the ammonia is transported during workdays only, 251 days a year, a total of 725 trips (Total In & out) will be required per day. The final location of the plant will determine the route/s to the National Road network (N11 and N2). The total volume of traffic per route may therefore be less. It is however a substantial volume of heavy vehicle traffic that should ideally not use unsurfaced district roads.

Refer to **Table 6-9** below for the summary of modes of transport.

Table 6-9: Transport Alternatives

TRANSPORT TYPE	ADVANTAGES	DISADVANTAGES	SUMMARY
Road and Rail transport	Low impact on local district roads due to lowest heavy vehicle volumes Low impact on local National roads district roads due to lowest heavy vehicle volumes No impact on National road network beyond Ermelo rail facility	**Isotainer transport from plant to rail facility:** — District roads between plant and National road access/es may require more regular maintenance, or upgrade to surfaced standard to reduce long term maintenance cost and dust/noise pollution pending final vehicle routes/volumes	Recommended
		Pressurised road tankers from plant to rail facility: — Highest impact on local road network due to hight daily heavy vehicle volumes — District roads between plant and National road access/es may require upgrade to surfaced standard to reduce long term maintenance cost and dust/noise pollution — Access of district roads onto N11 and N2 to be upgraded for capacity and safety reasons (potentially grade separation)	Not Recommended
Road transport: only with ISOtainers	Low impact on local and regional road network due to lower heavy vehicle volumes	— District roads between plant and National road access/es may require more regular maintenance, or upgrade to surfaced standard to reduce long term maintenance cost and dust/noise pollution pending final vehicle routes/volumes	Recommended
Road Standard pressurised tankers	None	— Highest impact on local road network due to hight daily heavy vehicle volumes — District roads between plant and National road access/es may require an upgrade to surfaced standard to reduce long term maintenance cost and dust/noise pollution — Access of district roads onto N11 and N2 to be upgraded for capacity and safety reasons (potentially grade separation)	Not recommended

It is recommended that only ISOtainers via road is utilised to transport the ammonia from the site to the greater road network and or the Ermelo or other feasible rail facilities.

6.5.7 'NO PROJECT' ALTERNATIVE

In the "no project" alternative, the Camden I GH&A Facility project will not be developed. In this scenario, there could be a missed opportunity to address the need for the green production of hydrogen and ammonia for commercial use in an effort to mitigate against concerns of climate change and exploitation of non-renewable resources. The no-go alternative would not assist in responding to the global call to reduce GHG emissions in the industrial sector. Conversely, negative environmental impacts of the project (as outlined in **Section 8)** associated with the development of the Camden I GH&A Facility would be avoided.

The "no project" alternative is considered in this EIA phase as a baseline against which the impacts of the Camden I GH&A Facility project is assessed.

7 DESCRIPTION OF BASELINE ENVIRONMENT

7.1 PHYSICAL ENVIRONMENT

7.1.1 CLIMATE AND METEOROLOGY

LOCAL METEOROLOGY OVERVIEW

According to the Köppen-Geiger Classification, the Camden/Ermelo area is classified as having a temperate climate with summer rainfall and dry winters. Meteorological variables, including hourly temperature, rainfall, humidity, wind speed and wind direction, were sourced for the South African Weather Service (SAWS) Ermelo ambient air quality monitoring (AAQM) station as well as Eskom's ambient air quality monitoring station (AQMS)[4] located ~6 km to the northeast. The datasets were analysed for the period January 2018 – December 2020 (i.e., three calendar years as required by the Regulations Regarding Air Dispersion Modelling[5], hereafter referred to as 'the Modelling Regulations'). The Ermelo AAQM station is located approximately 20 km to the northwest of the project site. Although the Ermelo station is at distance from the study site, the local topography is not complex and thus the meteorological data is considered representative of regional weather conditions that would prevail at the proposed development sites. Station details and data recovery information for the assessed period is given in **Table 7-1.**

Table 7-1 Details of the Ermelo AAQMl station

STATION NAME	LATITUDE (^{O}S)	LONGITUDE (^{O}E)	ALTITUDE (M)	DATA RECOVERY		
				Temperature	Rainfall	Wind
Ermelo	-26.497000°	29.983000°	1752	97%	98%	98%
Camden	-26.622600°	30.106000°	1646	97%	97%	96%

TEMPERATURE AND RAINFALL

Figure 7-1 and **Figure 7-2** presents average monthly temperature, rainfall and humidity as recorded at the Ermelo and Camden stations respectively. Both stations exhibit seasonal trends typical for the eastern half of South Africa. Higher rainfall occurs during the warmer summer months (December, January and February), with drier conditions during cooler winter months (June, July and August). Summer temperatures for the region average at 17.8°C while winter temperatures average at 11.0°C. Ermelo received 1 806 mm of rainfall over the three-year period, with approximately 49% of that received during the summer months and 3% during the winter months.

[4] This station's main function is the measurement of ambient air pollution, however, the station also measures an array of meteorological parameters. The nearest standalone SAWS meteorological station is Witbank (over 50 km to the north-northwest of the development site) and thus not representative of site conditions.

[5] Department of Environmental Affairs (2014): Regulations Regarding Air Dispersion Modelling (No. R. 533), Government Gazette, 11 July 2014, (No. 37804).

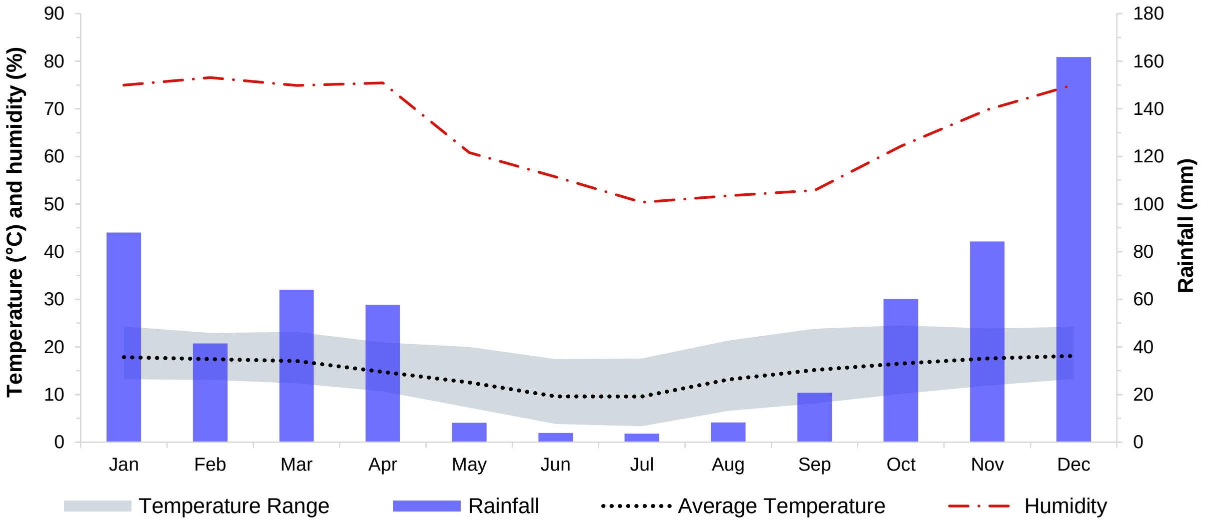


Figure 7-1 Meteorological summary for Ermelo (January 2018 - December 2020)

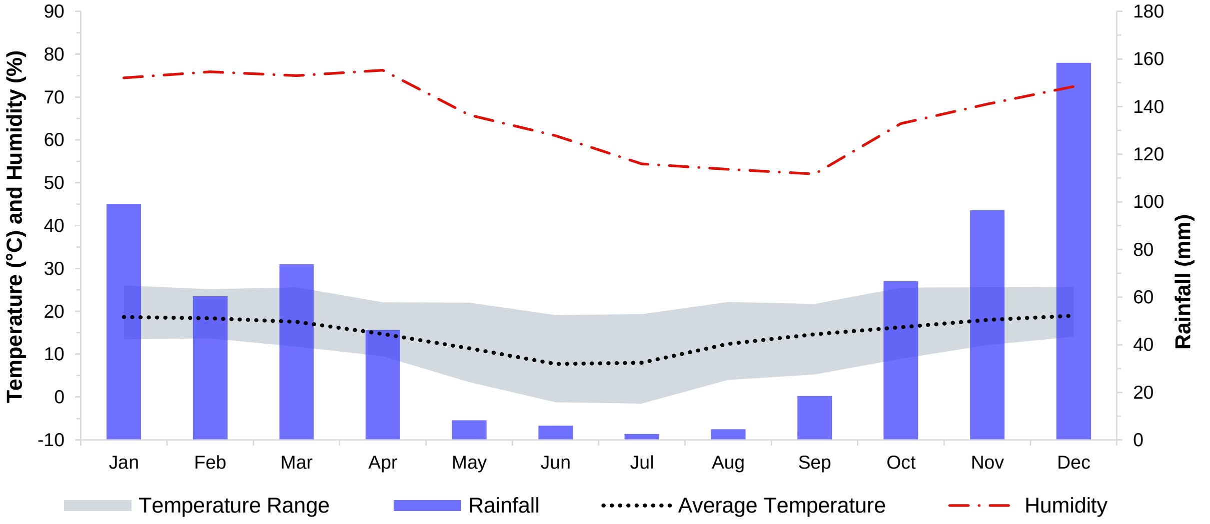


Figure 7-2: Meteorological summary for Camden (January 2018 - December 2020)

WIND

Wind roses summarize wind speed and directional frequency at a location. Calm conditions are defined as wind speeds less than 1.0 m/s (i.e. based on the typical sensitivity of the wind sensor installed at SAWS stations). Each directional branch on a wind rose represents wind originating from that direction. Each directional branch is divided into segments of colour, each representative of different wind speeds.

Typical wind fields are analysed for the full period (January 2018 – December 2020); diurnally for early morning (00h00–06h00), morning (06h00–12h00), afternoon (12h00–18h00) and evening (18h00–00h00); and seasonally for summer (December, January and February), autumn (March, April and May), winter (June, July and August) and Spring (September, October and November). Typical wind fields have been analysed using Lakes Environmental WRPlot Freeware (Version 7.0.0)

Wind roses for Ermelo are presented in **Figure 7-3**.

- Calm conditions (wind speeds <1.0 m/s) occurred 1.40% of the time;
- Moderate to strong easterlies and east-southeasterlies prevailed in the region;
- Peak (14 m/s) wind speeds occurred from the north-northwest;
- Winds from the east-northeast and north prevailed during the early morning (00h00 – 06h00);

— Easterly winds with components from the north-westerly quadrant prevailed during the morning (06h00 – 12h00);
— Winds from the west, west-northwest, northwest, east-southeast and east prevailed in the afternoon (12h00 – 18h00). Diurnal peak (12.9 m/s) wind speeds occurred during the afternoon;
— Easterlies prevail during the night (18h00 – 00h00);
— Winds from the east prevailed during the spring, summer and autumn months;
— Westerlies and north-north westerlies prevail during winter with higher directional variability noted for this period; and
— Highest average wind speeds of 4.9 m/s were observed during the spring months, with peak seasonal wind speeds of 12.9 m/s observed during winter.

Wind roses for Camden are presented in **Figure 7-4**.

— Calm conditions (wind speeds <1 m/s) occurred 14.13% of the time;
— Gentle to strong breezes from the east prevailed in the region;
— Peak (13.8 m/s) and highest average (5.5 m/s) wind speeds occurred from the west;
— Easterly winds prevail throughout the day and night with north-westerly components noted during the early morning (00h00-06h00), morning (06h00-12h00) and night-time (18h00-00h00) hours, as well as westerly components noted during the afternoon (12h00-18h00);
— Diurnal peak (13.3 m/s) and highest average (5.0 m/s) wind speeds occurred during the afternoon;
— Winds from the east prevailed during the spring and autumn months;
— Winds from the northwest, west-northwest, west and east prevailed during winter;
— Winds from the east and northwest prevailed during spring; and
— Seasonal peak (13.3 m/s) wind speeds occur during winter and highest average (4.0 m/s) wind speeds occur during spring

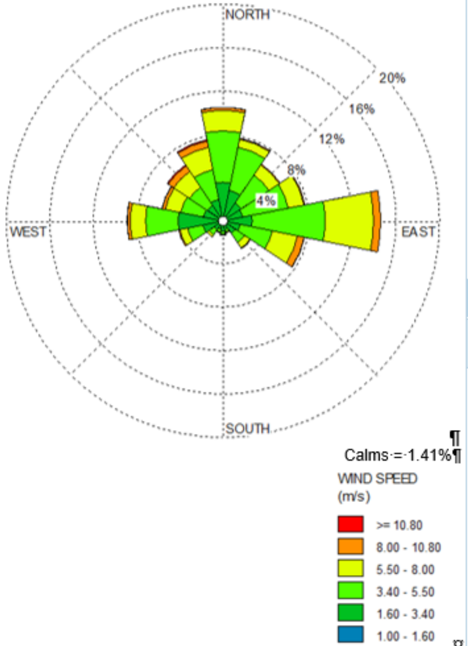
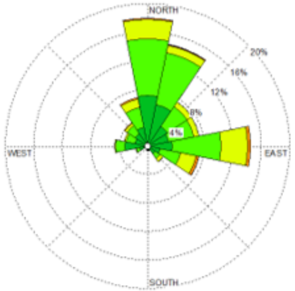
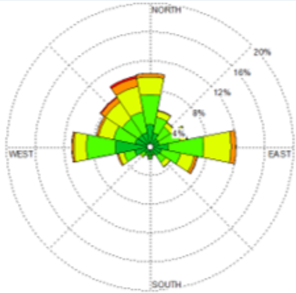
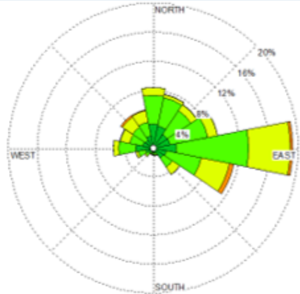
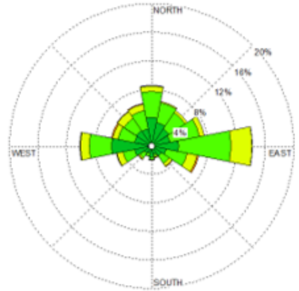
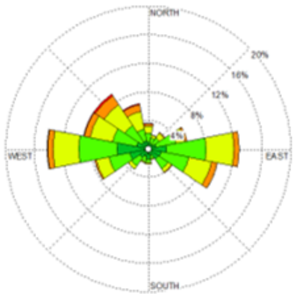
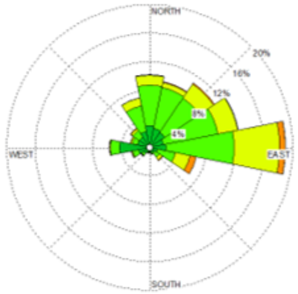
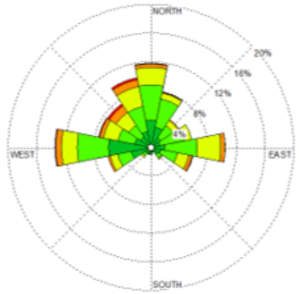
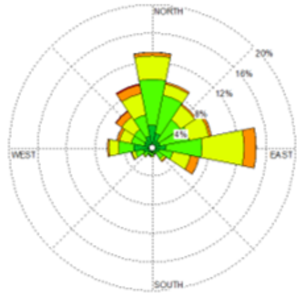
Ermelo	Early Morning	Morning	Summer	Autumn
January 2018 – December 2020	00h00 – 06h00	06h00 – 12h00	December, January & February	March, April & May
 Calms = 1.41%	 Calms = 2.11%	 Calms = 1.95%	 Calms = 1.23%	 Calms = 2.37%
	Afternoon	Night	Winter	Spring
	12h00 – 18h00	18h00 – 00h00	June, July & August	September, October & November
	 Calms = 0.62%	 Calms = 0.97%	 Calms = 1.43%	 Calms = 0.61%

Figure 7-3: Local Wind Conditions at Ermelo

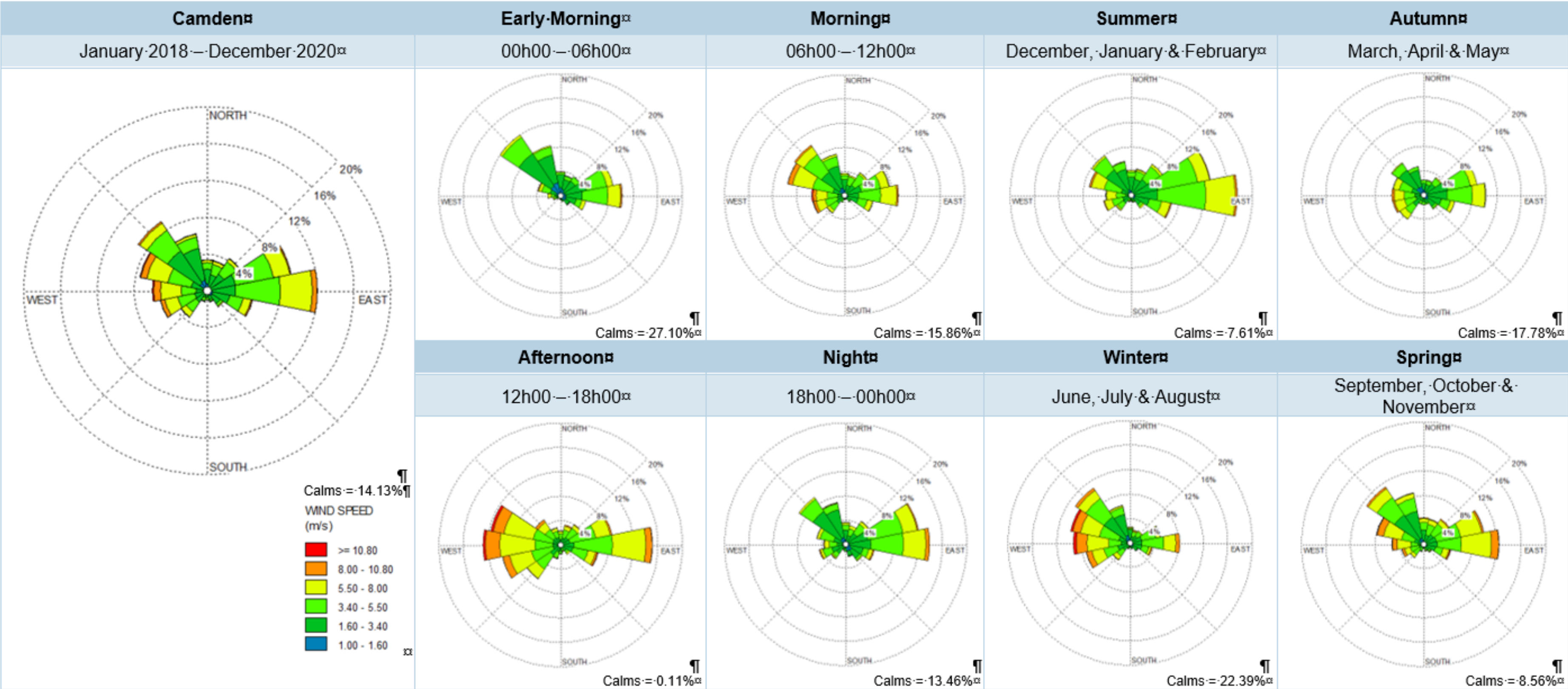


Figure 7-4: Local Wind Conditions at Camden

7.1.2 BACKGROUND AIR QUALITY

An evaluation of the existing air pollution situation provides an understanding of the potential risk for health impacts. The DFFE has identified District and Metropolitan Municipalities of concern with respect to air quality based on the prevalence of sources of emissions for each source category[6]. The National Framework for Air Quality Management in the Republic of South Africa[7] (hereafter referred to as '*The National Framework*') has rated the Gert Sibande District Municipality, as having "poor" air quality. The District area is thus identified as being in either the upper range of prevalence for one or more emission source categories[8] or middle range in two or more categories relative to other Districts. Municipalities that are classified as having poor air quality require priority attention in terms of air quality management planning.

The development site falls within one of South Africa's key air quality regions known as the Highveld Priority Area (HPA). The Highveld area is associated with poor air quality and elevated concentrations of criteria pollutants due to the high volume of both industrial and non-industrial emission sources. The HPA was declared on 23 November 2007, covers an area of 31,106 km^2 and encompasses multiple municipal jurisdictions including a single metropolitan municipality and nine local municipalities across the Gauteng and Mpumalanga provinces.

The Air Quality Management Plan (AQMP) for the HPA[9] identifies the Gert Sibande District Municipality as one of the HPA's nine air quality hot spot areas. This classification is based on atmospheric dispersion modelling outputs verified by ambient air quality monitoring data. The Camden area is identified in the AQMP for modelled O_3 exceedances. Modelled ambient NOx and monitored NO_2 concentrations were relatively low, but exceedances of the 8-hour O_3 standard were recorded in Camden and Ermelo. It is highlighted that the HPA AQMP's assessment is limited to criteria pollutants (specifically, SO_2, NO_2, PM10 and O_3) none of which are relevant to the proposed renewable energy complex.

The nearest AAQM station to the study site is the Ermelo station owned and managed by SAWS, approximately 20 km to the north-west of the study site. Pollutants measured by this station include PM10, PM2.5, CO, NO_2, SO_2 and O_3. None of these pollutants are relevant to the proposed renewable energy complex. Since the SAWS monitoring station does not measure NH_3 and is located too far away for ambient air quality measurements to be considered representative of ambient pollution concentrations at site, this data is not considered further.

SENSITIVE RECEPTORS

This area falls within one of South Africa's key air quality regions known as the Highveld Priority Area (HPA). The highveld area is associated with poor air quality and elevated concentrations of criteria pollutants due to the high volume of both industrial and non-industrial emission sources. Most of the remaining land is either under cultivation or is open veld (potentially earmarked for future mining prospects). There are no known industrial sources of NH_3 within the assessment area. Localised and transient increases in ambient NH_3 concentrations may be expected from intermittent agricultural activities, such as crop spraying and burning for field clearing.

The two site alternatives are under consideration for the proposed Green NH_3 processing facility, are at an approximate elevation of 1,660 m above mean seal level and up to 0.25 km^2 in extent. Elevations within the surrounding landscape gently undulate within 100 m of this and thus the local topography is considered flat.

Sensitive receptors (i.e. places where sensitive individuals may be impacted, such as residences) identified within a 5 km radius of the general study site are listed in

[6] Source categories include listed activities, domestic fuel burning, vehicle emissions and mining emissions
[7] Department of Environmental Affairs (2018): The 2017 National Framework for Air Quality Management in the Republic of South Africa (No.R.1144 of 2018) Government Gazette, 26 October 2018 (No. 41996).
[8] Emission source categories include listed activities, domestic fuel burning, traffic emissions and mining emissions (The National Framework, pg 50)
[9] DEA (2011): Highveld Priority Area Air Quality Management Plan (URL: https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/HIGHVELD_PRIORITY_AREA_AQMP.pdf)

Table 7-2 and presented in **Figure 7-5.**

Table 7-2: Sensitive Receptors

ID	RECEPTOR NAME	RECEPTOR TYPE	DISTANCE (KM) FROM SITE		CARDINAL DIRECTION		LATITUDE (ºS)	LONGITUDE (ºE)
			Site option 1	Site option 2	Site option 1	Site option 2		
1	Residence 1	Residential	1.4	3.6	ESE	S	-26.678195°	30.058971°
2	Residence 2	Residential	2.3	2.7	ENE	SSW	-26.670771°	30.069023°
3	Residence 3	Residential (uninhabited) / Agricultural	4.5	1.8	NE	ESE	-26.652939°	30.084148°
4	Residence 4	Residential	5.7	1.9	NNE	NE	-26.632051°	30.078345°
5	Residence 5	Residential	4.6	3.7	NNW	WNW	-26.634611°	30.033396°
6	Residence 6	Residential	4.4	5.5	NW	W	-26.647962°	30.012660°
7	Residence 7	Residential	4.1	6.2	WSW	WSW	-26.660107°	30.007612°

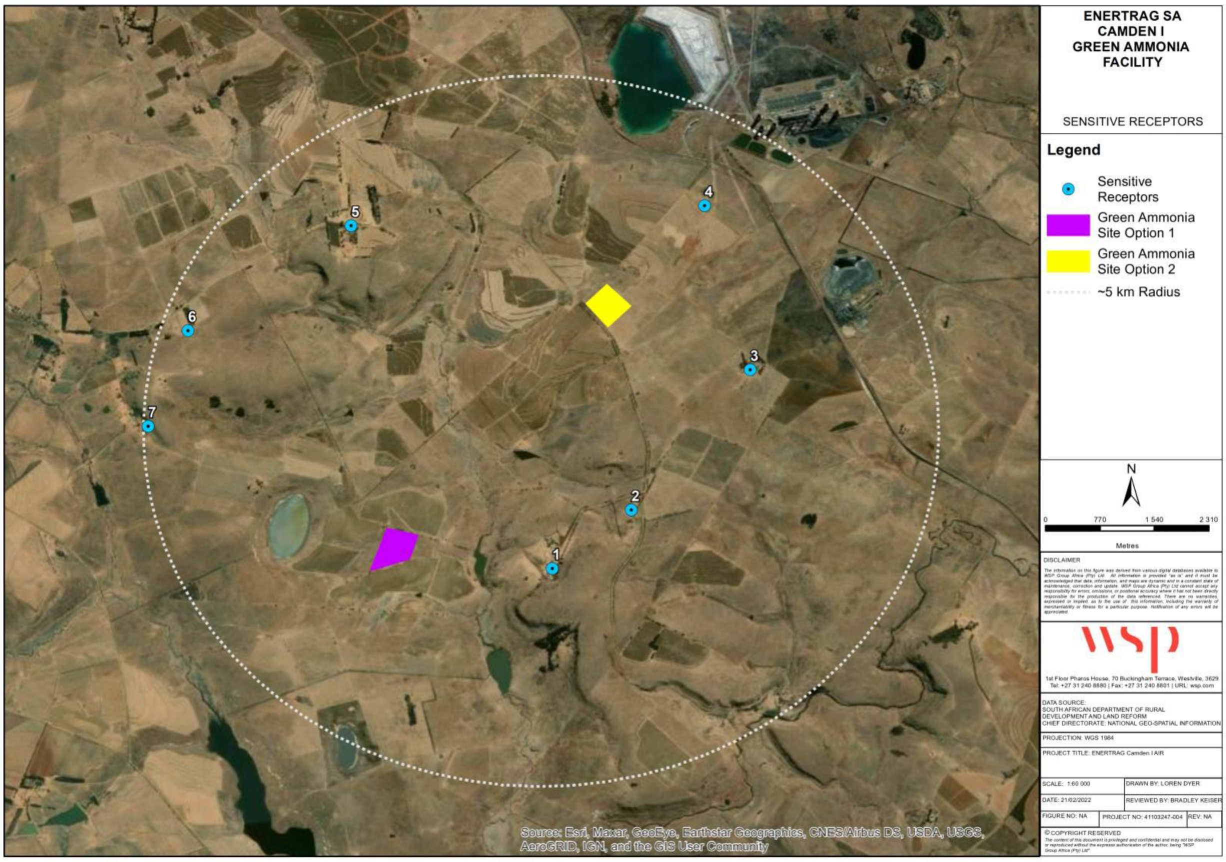


Figure 7-5: Sensitive receptors within 5 km

7.1.3 TOPOGRAPHY

The Project area is largely characterised by a mix of undulating plains and greater relief in the form of higher lying plateaus intersected by river valleys. Slopes across the study area are relatively gentle to moderate, with steeper slopes being largely associated with the more incised river valleys. The main water course in the study area is the Vaal River in the south-eastern portion of the study area. Flat to gently undulating terrain prevails across much of the Camden I GH&A Facility development site.

The study area undulates over a wide elevation range from a minimum of around 1 620m above mean sea level (amsl) within the west to a maximum of approximately 1 735m amsl in the north, with an overall topographic fall from north to south. The eastern portion of the area lies on a ridge that largely topographically separates the site from Camden Power Station to the northeast.

The topography and slopes within and in the immediate vicinity of the Camden I GH&A Facility area are indicated in **Figure 7-6** and **Figure 7-7** respectively.

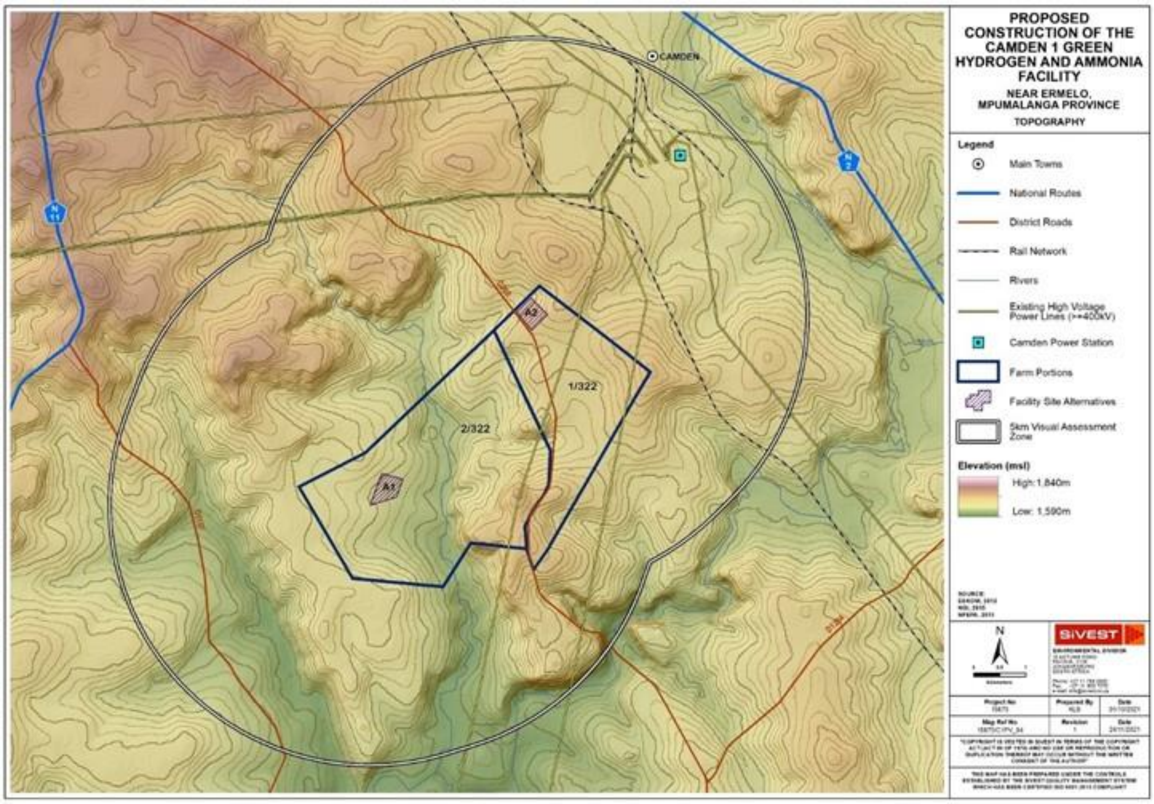


Figure 7-6: Topographical Map of Project Area (SiVest, 2021)

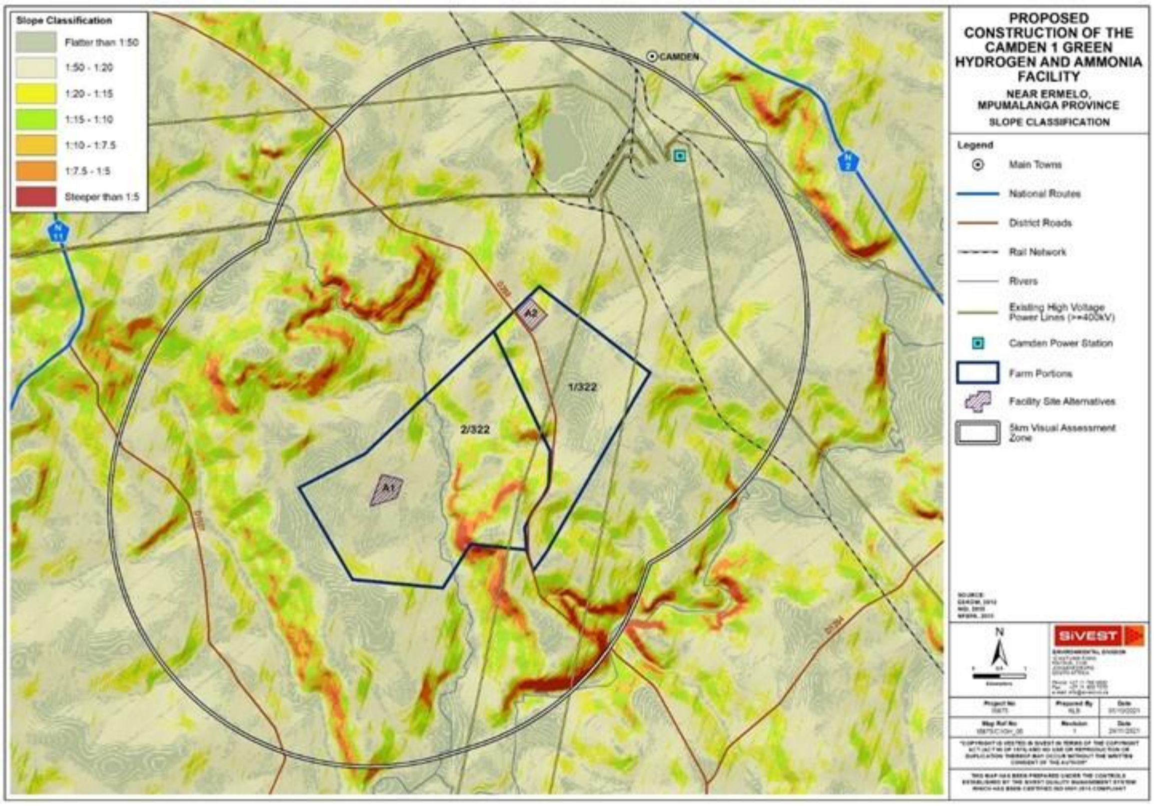


Figure 7-7: Slope classification of Project Area (SiVest, 2021)

7.1.4 GEOLOGY

A desktop review of the geology indicates the site is underlain predominantly by the Vryheid Formation of the Ecca Group (1:250 000, 2630) as shown in **Figure 7-8** below. The Vryheid Formation consists of sandstone, shale, siltstone and coal seam that underlie the project area. The Vryheid Formation is intruded by late Triassic to Middle Jurassic Karoo dolerite dykes and sills which influence the regional hydrogeology.

The abovementioned rock types may be closely intercalated, resulting in highly variable geotechnical conditions, both vertically and horizontally. It is not unusual for a weak lens of mudrock to occur within a competent layer of sandstone, or for a band of rock to disappear horizontally over a short distance. The occurrence of weaker strata within or below competent rock strata may be problematic for the founding of heavy structures. The assumption that the founding conditions will improve with depth does not necessarily apply in the case of the Vryheid Formation.

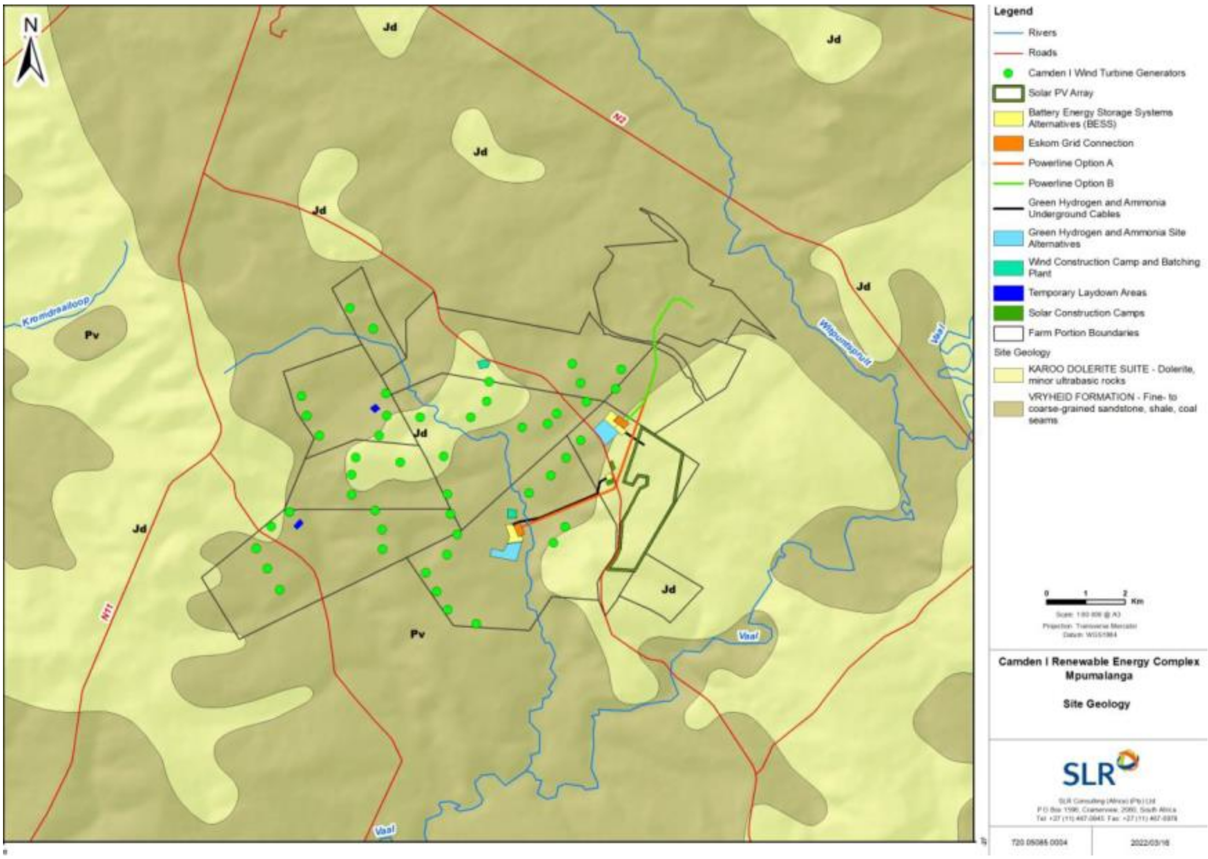


Figure 7-8: Geological Map of the Proposed Development Area

In respect of sourcing construction materials for roads and laydown areas consideration could be given to natural gravely or crushed sandstone bedrock. Selective usage must be exercised to avoid using sandstone containing excessive pyrite and muscovite, which can cause distress when used as basecourse (Brink, 1983). In addition, where chemical stabilization is required the clay matrix of sandstones make them suitable for stabilization with lime (Brink, 1983). The occurrence, nature, material quality and quantity of sandstone and other potential construction materials will have to be assessed during the detailed geotechnical investigation. It is recommended that provision be made to procure aggregates for use in upper pavement layer works construction and the manufacture of concrete from commercial sources.

Sandstones comprise a larger portion of the Karoo sediments and are generally closely intercalated with mudrocks, resulting in alternating bands of arenaceous and argillaceous sediments. The Vryheid Formation sandstones may typically occur as arkosic to greywacke, ranging from a generally coarse grained, poorly sorted material to a fine grained, well sorted material, with an abrupt upward transition.

The dolerite observed on the site, based on previous geotechnical investigations undertaken, was found to be weathered to moderate depths and the rock was overlain by residual soils, typically with a moderate to high clay content.

Of significant economic importance is the presence of coal seams located stratigraphically between the sandstone and mudrock bedding partings, at the base of the Vryheid Formation. The lower coal seams attain thicknesses of approximately 18 m which progressively diminishes upwards through the formation, due to various depositional and post-depositional factors (Brink, 1983).

Based on a preliminary assessment, the impact of the development from a geotechnical perspective will be restricted to the possible presence of undermined areas as well as the removal and displacement of soil, boulders and bedrock referred to in this report as "subsoils". The presence of undermined areas will have a negative effect on foundations, resulting in subsidence of the ground and potential collapse of both lightly and heavily loaded structures. The likelihood of undermined areas within the proposed development area is low, as the site is predominantly underlain by dolerite.

7.1.5 SOILS AND AGRICULTURAL POTENTIAL

Natural vegetation of the site is Eastern Highveld Grassland and Amersfoort Highveld Clay Grassland, which has been disturbed by agricultural and other anthropogenic activities.

The area is far above the national average in terms of agricultural productivity. The site contains cultivation lands that make an important contribution to national food security, within the South African context of a considerable scarcity of arable land. Mpumalanga is the province that produces the second highest amount of maize after the Free State. The area produces long term average maize and soya bean yields that, according to verbal information supplied by farmers in the area, are above average for commercial farmers in South Africa. The long-term grazing capacity across the site is 4 - 5 hectares per large stock unit (Department of Agriculture, Forestry and Fisheries, 2018), which is also high in a South African context.

The development is located within a grain and cattle farming agricultural region, but the soils vary in their suitability for crop production. Crops in the area include mainly maize and soya beans. Farmers generally utilise all suitable soil as cropland. Only soil that is not suitable for crop production is used for grazing of cattle and sheep. Limitations that render the soil unsuitable for crop production are poor drainage and depth limitations due to rock or dense clay in the subsoil.

The preferred site is on cropland while the alternative is on land not used for crops and therefore presumed to be unsuitable. Due to the favourable climate and suitable soils on the croplands, crop yields are fairly high with average maize yields of around 7 to 8 tons per hectare according to the farmers on site.

The preferred alternative site 2 is on land type Ca3 and the alternative site 1 is on Ba51. The geology is predominantly shale and sandstone of the Ecca Group of the Karoo Supergroup and includes dolerite. Approximately half of both land types comprise deep, red and yellow, reasonably-drained, loamy soils of the Avalon, Hutton, Glencoe, and other soil forms that are good for crop production. The other half comprises other soils that have various limitations for crop production, which are predominantly the result of poor drainage or limited depth due to underlying clay or bedrock. These soils are of the Mispah and Glenrosa soil forms (shallow bedrock) and the Kroonstad, Estcourt Valsrivier, Longlands, and other soil forms (poor drainage and underlying clay).

7.1.6 SURFACE WATER

HYDROLOGICAL CACHMENT

In terms of surface water, the study area is located within the western portion of C11B Quaternary Catchment (Vaal River) of the Highveld Ecoregion in the Vaal Water Management Area (WMA), with the Vaal River generally flowing northeast to southwest to within 1km of the south of the study area at its closest point. Most of the aquatic features and unknown tributary of the Vaal River within the study area are located within the riverine valleys and upper catchment areas of this quaternary catchment (**Figure 7-9**).

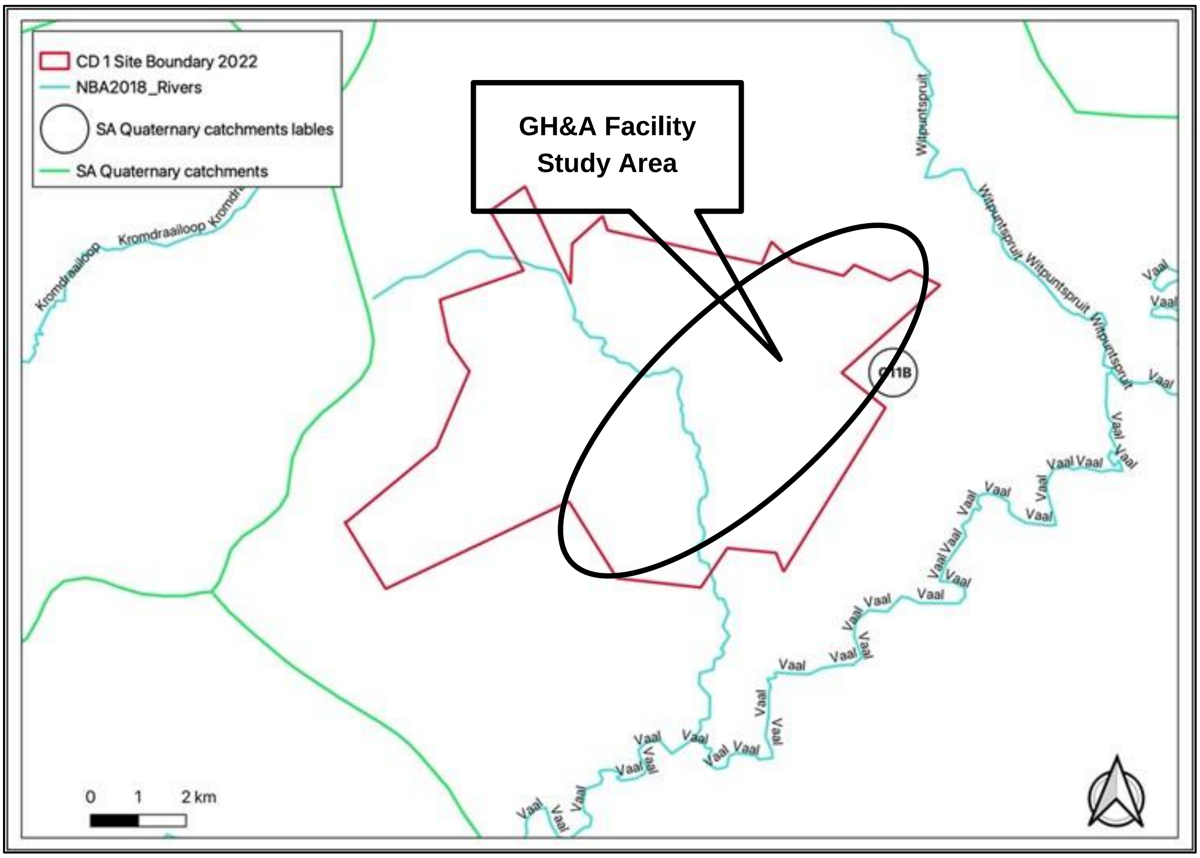


Figure 7-9: Mainstream rivers associated with the Project Area (EnviroSci, 2021)

LOCAL AQUATIC FEATURES

According to the EIA Phase Aquatic Assessment Report (EnviroSci, 2021) (**Appendix H**), the broader study area is dominated by a variety of aquatic features, characterised as follows:

— Mainstem Rivers - Floodplain dominated systems with oxbow wetlands (**Figure 7-10**). A few reaches did contain very narrow riparian zones, consisting mostly of a single row of willow trees associated with the unknown tributary of the Vaal River

— Seep wetlands (**Figure 7-11**)

— One minor watercourses (Plate 5) , that was previously part of a wetland systems, but now contains severe head cut and has eroded into a channel / watercourse.

Figure 7-10: Wetlands associated with the unknown tributary that bisects the broader study area

Figure 7-11: A Medium Sized Seep Wetland

The DFFE identified the aquatic environment for the study area as having a Very High Sensitivity, based on the fact the following criteria are present within the site or the associated catchment, namely:

- Presence of Wetlands to the north and west of the footprint;
- Aquatic Critical Biodiversity Areas (CBA)
- Freshwater Ecosystem Priority Area quinary catchments (NFEPA); and
- Eastern Highveld Grassland a listed Threatened Ecosystem under NEMA.
- Wetland clusters

The presence of these Very High Sensitivity features, although to a finer mapping scale were confirmed during the aquatic assessment. The study area is however not located within an International Bird Area (IBA) or a Strategic Water Resource Area.

This ground-truthed delineations were then compared to current wetland inventories (van Deventer *et al*., 2020), 1: 50 000 top cadastral surveys mapping and the site. These inventories include wetland spatial data based on landcover 2007 data, previous assessments and wetland information retained by the Provincial authorities, combined into one database that formed part of the updated National Spatial Biodiversity Assessment, 2018.

A baseline map was then developed and refined using the August 2020 survey data, noting that due to the complex nature of the topography and geology, the features were digitised at a scale of 1:4000 **(Figure 7-12**).

Coupled to the aquatic delineations, information was collected on potential species that could occur within the wetlands and water courses, especially any areas that would contain open water for long periods and or conservation worthy species (Listed or Protected). For the most part those that were observed are terrestrial in nature and thus listed in the ecological report.

Figure 7-12: Delineated Wetlands within Project footprint based on ground-truthing information collected

PRESENT ECOLOGICAL STATE AND CONSERVATION IMPORTANCE

The Present Ecological State (PES) of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation, and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters are assessed or the overall PES is rated between a C or D.

All of the systems assessed by DWS (2014) on a Sub quaternary level within the study area were rated as PES = C or Moderately Modified and PES = D or Largely Modified. While these were also rated as High in terms of Ecological Sensitivity and Ecological Importance respectively.

Based on the information collected during the field investigations, these ratings are verified and upheld for the riverine / wetland systems. The natural wetlands were however rated independently and achieved PES scores of C and D, while the EIS was rated as HIGH. The High EIS rating for both natural water courses and wetlands, is further substantiated by the fact that the affected catchments are included in both the National Freshwater Priority Atlas and the provincial Biodiversity Spatial Plan Critical Biodiversity Area spatial layers (**Figure 7-13** and **Figure 7-14**). These areas are also highlighted as important ecological support areas along the Vaal River.

Overall, these catchment areas and subsequent rivers / watercourses are largely in a natural state with localised impacts in some areas, which include the following:

- Erosion and sedimentation associated with road crossings;
- Impeded water flow due to several in channel farm dams; and
- Sedimentation and scour of channels due to undersized culverts within present day road crossings.

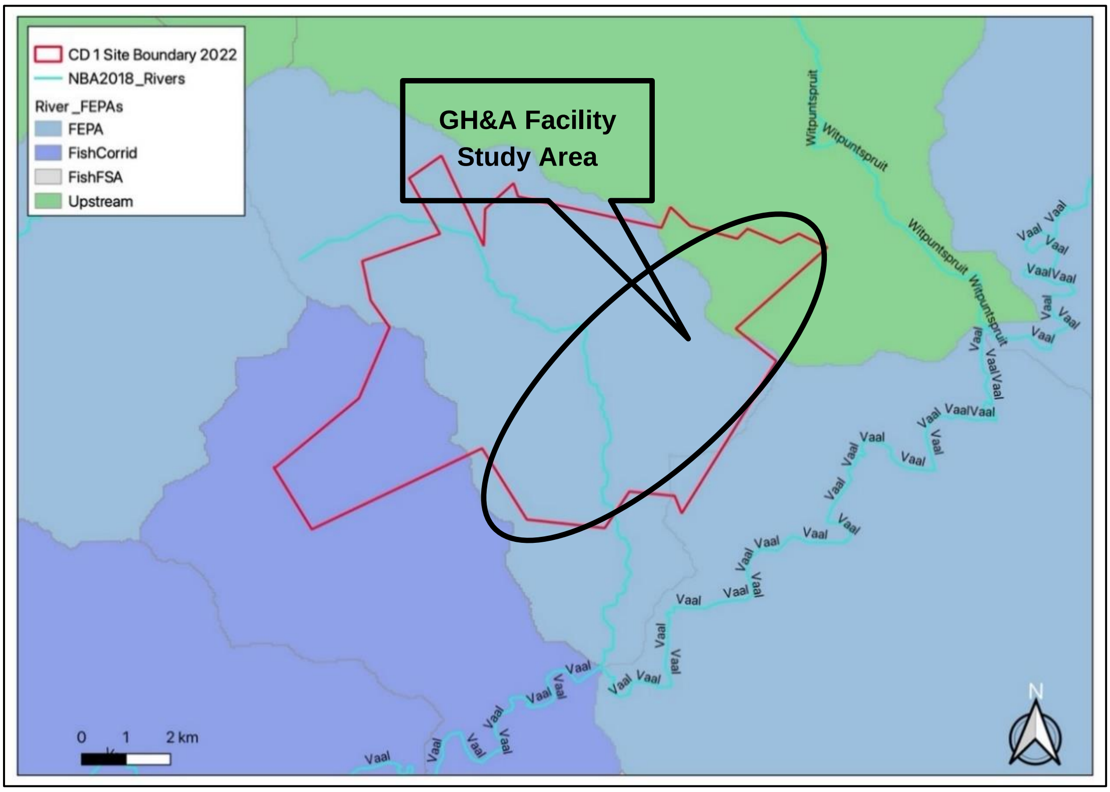


Figure 7-13: The Freshwater Ecosystem Priority Areas for the study area (Nel et al, 2011)

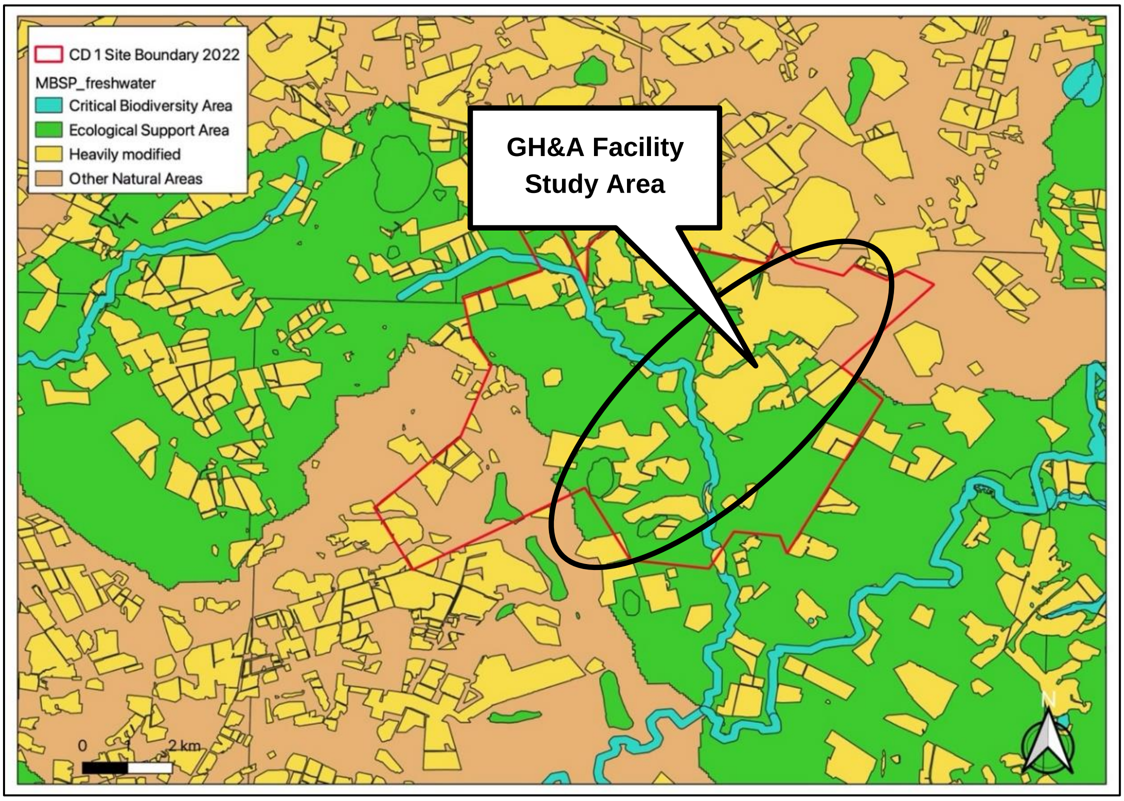


Figure 7-14: The Critical Biodiversity Areas as per the Mpumalanga Biodiversity Spatial Plan (Nel et al, 2011) issued 2014

SITE SENSITIVITY

Using the baseline description and field data while considering the current disturbances and site characteristics, the following features were identified, then categorised into one of a number of pre-determined sensitivity categories to provide protection and/or guide the layout planning and design processes of the Facility and respective grid assessment corridor. The full extent of the grid and water pipeline corridors were assessed to allow for micro siting therein. **Table 7-3** outlines the Aquatic sensitivity mapping categories used to categorise features or areas (with their buffers).

Table 7-3: Sensitivity Categories

No Go	Legislated "no go" areas or setbacks and areas or features that are considered of such significance that impacting them may be regarded as fatal flaw or strongly influence the project impact significance profile Therefore areas or features that are considered to have a high sensitivity or where project infrastructure would be highly constrained and should be avoided as far as possible. Infrastructure located in these areas are likely to drive up impact significance ratings and mitigations
Medium	Buffer areas and or areas that are deemed to be of medium sensitivity but should still be avoided were possible as this would minimise impacts and or the need for additional Water Use Authorisation
Low	Areas of low sensitivity or constraints, such as artificial systems
Neutral	Unconstrained areas (left blank in mapping)

Table 7-4 below provides an overview of the sensitivity of various aquatic features (with buffers distances included) as it relates to the main project component types for the project. The features are shown spatially in **Figure 7-15**. The sensitivity ratings of No go, Medium and Low were determined through an assessment of the aquatic habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general

terms to the project and there are areas where encroachment on these areas would occur (i.e. existing road crossings within wetlands) but this is considered acceptable since these areas have already been impacted.

These proposed constraints / buffers do not include bird and or bat specialist buffers / constraints as theirs buffers along aquatic features are at times far larger around aquatic features, than those required for the known aquatic species within this region.

Table 7-4: Results of the sensitivity rating / constraints assessment

DEVELOPMENT COMPONENT	WATERBODY TYPE	SENSITIVITY RATING OF THE RESPECTIVE WATERBODY TYPE AGAINST THE DEVELOPMENT TYPE AND THE REQUIRED BUFFER	SENSITIVITY RATING OVERRIDE, IF AN IMPACT SUCH AS A ROAD ALREADY OCCURS WITHIN THE PROPOSED FOOTPRINT
Buildings / Substations & BESS	Riverine Floodplains with Riparian Vegetation or wetland areas	No-Go with 95m buffer	
	Seepage Wetlands	No-Go with 62m buffer	
	Artificial dams or mine works		
Roads and Pipelines	Riverine Floodplains with Riparian Vegetation or wetland areas	No-Go with 95m buffer	Moderate if an existing crossing / road or impact is already present, that must then be included in the potential road or crossing network. However if the road or pipeline network can't be aligned with existing impacted areas, then any such crossings must be evaluated on a case by case basis, by the aquatic specialist, preferably with the engineers and a site visit.
	Seepage Wetlands	No-Go with 62m buffer	
	Artificial dams or mine works		
Overhead Lines	Riverine Floodplains with Riparian Vegetation or wetland areas	Assumption is that the overhead lines could span these areas, but the towers/pylons should adhere to the buffer distances as indicated as far as possible but where areas are too large to span (buffers) then these tower positions must be evaluated on a case by case basis.	
	Seepage Wetlands		
	Artificial dams or mine works		

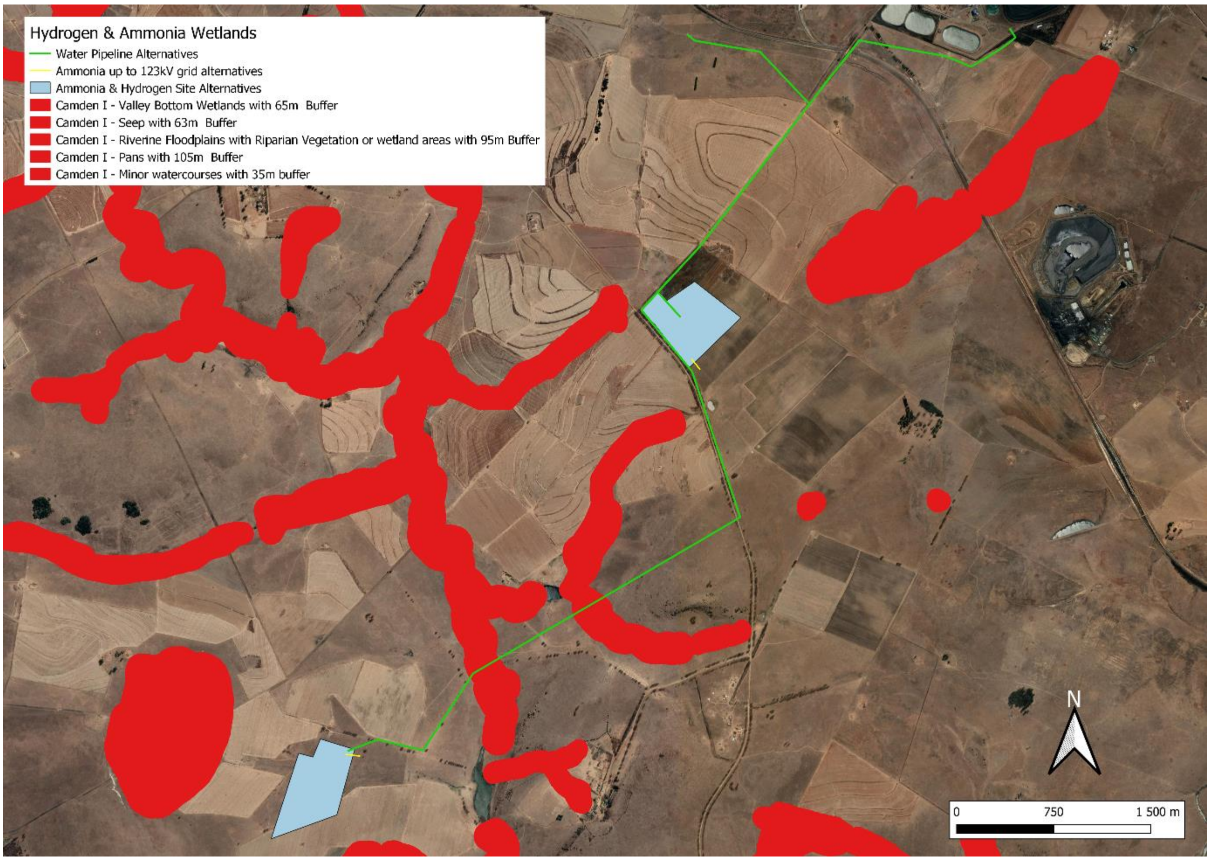


Figure 7-15: The delineated waterbodies inclusive of the respective buffer distances

7.1.7 GROUNDWATER

According to Aquifer Classification of South Africa (DWAF, 2012), the area is underlain by a Minor Aquifer with groundwater occurrence controlled by presence of fractures, faults and weathered zones within Karoo sediments, and dominated within the upper and lower contacts of the dolerite dykes and sills. Groundwater in the area is moderately vulnerable to contaminants when continuously discharged or leached (DWAF, 2013). The regional groundwater is of good quality with electrical conductivity typically <70mS/m (DWAF, 2012). With reference to GHT Consulting Scientists (GHT) Geohydrological Impact Assessment: Proposed Ash Dam Extension at Eskom Camden Power Station (2012) three aquifer types may be anticipated, as follows:

— **Shallow**: unconfined within the highly weathered Karoo sediments and/or alluvial deposits, and when underlain by less permeable material. Within the vicinity of the ash dam this reportedly ranges from approximately 0.2–1.3m below ground level (bgl)

— **Intermediate**: semi-confined within horizontal bedding interfaces between different lithologies or when connected through geological structures (joints, fractures, or dolerite dyke contacts)

— **Deep**: confined within basement lithologies

Groundwater flow directions are expected to somewhat mimic topography and regional drainage and largely be towards the south, in the direction of the Vaal River. This will, however, be complicated around the natural drainage lines where the topography will be expected to induce localised flows, particularly within the shallow aquifer, that will deviate from this general direction, with flow from elevated areas towards to lower lying drainage channels.

7.2 BIOLOGICAL ENVIRONMENT

7.2.1 REGIONAL VEGETATION

Based on the preliminary desktop and site-specific field study Terrestrial Plant species assessment Report (David Hoare Consulting, 2022) (Appendix I), there is one regional vegetation type occurring in the study area, namely Eastern Highveld Grassland (**Figure 7-16**). The vegetation type description below is from Mucina & Rutherford (2006), extracted from the SANBI BGIS website (http://bgis.sanbi.org/vegmap).

Figure 7-16: Regional Vegetation Types of the Study Area

EASTERN HIGHVELD GRASSLAND

DISTRIBUTION

Found in Mpumalanga and Gauteng Provinces, on the plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. The vegetation type occurs at an altitude of between 1 520–1 780 m.

VEGETATION & LANDSCAPE FEATURES

The vegetation occurs on slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya*, etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra*, *Celtis africana*, *Diospyros lycioides* subsp *lycioides*, *Parinari capensis*, *Protea caffra*, *P. welwitschii* and *Searsia magalismontanum*).

GEOLOGY & SOILS

Red to yellow sandy soils of the Ba and Bb land types found on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup). Land types Bb (65%) and Ba (30%).

CLIMATE

Strongly seasonal summer rainfall, with very dry winters. MAP 650–900 mm (overall average: 726 mm), MAP relatively uniform across most of this unit, but increases significantly in the extreme southeast. The coefficient of variation in MAP is 25% across most of the unit, but drops to 21% in the east and southeast. Incidence of frost from 13–42 days, but higher at higher elevations.

IMPORTANT TAXA

Low Shrubs	*Anthospermum rigidum* subsp. *pumilum*, *Stoebe plumosa*..
Herbs	*Berkheya setifera* (d), *Haplocarpha scaposa* (d), *Justicia anagalloides* (d), *Pelargonium luridum* (d), *Acalypha angustata*, *Chamaecrista mimosoides*, *Dicoma anomala*, *Euryops gilfillanii, E. transvaalensis* subsp. *setilobus, Helichrysum aureonitens*, *H. caespititium*, *H. callicomum*, *H. oreophilum*, *H. rugulosum*, *Ipomoea crassipes*, *Pentanisia prunelloides* subsp. *latifolia*, *Selago densiflora*, *Senecio coronatus*, *Vernonia oligocephala*, *Wahlenbergia undulata*.
Geophytic Herbs	*Gladiolus crassifolius*, *Haemanthus humilis* subsp. *hirsutus*, *Hypoxis rigidula* var. *pilosissima*, *Ledebouria ovatifolia*.
Succulent Herbs	*Aloe ecklonis*
Graminoids	*Aristida aequiglumis* (d), *A. congesta* (d), *A. junciformis* subsp. *galpinii* (d), *Brachiaria serrata* (d), *Cynodon dactylon* (d), *Digitaria monodactyla* (d), *D. tricholaenoides* (d), *Elionurus muticus* (d), *Eragrostis chloromelas* (d), *E. curvula* (d), *E. plana* (d), *E. racemosa* (d), *E. sclerantha* (d), *Heteropogon contortus* (d), *Loudetia simplex* (d), *Microchloa caffra* (d), *Monocymbium ceresiiforme* (d), *Setaria sphacelata* (d), *Sporobolus africanus* (d), *S. pectinatus* (d), *Themeda triandra* (d), *Trachypogon spicatus* (d), *Tristachya leucothrix* (d), *T. rehmannii* (d), *Alloteropsis semialata* subsp. *eckloniana*, *Andropogon appendiculatus*, *A. schirensis*, *Bewsia biflora*, *Ctenium concinnum*, *Diheteropogon amplectens*, *Eragrostis capensis*, *E. gummiflua*, *E. patentissima*, *Harpochloa falx*, *Panicum natalense*, *Rendlia altera*, *Schizachyrium sanguineum*, *Setaria nigrirostris*, *Urelytrum agropyroides*.

CONSERVATION STATUS OF THE REGIONAL VEGETATION TYPES

On the basis of a scientific approach used at national level by SANBI (Driver *et al*., 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in **Figure 7-17**, as determined by best available scientific approaches (Driver *et al*., 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al*., 2005).

According to scientific literature (Driver *et al*., 2005; Mucina *et al*., 2006), as shown in **Table 7-5**, Eastern Highvbeld Grassland is listed as Endangered.

Determining ecosystem status (Driver *et al.*, 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Figure 7-17: Ecosystem Status (Driver et al. 2005)

Table 7-5: Conservation status of different vegetation types occurring in the study area

VEGETATION TYPE	TARGET (%)	CONSERVED (%)	TRANSFORMED (%)	CONSERVATION STATUS	
				DRIVER *ET AL.* 2005; MUCINA *ET AL.*, 2006	NATIONAL ECOSYSTEM LIST (NEM:BA)
Eastern Highveld Grassland	24	0.3	44	Endangered	Vulnerable
Chrissiesmeer Panveld					Endangered

The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types, and other ecosystems defined in the Act, that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature. Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands are both listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011). Eastern Highveld Grassland covers the entire site (**Figure 7-16**).

There is an additional listed ecosystem defined under the National Ecosystem List, called Chrissiesmeer Panveld, which is listed as Endangered. This covers the entire site (**Figure 7-18**). It spatially co-incides partially with Eastern Highveld Grassland, but is defined on different criteria.

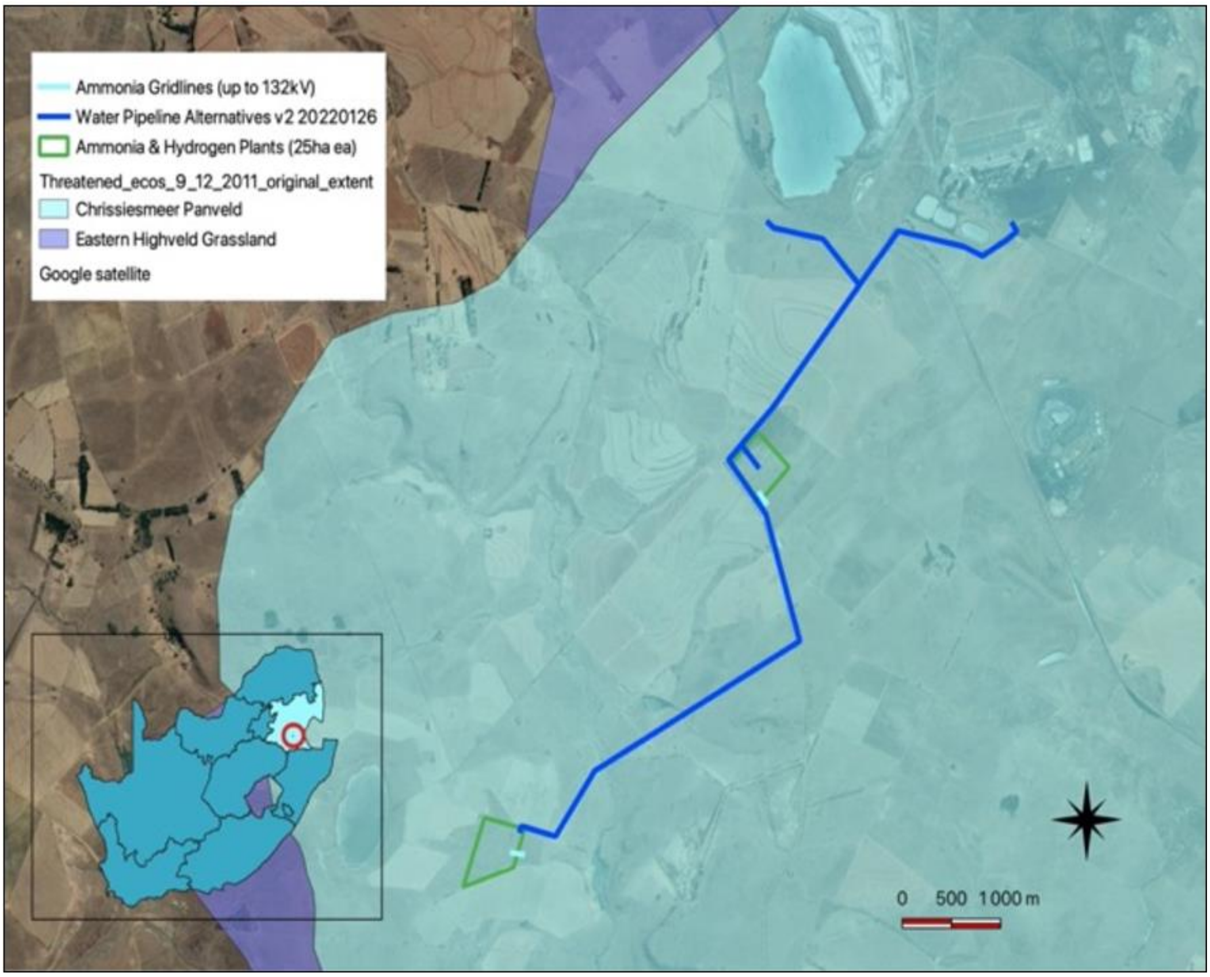


Figure 7-18: Distribution of listed ecosystems relative to the site

7.2.2 BIODIVERSITY CONSERVATION PLANS

The Mpumalanga Biodiversity Sector Plan (MBSP) (Mpumalanga Parks and Tourism Agency 2014) classifies the natural vegetation of the Province according to the following categories:

— Protected Areas (sub-divided into three categories);
— Critical Biodiversity Areas (sub-divided into "Irreplaceable" and "Optimal");
— Other natural areas;
— Ecological Support Area (sub-divided into four categories); and
— Modified (sub-divided into Heavily or Moderately modified

Figure 7-19 shows the features in the study area within three of the classes listed above:

— Protected Areas: (National Parks and Nature Reserves):
  — There is a proclaimed conservation area on site, the Langcarel Private Nature Reserve. This area has not been managed as a protected area and has undergone similar levels of degradation as surrounding areas due primarily to overgrazing, but also partially due to alien invasive plants. In addition, no conservation management activities were evident on site during the field assessment. This pattern of over-utilization affects all grasslands on site, resulting in them being in moderate to poor condition. A separate process is underway to have it (or part thereof) de-proclaimed as part of ongoing province-wide reserve verification efforts by the provincial authorities. The habitat has been used for livestock production and is impacted by this landuse. It is the opinion of the specialist that on the basis of the current land use and levels of modification, that the private nature reserve does not align with the objective and purpose of the protected area status.

— <u>Critical Biodiversity Areas (CBA):</u>
  - — Irreplaceable: two small patches.
  - — Optimal: a small nearby patch.

According to the National Parks Area Expansion Strategy (NPAES), there are no areas within the study area that have been identified as priority areas for inclusion in future protected areas. The study area is therefore **outside the NPAES focus area**.

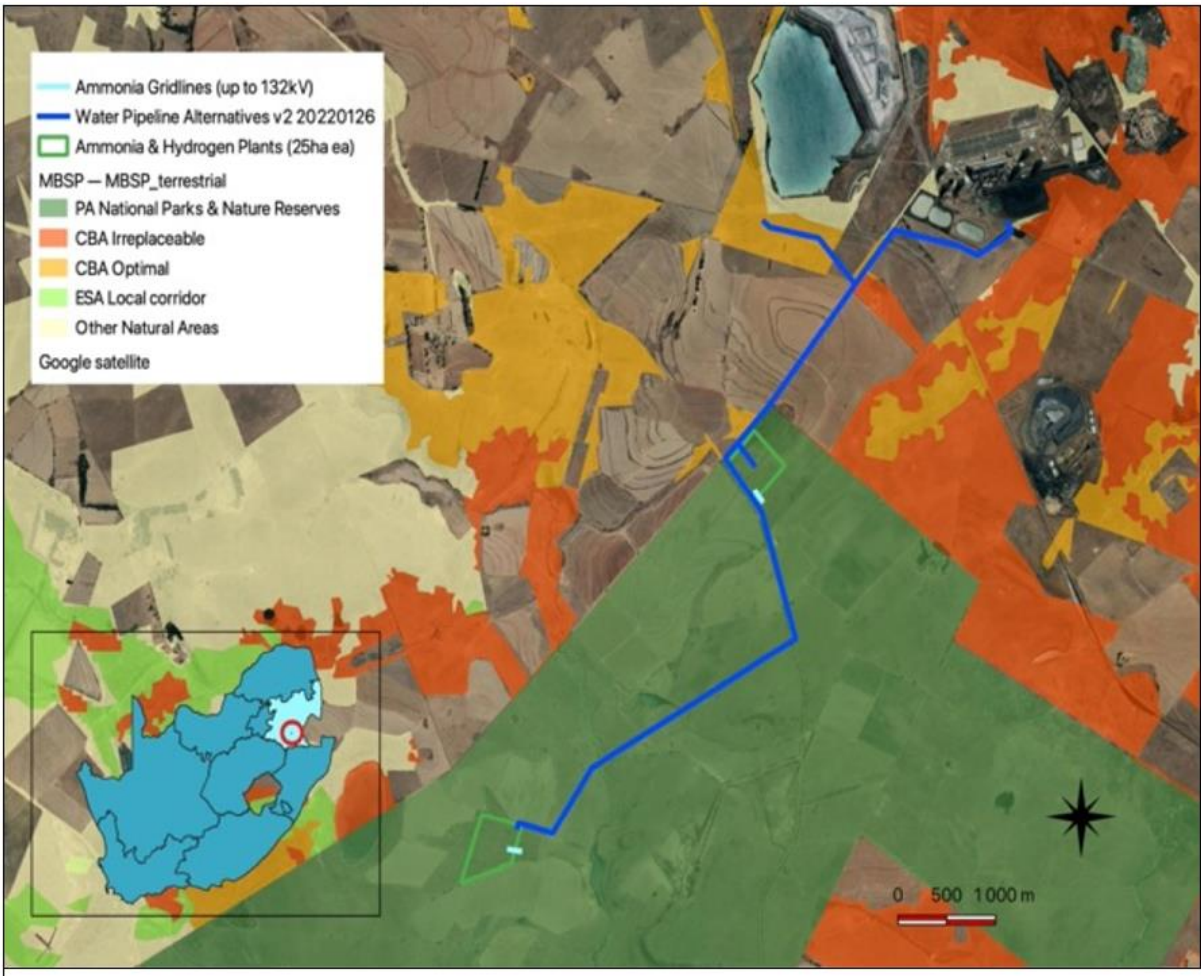


Figure 7-19: Biodiversity Map of the Project Area according to the MBSP (David Hoare Consulting, 2022)

7.2.3 PLANT SPECIES

According to the DFFE online environmental screening tool, seven plant species have been flagged as of concern for the area the current project is in. A description of each species is provided below.

Khadia carolinensis **-Vulnerable**

Occurs at Carolina and Belfast in Eastern Highveld Grassland, Lydenburg Montane Grassland, and Rand Highveld Grassland. It is found in well-drained, sandy loam soils among rocky outcrops, or at the edges of sandstone sheets, at around 1700 m elevation. It has been recently recorded just to the south of the site in grasslands close to the Vaal River. Based on the known distribution and habitat requirements, as well as known nearby populations, there is a HIGH chance of it occurring in the general area where the project is located.

Sensitive species 1201

Occurs on dolerite outcrops in grasslands at about 2000m altitude, from Dullstroom in the north to Vryheid in the south. This geophyte is fairly restricted and threatened by alien invasive plants, and is therefore listed as

Vulnerable on the national Red List. This species is conspicuous when flowering, with attractive pale white flowers in summer. The closest locality at which this species has been observed is Hartebeespruit due south of Camden. It therefore has a MODERATE chance of occurring on the site.

***Aspidoglossum xanthosphaerum* -Vulnerable**

Occurs in Mpumalanga, around Groenvlei and Ermelo. Closest known record is from Breyten and just to the west of Ermelo. It is found in montane grassland, marshy sites, at around 1800 m elevation. Based on the known distribution and habitat requirements, as well as known nearby populations, there is a HIGH chance of it occurring in the general area where the project is located.

Sensitive species 41

A common and widespread geophyte that is very similar to Gladiolus crassifolius, also a widespread and common species with a similar distribution. The main distribution area is Witbank to Lydenburg, and southwards to Piet Retief and Wakkerstroom. It occurs in wetlands or marshes in high altitude grassland that remain wet throughout the year or dry out for only a short period. This species is listed on the South African Red List with a national assessment of Vulnerable, but is currently not recognized by the IUCN as it is regarded as a synonym of G. crassifolius. Whereas this species is confined more to wetland habitats, G. crassofolius has larger leaves, longer spikes and smaller flowers, and is found in drier, more stony habitats. It flowers from October to January and has a high probability of occurring in wetland areas on the study site. Without flowers, the plant can be recognized as a Gladiolus. The closest historical record is approximately 30km from the study site. This species has a MODERATE chance of occurring on the site.

Sensitive species 691

A widespread geophyte distributed in Free State, North West, Gauteng, and in Mpumalanga from Belfast and Ermelo to Wolmaransstad. It is found in wetlands in undulating grasslands. The species is currently listed as Vulnerable. It flowers from January to March but its peak flowering month is February. It could feasibly be found in wet areas on the site but is quite conspicuous in February when if flowers. The closest historical record is approximately 40km from the site. It has a MODERATE chance of occurring on the site.

***Pachycarpus suaveolens* -Vulnerable**

Occurs in Gauteng and Mpumalanga to Eswatini, where it is found in Lydenburg Montane Grassland, Eastern Highveld Grassland, and Soweto Highveld Grassland in short or annually burnt grasslands, at elevations of 1400-2000 m. Based on the known distribution and habitat requirements, as well as known nearby populations, there is a HIGH chance of it occurring in the general area where the project is located.

Sensitive species 851

A small succulent perennial herb with white flowers, growing in marshy areas or shallow vleis. This species is listed as Vulnerable but the confidence in this assessment is low (according to the Red List). Its distribution is uncertain because of its taxonomic confusion with the very similar Crassula inanis, but it appears to be restricted to the area between Ermelo and Maseru. The closest known record to the site of the Project is in the Bethal area. It has a MODERATE chance of occurring on the site.

A database search identified additional plant species of conservation concern that could also occur on site that are not flagged in the Screening Tool output. These are included in the following **Table 7-6** :

Table 7-6: Additional listed plant species for the study area

TAXON	RED LIST STATUS	HABITAT AND DISTRIBUTION	FLOWERING TIME	PROBABILITY OF OCCURRENCE
Alepidea cordifolia APIACEAE	Endangered (SA)	Widespread and extremely common across the eastern highveld of Mpumalanga, the eastern Free State, and north-western KwaZulu-Natal. It occurs along the north and north-eastern borders of Lesotho and is also found in Eswatini, on the Eastern Highlands of Zimbabwe and the Chimanimani Mountains of Mozambique. Forest margins, west and south facing mountain slopes and near drainage lines or islands within wetlands. Open grassland or on forest margins, often amongst rocks and/or along streams.	Summer, mostly February to March	**MODERATE** (within known overall distribution)
Alepidea longeciliata APIACEAE	Endangered	Between Breyten, Lothair, Middelburg and Stoffberg. Recorded from 2 neighbouring grids. Eastern Highveld Grassland. Grassland, Karoo Sandstone, above 1600 m. Possibly associated with edges of pans.	Summer	**MODERATE** (within known overall distribution)
Bowiea volubilis subsp. volubilis HYACINTHACEAE	Vulnerable (national)	Eastern Cape to Limpopo Province. Widespread elsewhere in southern and eastern Africa. Low and medium altitudes, usually along mountain ranges and in thickly vegetated river valleys, often under bush clumps and in boulder screes, sometimes found scrambling at the margins of karroid, succulent bush in the Eastern Cape. Occurs in bushy kloofs at the coast and inland in KwaZulu-Natal. In Gauteng, Mpumalanga and North West Province it is often found in open woodland or on steep rocky hills usually in well-shaded situations. Tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm.		LOW (site within gap in distribution, habitat not suitable)
Brachystelma gerrardii APOCYNACEAE	Endangered	KwaZulu-Natal, Waterberg, Wolkberg and Eswatini. Open grassland, 400-1800 m. Site is within overall distribution range, but plant absent from Mpumalanga highveld.		LOW

TAXON	RED LIST STATUS	HABITAT AND DISTRIBUTION	FLOWERING TIME	PROBABILITY OF OCCURRENCE
Eucomis pallidiflora subsp. polevansii HYACINTHACEAE	Near Threatened	Pilgrim's Rest and Lydenburg to Eswatini to southern Mpumalanga. Wetlands in grassland, often in standing water up to 300 mm deep. Recorded at Ermelo in similar habitat as that found on site.		**HIGH** (wetlands)
Gladiolus robertsoniae IRIDACEAE	Near Threatened	South-eastern Gauteng, northern Free State and south-western Mpumalanga. Moist highveld grasslands, found in wet, rocky sites, mostly dolerite outcrops, wedged in rock crevices.		**HIGH**
Habenaria barbertonii ORCHIDACEAE	Near Threatened	Gauteng and Mpumalanga. Rocky hillsides, in bushveld in association with acacias, 1000-1500 m.	February to March	**MODERATE** (habitat may not be suitable)
Kniphofia typhoides ASPHODELACEAE	Near Threatened	Gauteng, Limpopo, Mpumalanga, North West, Parys to Lydenburg to Paulpietersburg to Newcastle. Low lying wetlands and seasonally wet areas in climax Themeda triandra grasslands on heavy black clay soils, tends to disappear from degraded grasslands.		**MODERATE** (habitat may not be suitable)
Merwilla plumbea HYACINTHACEAE	Near Threatened	Widespread in eastern half of South Africa, Eswatini and Lesotho. Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.		**HIGH**
Miraglossum davyi APOCYNACEAE	Vulnerable	Dullstroom, Middelburg and Standerton. Grassland (Lydenburg Montane Grassland, Soweto Highveld Grassland, Eastern Highveld Grassland).		**HIGH**
Riocreuxia aberrans APOCYNACEAE	Near Threatened	Dullstroom to Ermelo. Grassland. Wedged in cracks among rocks on exposed quartzite ridges.		LOW (habitat not suitable)

None of the tree species protected under the National Forests Act (Appendix 1 of the Plant Species Assessment report, 2022) have been previously recorded in the area in which the site is located. A full list of plants that could occur on site, as well as those recorded, is given in Appendix 2 of the Plant Species Assessment report, 2022. (**Appendix H-15**)

There are species recorded on site that are protected under the Mpumalanga Nature Conservation Act No. 10 of 1998 (Appendix 3 of the Plant Species Assessment report, 2022) (**Appendix H-15**). It is a legal requirement to obtain a permit from the provincial authorities for the destruction of any of these species. A comprehensive walk-through survey of the final footprint is required to compile a complete list of these protected species.

Low existing populations of alien plants were observed on site, but areas of farm infrastructure were not investigated in detail during the field survey. There is a high possibility that alien plants could be introduced to areas within the footprint of the proposed activities from surrounding areas in the absence of control measures. The potential consequences may be of moderate seriousness for affected natural habitats. Control measures could prevent the impact from occurring. These control measures are relatively standard and well-known. Known alien invasive species recorded in the general geographical area that includes the site are as follows (in order of frequency observed):

- *Campuloclinium macrocephalum;*
- *Acacia mearnsii;*
- *Verbena bonariensis;*
- *Solanum mauritianum;*
- *Datura stramonium;*
- *Cirsium vulgare;*
- *Rumex acetosella;*
- *Acacia dealbata;*
- *Solanum sisymbriifolium;*
- *Cortaderia selloana;*
- *Arundo donax;*
- *Sesbania punicea;*
- *Ipomoea purpurea;*
- *Melia azedarach;*
- *Nicotiana glauca;*
- *Eucalyptus camaldulensis;*
- *Solanum elaeagnifolium;*
- *Phytolacca octandra;*
- *Robinia pseudoacacia;*
- *Ailanthus altissima;*
- *Xanthium spinosum;*
- *Myriophyllum aquaticum;*
- *Araujia sericifera;*
- *Nasturtium officinale;*
- *Verbena rigida;*
- *Acacia melanoxylon;*
- *Xanthium strumarium;*
- *Azolla filiculoides;*
- *Pinus taeda;*
- *Alisma plantago-aquatica;*
- *Rubus niveus;*
- *Agave americana;*
- *Acacia podalyriifolia;*
- *Carduus nutans;*
- *Ligustrum lucidum;*
- *Ageratum houstonianum;*
- *Spathodea campanulate;*

- *Verbena brasiliensis;*
- *Salvia tiliifolia;*
- *Solanum pseudocapsicum;*
- *Argemone ochroleuca;*
- *Pinus patula;*
- *Paspalum quadrifarium;*
- *Austrocylindropuntia subulate; and*
- *Rumex usambarensis.*

7.2.4 ANIMAL SPECIES

Vertebrate species (mammals, reptiles, amphibians) with a geographical distribution that includes the study area are listed in Appendix 3 of the Animal Species Assessment Report (**Appendix H-14**). All threatened (Critically Endangered, Endangered or Vulnerable) or near threatened vertebrate animals that could occur in the study area and have habitat preference that includes habitats available in the study area, are discussed further below.

MAMMALS

There are 81 mammal species that have a geographical distribution that includes the study area, of which fourteen are listed in a conservation category of some level (see Appendix 1 of the Animal Species Assessment Report – **Appendix H-14**). This is a relatively moderate diversity of mammals compared to other parts of South Africa. Based on the natural state of the study area and surrounding areas, it is considered likely that some of these species could occur on site.

Of the species currently listed as threatened or protected (see Appendix 2 of the Animal Species Assessment Report - **Appendix H-14** for list of protected species), eight of those listed in **Table 7-7** are considered to have a medium to high probability of occurring on site and being potentially negatively affected by proposed activities associated with the proposed projects.

Table 7-7: Mammal species of conservation concern with a likelihood of occurring on site

SCIENTIFIC NAME	COMMON NAME	STATUS	LIKELIHOOD OF OCCURRENCE
Ourebia ourebi	Oribi	Endangered	Low
Pelea capreolus	Grey Rhebok	Near Threatened, protected	Medium
Felis nigripes	Black-footed Cat	Vulnerable, protected	High
Panthera pardus	Leopard	Vulnerable, protected	Low
Dasymys robertsii	African Marsh Rat	Vulnerable	Low
Aonyx capensis	Cape Clawless Otter	Near Threatened, protected	Medium
Hydrictus maculicollis	Spotted-necked Otter	Vulnerable, protected	Medium
Poecilogale albinucha	African Striped Weasel	Near Threatened	Medium
Parahyaena brunnea	Brown hyaena	Near Threatened	Low
Atelerix frontalis	South African Hedgehog	Near Threatened, protected	High

SCIENTIFIC NAME	COMMON NAME	STATUS	LIKELIHOOD OF OCCURRENCE
Crocidura maquassiensis	Maquassie Musk Shrew	Vulnerable	Low
Crocidura mariquensis	Swamp Musk Shrew	Near Threatened	High
Amblysomus septentrionalis	Highveld Golden Mole	Near Threatened	Medium
Mystromys albicaudatus	White-tailed Rat	Vulnerable	Low
Otomys auratus	Vlei Rat	Near Threatened	High

REPTILES

A total of 60 reptile species have a geographical distribution that includes the study area in which the project site is found (Alexander & Marais 2007, Bates *et al*. 2014, Branch 1988, Marais 2004, Tolley & Burger 2007). This is a moderate diversity compared to average diversity in other parts of the country. Of the reptile species that could potentially occur in the study area, four have been listed in a threat category (**Table 7-8**). There are three reptile species of conservation concern that could potentially occur in the study area and that may therefore be affected by the proposed projects.

Table 7-8: Reptile species of conservation concern with a likelihood of occurring on site.

SCIENTIFIC NAME	COMMON NAME	STATUS	LIKELIHOOD OF OCCURRENCE
Chamaesaura aenea	Coppery grass lizard	Near Threatened	Medium to High
Chamaesaura macrolepis	Large-scaled Grass Lizard	Near Threatened	Low
Tetradactylus breyeri	Breyer’s Long-tailed Seps	Vulnerable	Low
Homoroselaps dorsalis	Striped Harlequin Snake	Near Threatened	Medium to High

AMPHIBIANS

A total of 24 frog species have a geographical distribution that includes the general study area in which the project site is found (Du Preez & Carruthers 2009). Some of these species are only marginally present in the study area due to the fact that their distribution range ends close to the study area. Of the frog species that could potentially occur in the study area, none are listed in a threat category, but one species is listed as protected, according to National legislation, the Giant Bullfrog.

It is concluded that the site contains habitat that is suitable for various frog species, although only one species of conservation concern is likely to occur in the study area. One frog species of concern is therefore potentially likely to be affected by development in the study area, as shown in **Table 7-9**.

Table 7-9: Amphibian species of conservation concern with a likelihood of occurring on site.

SCIENTIFIC NAME	COMMON NAME	STATUS	LIKELIHOOD OF OCCURRENCE
Pyxicephalus adspersus	Giant Bullfrog	Protected	Medium

PROTECTED ANIMALS

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (see Appendix 3 of the Animal Species Assessment Report - **Appendix H-14**). According to this Act, "*a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7*". Such activities include any that are "*of a nature that may negatively impact on the survival of a listed threatened or protected species*". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution that includes the site are listed in Appendix 3 of the Animal Species Assessment Report (**Appendix H-14)**. This includes the following species:

- Black Wildebeest (doesn't occur on site);
- Oribi (unlikely to occur on site);
- White Rhinoceros (doesn't occur on site);
- Black-footed Cat;
- Serval;
- Leopard (probably does not occur on site);
- Cape Clawless Otter;
- Spotted-necked Otter;
- Cape Fox;
- Honey Badger;
- South African Hedgehog;
- Brown Hyena; and
- Giant Bullfrog.

There are additional species protected under the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) (see Appendix 2 of the Animal Species Assessment Report - **Appendix H-14**). These include the following that have a geographical distribution that includes the site:

- Giant Bullfrog;
- South African Hedgehog;
- Honey Badger;
- Aardwolf;
- Brown Hyaena;
- Mountain Reedbuck;
- Black Wildebeest;
- Klipspringer;
- Orbi;
- Steenbok;
- Eland;
- Cape Clawless Otter;and
- Spotted-necked Otter.

All species of reptiles, except the water leguaan, rock leguaan and all species of snakes, of which the following have a geographical distribution that includes the site:

- Marsh terrapin;
- Leopard tortoise;
- Common dwarf gecko;
- Spotted dwarf gecko;
- Van Son's gecko;

— Delalande’s sandveld lizard;
— Burchell’s sand lizard;
— (Spotted sand lizard);
— Coppery grass lizard;
— Cape grass lizard;
— Large-scaled grass lizard;
— Common girdled lizard;
— Common crag lizard;
— Yellow-throated plated lizard;
— Breyer’s long-tailed seps;
— Short-headed legless skink;
— Thin-tailed legless skink;
— Wahlberg’s snake-eyed skink;
— Cape skink;
— Red-sided skink;
— Speckled rock skink;
— Variable skink;
— Montane dwarf burrowing skink;
— Common flap-necked chameleon;
— Eastern ground agama; and
— Southern rock agama.

7.2.5 BATS

Currently there is no evidence of GH&A facilities posing a direct threat of fatality impact on bats during operation. However, roosting and foraging habitats may be destroyed during the construction phase. This is primarily due the fact that such facilities require areas of land to be cleared, and in some cases, earthworks are required for levelling purposes. This can result in habitat that is suitable for micro roosts, such as rocky outcrops, clumps of trees and certain vegetation being destroyed, which can also be fatal to bats residing in such roosts. Natural vegetation can support higher insect food quantities and diversity than cleared land, therefore foraging habitat can also be displaced, especially by solar facilities.

The presence of security lights on and around these facilities creates significant light pollution that can impact bat feeding habits and species compositions negatively, by artificially discouraging photophobic (light averse) species and favouring species that readily forage around insect-attracting lights. Additionally, if the buildings and associated infrastructure for these facilities are placed close to wind turbines, the light pollution at these buildings can attract photophilic bat species, thereby significantly increasing their chances of being killed by moving blades of turbines within close proximity.

Figure 7-20 illustrates the bat sensitivity map, which confirms that the two GH&A facility alternatives are located outside of any high and medium sensitivity areas.

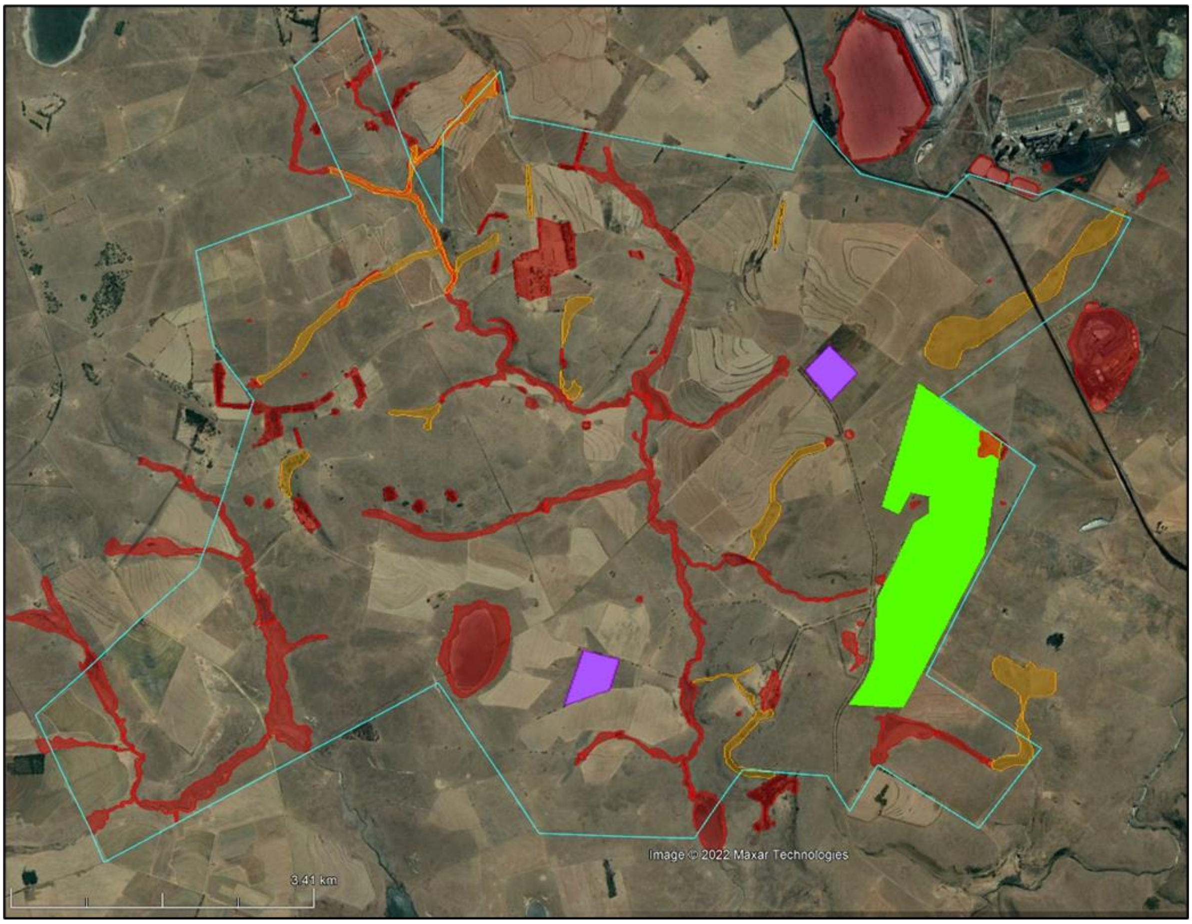


Figure 7-20: Bat sensitivity map of the site (purple blocks indicate footprint alternatives). Shaded red = high sensitivity Shaded orange = medium sensitivity.

7.2.6 HABITATS

A map of habitats within the study area is provided below in **Figure 7-21**. The site is within an area of natural grassland but degraded (from heavily to light). The grassland contains variation due to changes in topography, slope inclination, surface rockiness and the influence of water-flow and water retention in the landscape. A broad classification of the natural habitat units on site, which also reflects relatively uniform plant species compositional units, is as follows:

Natural habitats:

- Natural grassland (open grassland on undulating plains – the condition is not indicated in the habitat map although there is a gradient from heavily grazed poor condition to moderate condition);
- Wetlands (permanent and seasonal wetlands in drainage valleys, including channels, where they occur);

Transformed and degraded areas:

- Old lands (secondary grasslands on previously cultivated areas);
- Exotic trees (stands of exotic trees);
- Degraded areas (disturbed areas with bare ground, weeds or waste ground).
- Current cultivation (areas currently cultivated and fallow lands);
- Transformed (areas such as roads and buildings where there is no vegetation).

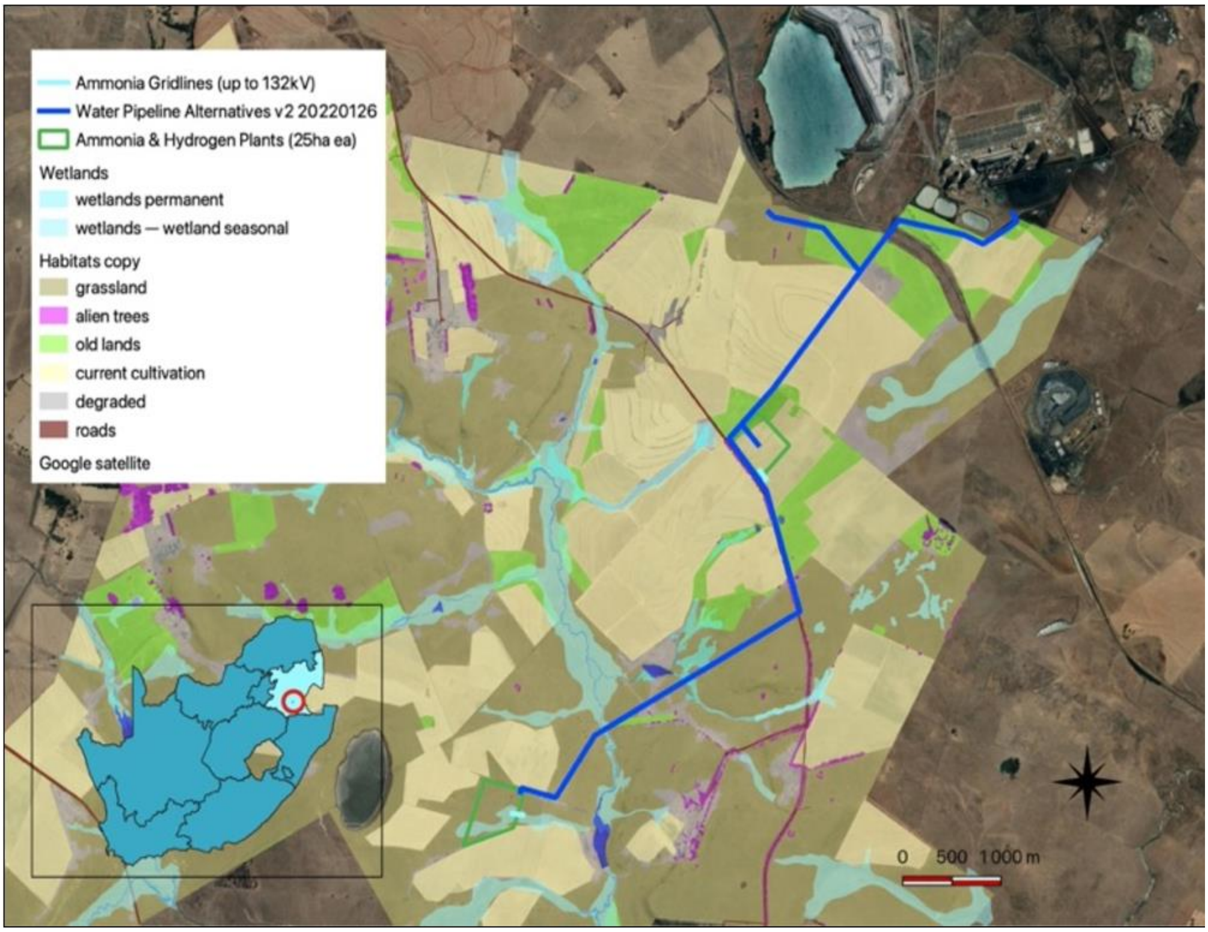


Figure 7-21: Main habitats of the study area (David Hoare Consulting, 2021)

To determine ecological sensitivity in the study area, site-specific, local and regional factors were taken into account. There are some habitats in the study area that have been described as sensitive in their own right, irrespective of regional assessments. This includes primarily the stream beds and associated riparian zones and adjacent floodplains. A detailed assessment and delineation of these areas was undertaken by an aquatic specialist and they are only considered here in terms of being important habitat for flora and fauna.

At a regional level, the CBA map for Mpumalanga indicates various parts of the study area as being important for conservation. The CBA map therefore corresponds with the distribution of remaining natural habitat on site. However, no parts of the site fall within CBAs (see **Figure 7-19**)

In terms of other species of concern, including both plants and animals, the preferred habitat of each of these can be determined or has been described. They are, however, distributed amongst different habitats on site, which means that no single habitat is primarily important as habitat for species of concern.

A summary of sensitivities that occur on site and that may be vulnerable to damage from the proposed project are as follows:

— **CBA "Irreplaceable" areas**: The Mpumalanga Biodiversity Sector Plan (MBSP) (Mpumalanga Parks and Tourism Agency 2014) shows areas on site within various conservation planning categories, including areas designated as "CBA: Irreplaceable". These are areas that are required to meet biodiversity targets (for biodiversity pattern and ecological process features), the implication being that there are no other areas that meet the biodiversity criteria for meeting these conservation planning objectives. The Provincial policy is that they should remain in a natural state. Where possible, impacts on these areas should be minimised.

— **Wetlands**: These are described here only in terms of being a unique botanical habitat and not in the sense of a formal wetland delineation, which is normally assessed in a separate specialist study. The wetlands must be delineated according to "DWAF, 2003: A Practical Guideline Procedure for the Identification and

Delineation of Wetlands and Riparian Zones". Restrictions in terms of infrastructure within these areas should be according to the National Water Act (Act 36 of 1998).

- **Listed ecosystems**: Chrissiesmeer Panveld is listed as Endangered, and Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands are both listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).
- **Grasslands**: Grassland vegetation, in a general sense has been identified as threatened nationally as a habitat type. Indications are that loss of any grassland habitat is permanent in an ecological and biodiversity sense, and it is not possible to restore grassland to a natural state after they have been disturbed. They should therefore be treated as sensitive and all efforts made to minimize impacts on any area of grassland. If possible, the footprint of any proposed infrastructure should be kept to a minimum within any natural grasslands, especially those in a moderate to good condition.
- **Plant species of concern**: There are a number of listed plant species that could potentially occur on site. The key habitats are grasslands and wetlands. There are also various protected species that could potentially occur on site

Grassland

The general study area is characterised by an open grassland on the undulating hills and plains. It is generally a short to moderate height tussock grassland with closed canopy cover. The soil depth varies, as does the amount of surface rock cover, but tends to have shallow soil.

The general floristic character of this vegetation on site is fairly uniform across wide areas, often dominated by the same suite of species, including the grasses, *Alloteropsis semialata, Aristida diffusa, Aristida junciformis, Bewsia biflora, Brachiaria serrata, Diheteropogon amplectens, Elionurus muticus, Eragrostis capensis, Eragrostis chloromelas, Eragrostis plana, Eragrostis racemosa, Harpochloa falx, Heteropogon contortus, Microchloa caffra, Panicum natalense, Setaria sphacelata var. torta, Themeda triandra, and Tristachya leucothrix, and the forbs, Acalypha angustata, Anthospermum rigidum subsp. rigidum, Berkheya setifera, Chaetacanthus costatus, Commelina africana, Crabbea acaulis, Cucumis hirsutus, Cucumis zeyheri, Cyanotis speciosa, Gerbera viridifolia, Haplocarpha scaposa, Helichrysum rugulosum, Hemizygia pretoriae, Hermannia transvaalensis, Hibiscus aethiopicus, Hypoxis obtusa, Hypoxis rigidula, Indigofera comosa, Ipomoea ommaneyi, Justicia anagalloides, Kohautia amatymbica, Ledebouria ovatifolia, Monsonia attenuata, Nidorella hottentotta, Pentanisia angustifolia, Pollichia campestris, Scabiosa columbaria, Selago densiflora, Seriphium plumosum, Vernonia galpinii, Vernonia oligocephala,* and *Zornia milneana*. Overall diversity in this unit was high and included a full list of over 100 species. Local species richness was also high at 56 species per 400m2 sampling area. This rivals the local richness of some of the most species-rich grasslands anywhere in the country.

Wetlands

Wetlands were mapped from Google Earth imagery dated 28/03/2019, a date which shows the wetness signal very well as darker green areas. This also corresponds well to black and white historical aerial photographs from 1955, where wetlands appear as darker areas.

Valley bottom wetlands in this general area around Ermelo, such as this one, are generally dominated by a variety of grasses, sedges and herbaceous plants, including the graminoids, *Kyllinga erecta, Leersia hexandra, Agrostis lachnantha, Andropogon appendiculatus, Helictotrichon turgidulum, Scirpoides burkei, Cyperus teneristolon, Cyperus macranthus, Typha capensis, Agrostis erianthe, Hemarthria altissima, Panicum schinzii, Cyperus rigidifolius and Arundinella nepalensis, the herbs, Centella asiatica, Senecio polyodon, Senecio erubescens, Haplocarpha scaposa, Pelargonium luridum, Commelina africana, Lobelia flaccida, Monopsis decipiens,* and *Helichrysum aureonitens*. The species composition depends entirely on the hydrological characteristics of the site, with a greater number of obligate wetland species occurring in more permanently damp areas, whereas dryer areas more closely resembling terrestrial grassland in species composition.

Current cultivation

These are areas that, according to recent satellite imagery, are currently being cultivated, or were recently cultivated (within the last five years). If not under crops, they would be a ploughed land, or a fallow land with either weeds or a cover crop. From an ecological or biodiversity perspective, these areas have no natural habitat and have no plant or vegetation biodiversity value. The soil profile has been completely disturbed, removing all original vegetation, including geophytic and resprouting plant species. In the Grassland Biome of South Africa, a large proportion of the indigenous biodiversity consists of herbaceous and low shrubby species that re-sprout seasonally, after fire, or after defoliation from grazing animals, and can persist under these conditions. In cultivated areas, it is possible through natural succession, or through active rehabilitation, to restore a perennial cover of grasses, but the original biodiversity is permanently lost. They also have little value for animal biodiversity, except for species that forage in cultivated areas.

Old lands

These are areas that were previously ploughed for cultivation but have been left for an extended period without ploughing. Through natural succession processes, they generally develop a perennial cover of grasses, but these secondary grasslands are species poor and the original diversity of resprouting species is usually entirely absent. Non-grass species diversity usually consists of re-seeding and weedy species, and sometimes animal- and/or bird-dispersed woody species.

On aerial photographs and satellite images with adequate resolution, these areas are often recognisable by the presence of residual plough lines and other structural features often present in cultivated fields.

Exotic trees

There are planted windrows on the roadsides in various parts of the site, as well as within homestead complex areas. These are mostly deliberately planted some decades ago and are not alien invasive species. There are, however, various places on site where alien invasive species have become established in previously disturbed areas. In both cases, the underlying natural grassland is lost

Degraded areas

Any areas where the original vegetation is lost due to continuous degradation, such as trampling, severe overgrazing, or some other factor, it is mapped as degraded. These areas are unlikely to restore to natural grassland, even with removal of the drivers of the degradation.

Transformed areas

Areas where natural habitat no longer exists due to development of infrastructure, such as roads, buildings, and other hard surfaces. Current cultivation is also transformed, but has not been replaced by built infrastructure, therefore the soil surface can be colonized by plants, if cultivation is stopped.

The Species Environmental Assessment Guidelines (SANBI 2020) require that a Site Ecological Importance is calculated for each habitat on site, and provides methodology for making this calculation.

- Natural grassland (open grassland on undulating plains, including moderately to heavily grazed areas);
- Wetlands (seasonal wetlands in drainage valleys);
- Old lands (secondary grasslands on old lands);
- Current cultivation (areas currently cultivated and fallow lands);
- Exotic trees (stands of exotic trees);
- Degraded areas (disturbed areas with weeds or waste ground);
- Transformed areas (no vegetation, due to complete removal and replacement with hard surface or structure).

As per the Species Environmental Assessment Guidelines (SANBI 2020), Site Ecological Importance (SEI) is calculated as a function of the Biodiversity Importance (BI) of the receptor and its resilience to impacts (SEI = BI + RR). The Biodiversity Importance (BI) in turn is a function of Conservation Importance (CI) and Functional Integrity (FI), i.e. BI = CI + FI. This is outlined in **Table 7-10** below.

Table 7-10: Site ecological importance for habitats found on site

HABITAT	CONSERVATION IMPORTANCE	FUNCTIONAL INTEGRITY	RECEPTOR RESILIENCE	SITE ECOLOGICAL IMPORTANCE (BI)
Natural grassland	High Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type.	Medium Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. (Chrissiesmeer Panveld is listed as EN) BUT Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.	Very low Habitat that is unable to recover from major impacts	High (BI = Medium)
Wetlands	High Any area of natural habitat of threatened ecosystem type with status of VU.	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types	Low Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore less than 50% of the original species composition and functionality	High (BI = Medium)
Old lands	Low No confirmed or highly likely populations of SCC or range-restricted species.	Very low Several major current negative ecological impacts.	High Habitat that can recover relatively quickly (5-10 years) to restore >75% to restore the original species composition and functionality	Very low (BI = Very low)
Current cultivation	Very low No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining.	Very low Several major current negative ecological impacts.	Very high Habitat that can recover rapidly	Very low (BI = Very low)

Exotic trees	Very low No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining.	Very low Several major current negative ecological impacts.	Very high Habitat that can recover rapidly	Very low (BI = Very low)
Degraded	Very low No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining.	Very low Several major current negative ecological impacts.	Very high Habitat that can recover rapidly	Very low (BI = Very low)
Transformed	Very low No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining.	Very low Several major current negative ecological impacts.	Very high Habitat that can recover rapidly	Very low (BI = Very low)

The calculation of Site Ecological Importance matches the sensitivity classification given in the previous section of this report, but includes an explicit recognition of the ability of each ecosystem to tolerate and recover from disturbance. Guidelines for development activities within different importance levels are given in the **Table 7-11**.

Table 7-11: Guidelines for interpreting SEI in the context of the proposed development activities

SITE ECOLOGICAL IMPORTANCE	INTERPRETATION IN RELATION TO PROPOSED DEVELOPMENT ACTIVITIES
Very high	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/ not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities
Very low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

Based on this information, a map of habitat sensitivity on site is provided in **Figure 7-22**. This shows main habitat sensitivity classes on site, as follows:

— LOW for all transformed areas.
— MEDIUM-LOW for secondary grasslands in previously cultivated areas.
— MEDIUM for cultivated wetlands.

— MEDIUM-HIGH for all remaining natural habitat on site.
— HIGH for remaining natural habitat within “CBA: Irreplaceable” and “CBA: Optimal” areas.
— VERY HIGH for intact natural wetlands

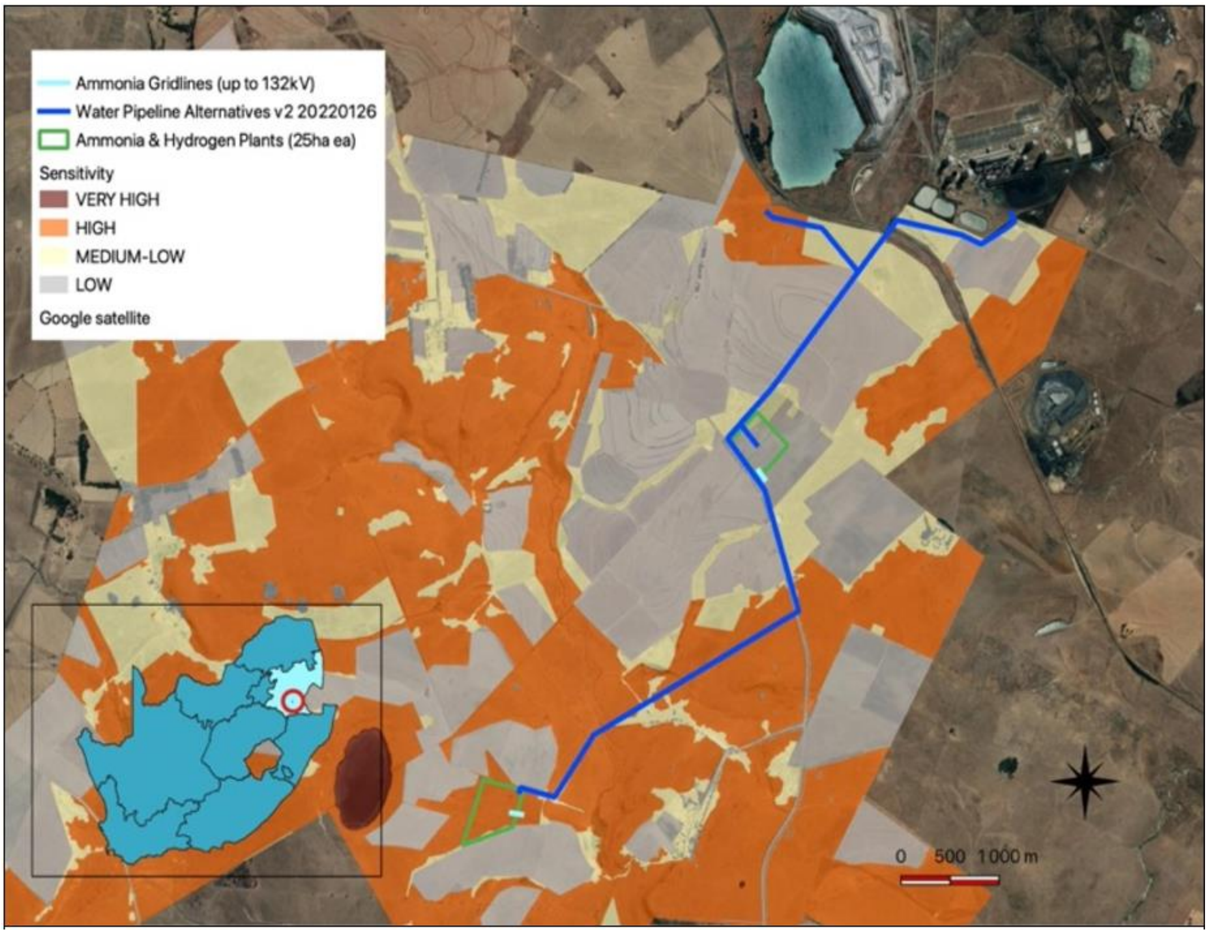


Figure 7-22: Habitat Sensitivity of the Study Area

Infrastructure locations relative to mapped sensitivities are shown in **Figure 7-22**. There are two possible Green Hydrogen and Ammonia Facility site alternatives. **Table 7-12** and **Table 7-13** below outlines the footprint of each alternative relative to the habitat it falls in. The proposed infrastructure includes the following:

— Alternative 2: the preferred site (PS) - in the north - this is within a cultivated land.
— Alternative 1: alternative site (AS) - in the south - this is within a grassland area.

Table 7-12: Amount of each type of habitat in the footprint of Alternative 1

HABITAT	STATUS	AREA IN HECTARES	PROPORTION OF TOTAL AREA
Grassland	Natural	15.29	71.2
Wetland	Natural	5.86	27.3
Current cultivation	Transformed	0.32	1.5
TOTAL		**21.47 ha**	**100.0%**

Table 7-13: Amount of each type of habitat in the footprint of Alternative 2 (Preferred):

HABITAT	STATUS	AREA IN HECTARES
Current cultivation	Transformed	18.16
TOTAL		**18.16 ha**
Habitat	**Status**	**Area in hectares**

Pipelines

Each ammonia facility requires a pipeline to obtain water. The two potential sources are at Camden Power Station Confluence, and at a second location nearer the Usutu bulk water supply pipeline. There are four pipeline route alternatives. The **Table 7-14** below outlines the footprint of each alternative relative to the habitat it falls in.

- Alternative 1: PS to Usutu Scour (preferred)
- Alternative 2: AS to Camden PS
- Alternative 3: AS to Usutu Scour
- Alternative 4: PS to Camden PS

Table 7-14: Distance of each type of habitat in the footprint of the water pipeline

HABITAT	STATUS	ALTERNATIVE 1 (PREFERRED)	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
Grassland	Natural	422	2698	3120	
Wetland	Natural		200	200	
Exotic trees	Degraded		1437	1437	
Degraded areas	Degraded	86	1174	610	650
Old lands	Secondary	1236	1781	1440	1577
Current cultivation	Transformed	1521	2036	1657	1900
Road	Transformed		20	20	
TOTAL		3265 m	9346 m	8484 m	4127 m

7.2.7 AVIFAUNA

IMPORTANT BIRD AREAS

The project site is not located in an Important Bird Area (IBA), but it is located between three IBAs. The closest IBA to the project site is the Amersfoort-Bethal-Carolina IBA SA018, which is located within 1.5km from the site to the west. The Grasslands IBA SA020 is located 6-7km to the east of the site. The Chrissies Pans IBA SA019 is located 16-17km to the north-east of the site. Due to the close proximity of the site to the IBAs, it is possible that some highly mobile priority species which are also IBA trigger species, and which occur either permanently or sporadically in the IBAs, might be impacted by the project when they leave to forage or breed beyond the borders of the IBA. Species that were recorded in the broader areas and fall within this category are the following:

- Secretary bird
- Denham's Bustard
- Blue Crane
- Grey Crowned Crane
- Wattled Crane
- Martial Eagle
- Lanner Falcon
- Greater Flamingo
- Lesser Flamingo
- African Marsh Harrier
- Black Harrier
- Southern Bald Ibis
- African Grass Owl

BIRD HABITAT

Whilst much of the distribution and abundance of the bird species in the project site can be explained by the dominant biomes and vegetation types, it is also important to examine the modifications which have changed the natural landscape, and which may have an effect on the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types, and are determined by a host of factors such as topography, land use and man-made infrastructure.

The following bird habitat classes were identified in the project site:

GRASSLAND

The majority of the habitat in the project site comprises natural grassland. The grassland varies from dense stands of relatively high grass to areas of heavily grazed short grass. The priority species which could potentially use the natural grassland in the project site on a regular basis are the following:

- Secretary bird
- White-bellied Bustard
- Blue Crane
- Grey Crowned Crane
- Lanner Falcon
- Southern Bald Ibis
- Blue Korhaan
- African Grass Owl

The priority species which could occasionally use the natural grassland in the project site are the following:

- Denham's Bustard
- Martial Eagle
- African Marsh Harrier
- Black Harrier
- Montagu's Harrier
- Cape Vulture
-

AGRICULTURAL LANDS

The project site contains a patchwork of agricultural fields, where maize, soya beans and pastures are cultivated. Some fields are lying fallow or are in the process of being re-vegetated by grass. The priority species which could potentially use the agricultural fields in the project site on a regular basis are the following:

- Blue Crane
- Grey Crowned Crane
- Lanner Falcon
- Southern Bald Ibis

The priority species which could occasionally use the agricultural lands in the project site are the following:

- Denham's Bustard
- Brown Snake Eagle
- Martial Eagle
- Cape Vulture

PRIORITY SPECIES

The South African Bird Atlas Project 2 (SABAP2) data indicates that a total of 234 bird species could potentially occur within the broader area. Appendix 1 of the Avifauna impact assessment Report (**Appendix H-2**) provides a comprehensive list of all the species. Of these, 15 species are classified as priority species (see definition of priority species in section 4) and of the priority species, 10 are likely to occur regularly in the development area.

Table 7-15 lists all the priority species that are likely to occur regularly and the possible impact on the respective species by the proposed solar farm. The following abbreviations and acronyms are used:

- NT = Near threatened
- VU = Vulnerable
- EN = Endangered

Table 7-15: Priority species potentially occurring at the development area

SPECIES NAME	SCIENTIFIC NAME	SABAP2 FULL PROTOCOL REPORTING RATE	SABAP2 AD HOC PROTOCOL REPORTING RATE	GLOBAL STATUS	REGIONAL STATUS	RECORDED DURING SURVEYS	LIKELIHOOD OF REGULAR OCCURRENCE	GRASSLAND	AGRICULTURE	POWERLINE - COLLISION	DISPLACEMENT: DISTURBANCE	DISPLACEMENT: HABITAT TRANSFORMATION	ELECTROCUTIONS: 132KV GRID
African Grass Owl	*Tyto capensis*	2.4	0	-	VU	x	M	x		x	x	x	
Denham's Bustard	*Neotis denhami*	1.8	0	NT	VU		L	x		x	x	x	
Lanner Falcon	*Falco biarmicus*	7.3	0	-	VU	x	M	x	x				
Secretarybird	*Sagittarius serpentarius*	13	0	EN	VU	x	H	x		x	x	x	
Southern Bald Ibis	*Geronticus calvus*	23	3.1	VU	VU	x	H	x	x	x			
White-bellied Bustard	*Eupodotis senegalensis*	7.9	0	-	VU	x	M	x		x	x	x	
Blue Crane	*Grus paradisea*	12	0.4	VU	NT	x	H	x	x	x	x	x	

SPECIES NAME	SCIENTIFIC NAME	SABAP2 FULL PROTOCOL REPORTING RATE	SABAP2 AD HOC PROTOCOL REPORTING RATE	GLOBAL STATUS	REGIONAL STATUS	RECORDED DURING SURVEYS	LIKELIHOOD OF REGULAR OCCURRENCE	GRASSLAND	AGRICULTURE	POWERLINE - COLLISION	DISPLACEMENT: DISTURBANCE	DISPLACEMENT: HABITAT TRANSFORMATION	ELECTROCUTIONS: 132KV GRID
Greater Flamingo	*Phoenicopterus roseus*	3.6	4.4	-	NT	x	M			x			
Lesser Flamingo	*Phoeniconaias minor*	3.6	1.3	NT	NT	x	M			x			
African Marsh Harrier	*Circus ranivorus*	0.6	0	-	EN		L						
Black Harrier	*Circus maurus*	0	0.9	EN	EN		L	x					
Cape Vulture	*Gyps coprotheres*	0	0	EN	EN	x	L	x		x			x
Grey Crowned Crane	*Balearica regulorum*	5.5	0	EN	EN	x	M	x	x	x	x	x	
Martial Eagle	*Polemaetus bellicosus*	2.4	0	EN	EN	x	L	x					
Wattled Crane	*Grus carunculata*	0.6	0	VU	CR		L			x			

AVIFAUNA SENSITIVITY

The following specific environmental sensitivities have been identified from an avifaunal perspective:

- **100m all infrastructure exclusion zone (barring essential roads and grid line crossings) around drainage lines and associated wetlands.** Wetlands are important breeding, roosting and foraging habitat for a variety of Red List priority species, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African Marsh Harrier (SA status Endangered).
- **High sensitivity grassland - Limited infrastructure exclusion zone**. Development in the remaining high sensitivity grassland in the project site must be limited as far as possible. The grassland is vital breeding, roosting and foraging habitat for a variety of Red List priority species. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham's Bustard (SA Status Vulnerable) and Secretary bird (Global and SA status Endangered).

The avifaunal sensitivities identified for the Camden I GH&A facility are shown in **Figure 7-23**.

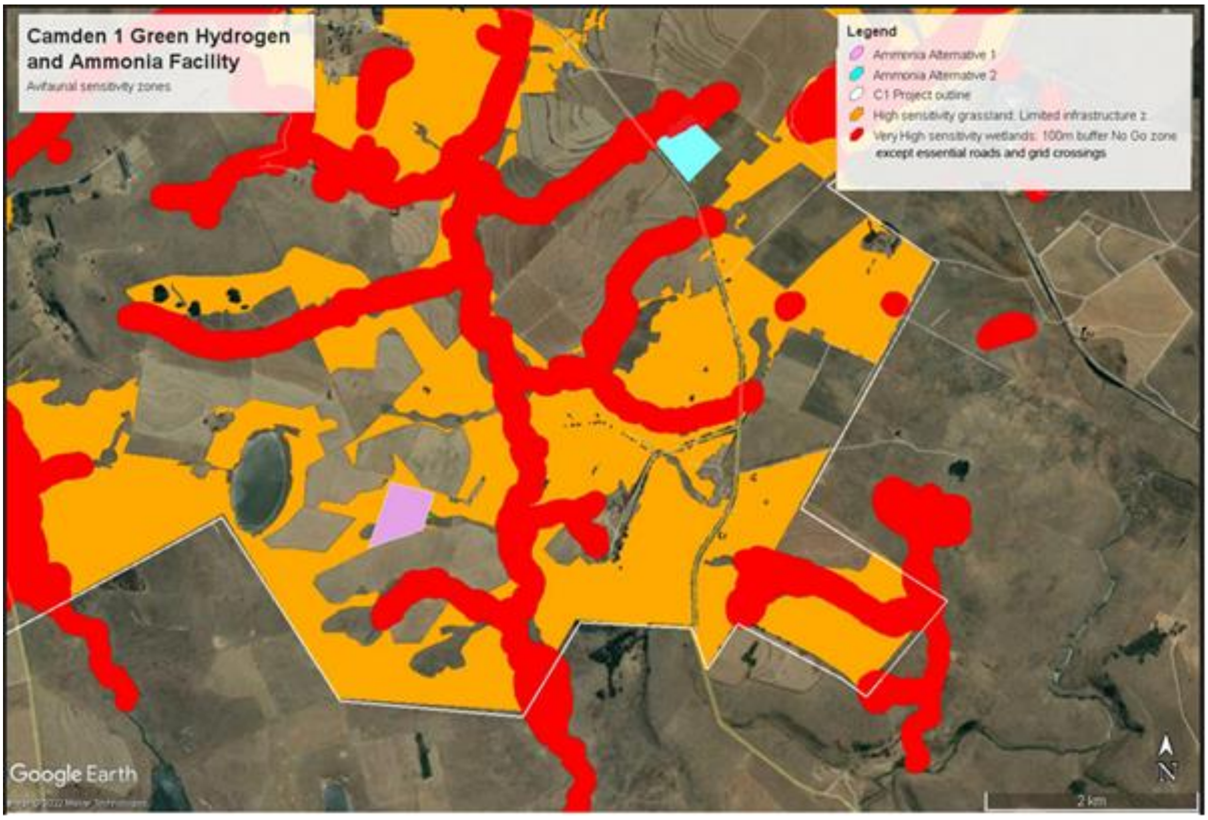


Figure 7-23: Proposed avifaunal sensitivities at the Camden I GH&A facility (Chris van Rooyen Consulting, 2022).

7.3 SOCIAL ENVIRONMENT

7.3.1 LAND USE

DEVELOPMENT SITE

The site is used for cultivation and for the grazing of both cattle and sheep. Cultivated crops include maize, soya beans and the fodder crop, weeping love grass, Eragrostis curvula.

In terms of the South African National Land Cover dataset, the site is classified as Grassland interspersed with cultivation areas, Small tracts of forested land and numerous water bodies are scattered throughout the study area (**Figure 7-24**).

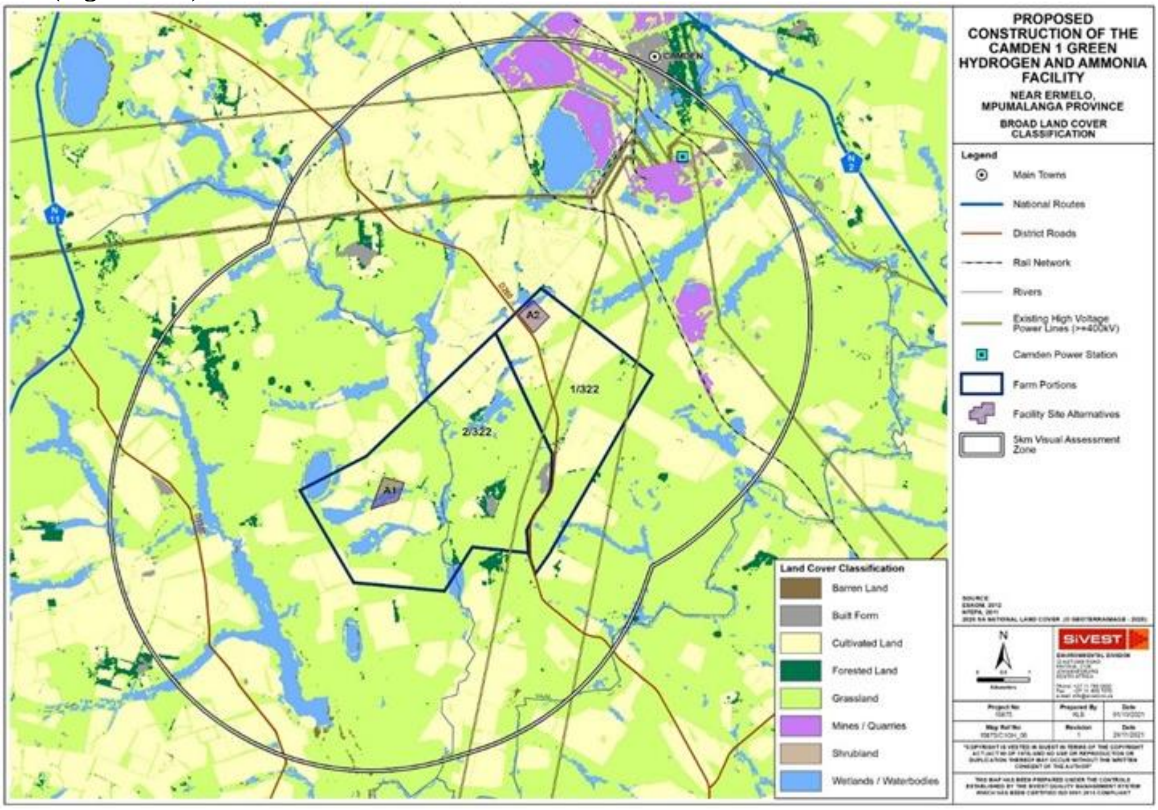


Figure 7-24: Broad land cover classification (SiVest 2021)

SURROUNDING AREAS

The broader study area is located approximately 10km south east of the town of Ermelo. The only other settlement in the area is the rural settlement of Sheepmore located approximately 20 km to the east of the proposed project site.

Commercial agriculture is the dominant activity in the study area, with the main focus being maize cultivation and livestock grazing. There are multiple farm portions in the broader study area, resulting in a relatively moderate density of rural settlement with many scattered farmsteads in evidence. Built form in much of the study area comprises farmsteads, ancillary farm buildings and workers' dwellings, gravel access roads, telephone lines, fences and windmills.

High levels of human influence are however visible in the northern / north-eastern sector of the broader study area. Much of the town of Ermelo encroaches into the study area and peri-urban areas stretching southwards from Ermelo along the N2 national route are dominated by mining activity and associated infrastructure, including Mooiplaats and Vunene Collieries. Also located in this area is the Camden Power Station with associated high voltage power lines, and the adjacent Camden residential area.

Other evidence of significant human influence includes a sizeable quarry (Rietspruit Crushers) located to the west of the N11 national route, as well as road, rail, telecommunications and high voltage electricity infrastructure.

7.3.2 NOISE CLIMATE

It is important to note that wind speed and direction play a vital role in determining baseline noise levels. Noise monitoring is usually discouraged when wind speeds exceed 5 m/s (>18 km/h) as wind noise distorts the baseline noise levels by masking other noise sources. However, no wind speeds exceeding 5 m/s were recorded during the monitoring period.

The existing noise climate surrounding the Camden I GH&A Facility is predominantly rural with very low baseline noise levels anticipated. Noise sources may include birds, insects, livestock and activities of resident farmers. Anthropogenic influences may include traffic on local roads and on the nearby N2 and N11 National roads as well as train activity along the railway line located just northeast of the study area. A distinctive hum from the nearby Camden power station may also be evident at receptors in close proximity to the power station.

Sensitive receptors are identified as areas that may be impacted negatively due to noise associated with the proposed GH&A Facility. Examples of receptors include, but are not limited to, schools, shopping centres, hospitals, office blocks and residential areas. Being such a remotely located site, dominant receptors in the area surrounding the site include small farmsteads and farmhouses. The specific sensitive receptors (farmhouses) considered in the study are presented in **Figure 7-25** and **Table 7-16**.

Table 7-16: Acoustic Sensitivities

ID	DESCRIPTION	LATITUDE (°S)	LONGITUDE (°E)	DISTANCE FROM FACILITY (M)	DIRECTION FROM FACILITY
C1_Rec 01	Farmhouse	26.634611	30.033396	3,160	NW
C1_Rec 02	Farmhouse	26.632051	30.078345	1,645	NE
C1_Rec 03	Farmhouse	26.670771	30.069023	2,510	S

Figure 7-25: Sensitive receptors surrounding the Camden I GH&A Facility Preferred Alternative

7.3.3 TRANSPORT NETWORK

The Camden I GH&A facility will be located south-west Camden and National Road N2, and to the west of National Road N11. The N2 is the primary road link between Ermelo and Richards Bay and south to Durban. In the vicinity of the site, the N2 is a single carriageway with 1 lane per direction and gravel shoulders.

The N11 is the primary road link between Ladysmith and Newcastle in Kwa-Zulu-Natal, through Ermelo to Middelburg and beyond. In the vicinity of the site, the N11 is a single carriageway with 1 lane per direction and gravel shoulders.

The local road network consists of the N2 to the north and northeast of the project site, and the N11 to the west and south of the site. The Richards Bay railway line traverse the site to the south of the Camden Power station site. There are 3 landing strips within Msukaligwa municipality one municipal landing strip in Ermelo with tarred runaway for various activities, one at Warburton and Woodstock farms respectively used for fire-fighting purposes by forestry companies.

The site is traversed by two district roads, refer to **Figure 7-26** for the alignment of these roads as shown on the potential site access map.

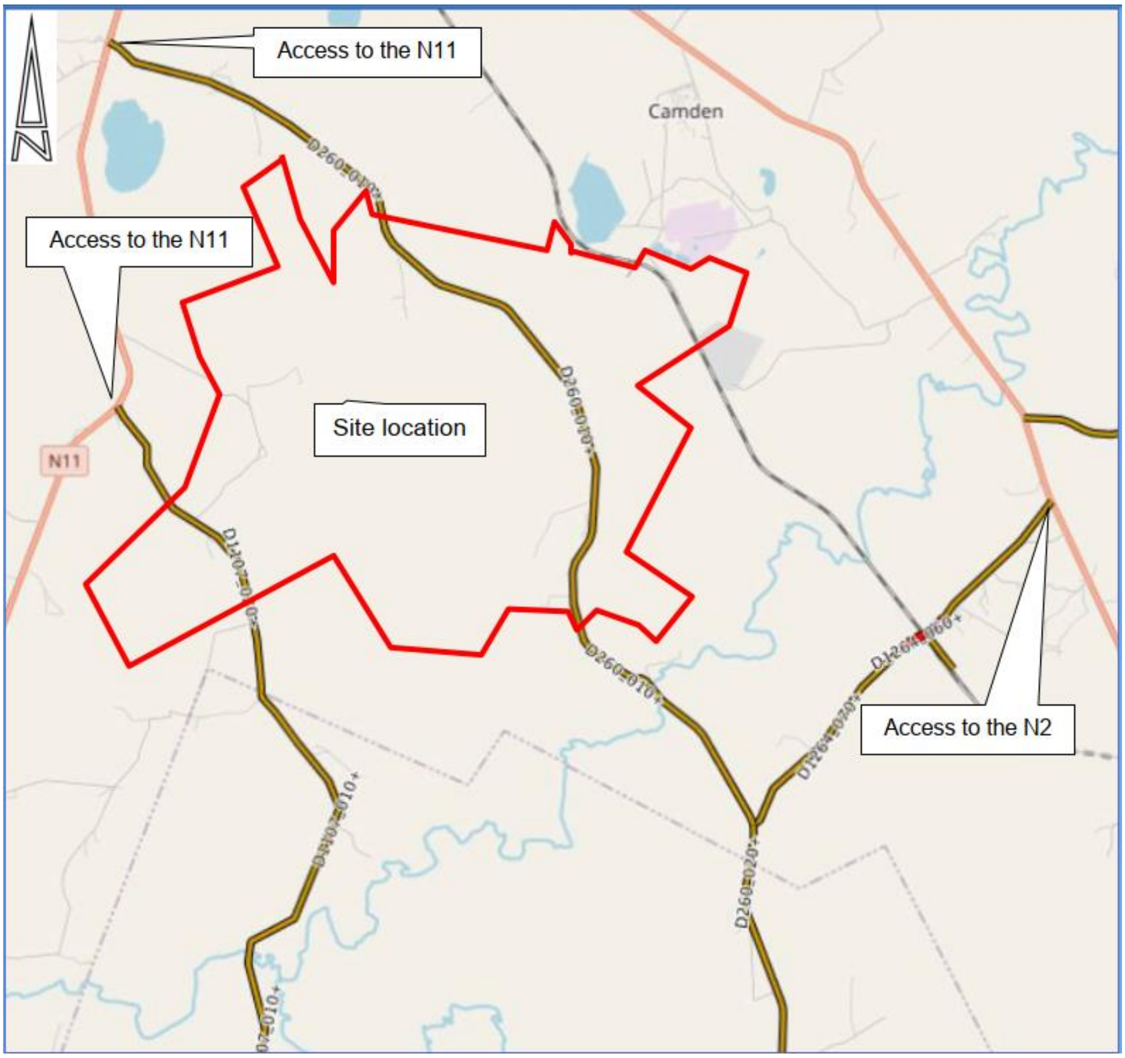


Figure 7-26: Potential site access

The D260 is a district collector from the N11 and follows a roughly southerly alignment beyond its intersection with the D1264. It is a single carriageway 2-way unsurfaced road (1 lane per direction), with no shoulders. It has a priority Stop controlled T-junction on the N11.

The D1107 is a district collector between the N11 and Road D1329/D261. It is a single carriageway 2-way unsurfaced road (1 lane per direction), with no shoulders. It has a priority Stop controlled T-junction on the N11.

The D1264 is a district collector between the D260 and the N2, located to the south of the site. It is a single carriageway 2-way unsurfaced road (1 lane per direction), with no shoulders. It has a priority Stop controlled T-junction on the N2, and a grade separated crossing (road over rail), over the main railway line between Mpumalanga and Richards Bay.

7.3.4 HERITAGE AND CULTURAL RESOURCES

The Camden power station and associated small town is situated 16km south from Ermelo in Mpumalanga. The archaeological record for the greater study area consists of the Stone Age and Iron Age.

STONE AGE

The Stone Age of southern Africa starts when hominins (ancestral to modern-day humans) first started to produce crude tools made with stone. The Earlier Stone Age (2 million - 200 000 years ago) is associated with hominins such as Homo habilis and Homo erectus (Dusseldorp et al. 2013). Mpumalanga currently does not have an extensive ESA archaeological record, at Maleoskop on the farm Rietkloof, only a few ESA artefacts have been found and stone tools consisted of choppers (Oldowan), hand axes, and cleavers (Acheulean) (Esterhuysen & Smith 2007) and some surface scatters have been recorded near Piet Retief (Nel & Karodia 2013).

Middle Stone Age artefacts represents archaic and modern humans that occupied the landscape between 300 000 to 40 000 before present. Later Stone Age occupational sequences reflect San and Khoisan communities from 40 000 years ago until recently (Dusseldorp et al. 2013). Although the MSA and LSA has not been extensively studied in Mpumalanga, evidence for these periods has been excavated from Bushman Rock Shelter in the Ohrigstad District (Esterhuysen & Smith 2007; Lombard et al. 2012) and it is known that San communities lived near Lake Chrissie as recently as the 1950s (e.g., Schlebusch et al. 2016). MSA and LSA surface scatters have also been investigated in the vicinity of Piet Retief, and De Wittekrans nearby Camden is a Later Stone Age archaeological rock art site complex (Nel & Karodia 2013).

IRON AGE

The archaeology of farming communities of southern Africa encompasses three phases. The Early Iron Age (200-900 CE) represents the arrival of Bantu-speaking farmers in southern Africa. Living in sedentary settlements often located next to rivers, these farmers cultivated sorghum, beans, cowpeas, and kept livestock. The Middle Iron Age (900-1300 CE) is mostly confined to the Limpopo Valley in southern Africa with Mapungubwe Hill probably representing the earliest ‘state’ in this region (Huffman 2007).

The Late Iron Age (1300-1840s CE) marks the arrival and spread of ancestral Eastern Bantu-speaking Nguni and Sotho-Tswana communities into southern Africa. The location of Late Iron Age settlements is usually on or near hilltops for defensive purposes. The Late Iron Age as an archaeological period ended by 1840 CE, when the Mfecane caused major socio-political disruptions in southern Africa (Huffman 2007).

Dates from Early Iron Age sites indicated that by the beginning of the 5th century CE Bantu-speaking farmers had settled in the Mpumalanga lowveld. Subsequently, farmers continued to move into and between the lowveld and highveld of Mpumalanga. Iron Age sites such as Welgelegen Shelter, Robertsdrift and Tafelkop situated 50-100 km west of Camden dates from the 12th to the 18th century (Derricourt & Evers 1973; Esterhuysen & Smith 2007).

During the mid-17th century Europeans started to settle in modern-day Cape Town. During and after the conflict caused by the Mfecane (1820-1840), during the reign of king kaSenzangakhona Zulu, known as Shaka, Dutch-speaking farmers started to migrate to the interior regions of South Africa. A period that is marked by various skirmishes and battles between the local inhabitants, Dutch settlers and the British (Giliomee & Mbenga 2007).

HISTORICAL CONTEXT OF CAMDEN

Camden power station was commissioned in 1967 (Gaigher 2011; Matenga 2020). However, the nearby town of Ermelo has a rich history. The earliest record for settlers in Ermelo is from 1860, when the area was under the jurisdiction of Zulu-speaking Nhlapo communities (Nhlapo 1945). The construction of the town of Ermelo was initiated by the Dutch Reform Church, which purchased the eastern part of the farm Nooitgedacht on 26 May 1879. The town was officially proclaimed on 12 February 1880 by William Owen Lanyon, the Administrator of the Transvaal (Greyling 2017).

BATTLEFIELDS AND WAR HISTORY

Due to the proximity of Ermelo to the Nederlandsche Zuid-Afrikaansche Spoorweg-Maatskappij railway line linking Pretoria with Lourenço Marques (Maputo), the area was subject to various skirmishes during the Anglo-Boer War of 1899-1902. At the time there were about 100 families residing in the town and many women and children were sent to British concentration camps. In 1901, British troops burnt the town down due to their scorched earth policy, and Ermelo was rebuilt in 1903 (Moody 1977; Pretorius 2000; Van Schalkwyk 2012; Greyling 2017).

RUINS AND BURIAL SITES

The Klipbank cemetery with 21 graves is indicated 4,6 km to the south of the Project. Heritage finds in the in the broader study area (i.e., inclusive of Camden I Solar PV and Camden I & II Wind Energy Facilities) are limited to burial sites and the demolished remains of structures in the greater area (**Figure 7-27**).

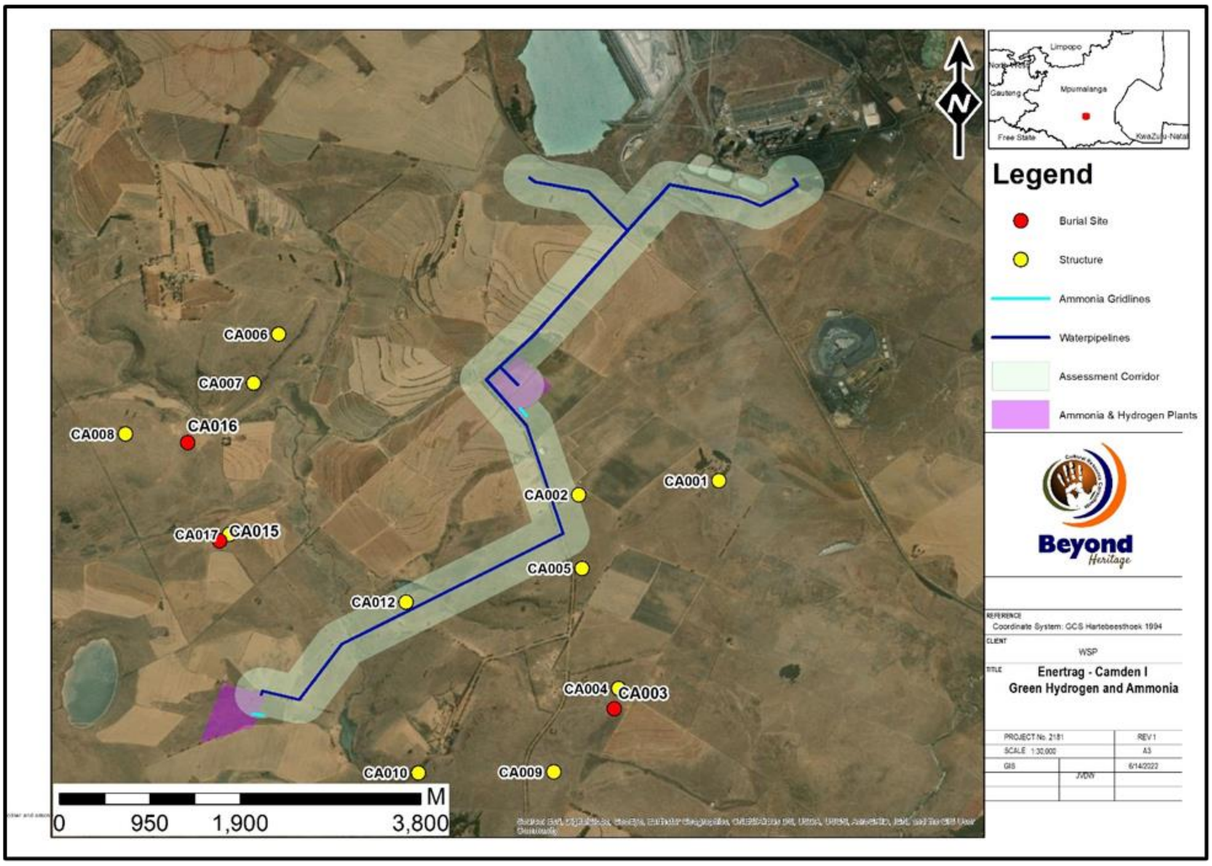


Figure 7-27: Ruins and burial sites observed in relation to the proposed project infrastructure

The recorded sites in the assessed area are briefly described in **Table 7-17** below and show in the **Figure 7-28, Figure 7-29** and **Figure 7-30** below **.**

Table 7-17: Details of observed sites

LABEL	LONGITUDE	LATITUDE	DESCRIPTION	SIGNIFICANCE
CA002	30° 04' 17.9363" E	26° 39' 18.3757" S	The feature is situated right next to the existing powerline and includes the ephemeral traces of the possible foundation of a stone packed wall over 5 x 5 m.	Generally Protected C (GP.C) - Low significance
CA012	30° 03' 19.0655" E	26° 39' 54.9277" S	The site is historical and consists of the remains of three stone structures one is rectangular and is 20mx13m in size while the other is circular, 4m x4m in size while the third is 12mx9m in size. The site extends over an 80mx50m area and is situated 50m south of a dam.	GP. B - Medium significance

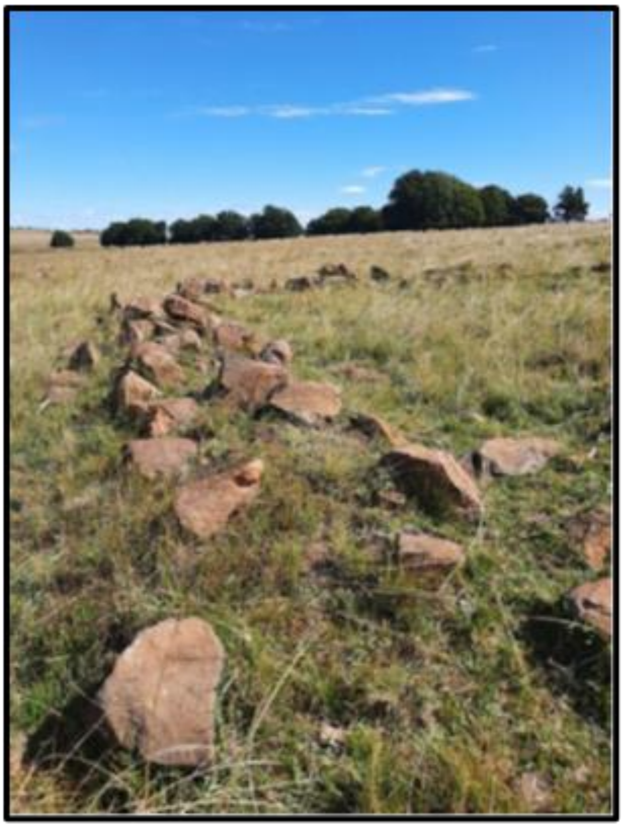


Figure 7-28: Ephemeral stone packed wall at CA002.

Figure 7-29: Location of CA002 in relation to the powerline.

Figure 7-30: Remnants of stone packed wall at CA012.

PALAEONOLOGY

According to the SAHRA Paleontological map the study area is of zero to very high paleontological significance (**Figure 7-31**) and an independent study was conducted for this aspect. Bamford (2022) concluded that based on the fossil record but confirmed by the site visit and walk through, there are NO FOSSILS of the Glossopteris flora even though fossils have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the shales of the Vryheid Formation (Ecca Group, Karoo Supergroup) so a Fossil Chance Find Protocol should be added to the EMPr.

However, a site visit and walk down was done in April 2022 by the specialist. It was observed that most of the area and routes are either under cultivation currently have been cultivated previously so the land has a soil cover and grasses or crops. The topography is fairly flat and there are no rocky outcrops or shale outcrops there are no fossils visible on the surface. No fossils were seen on the land surface.

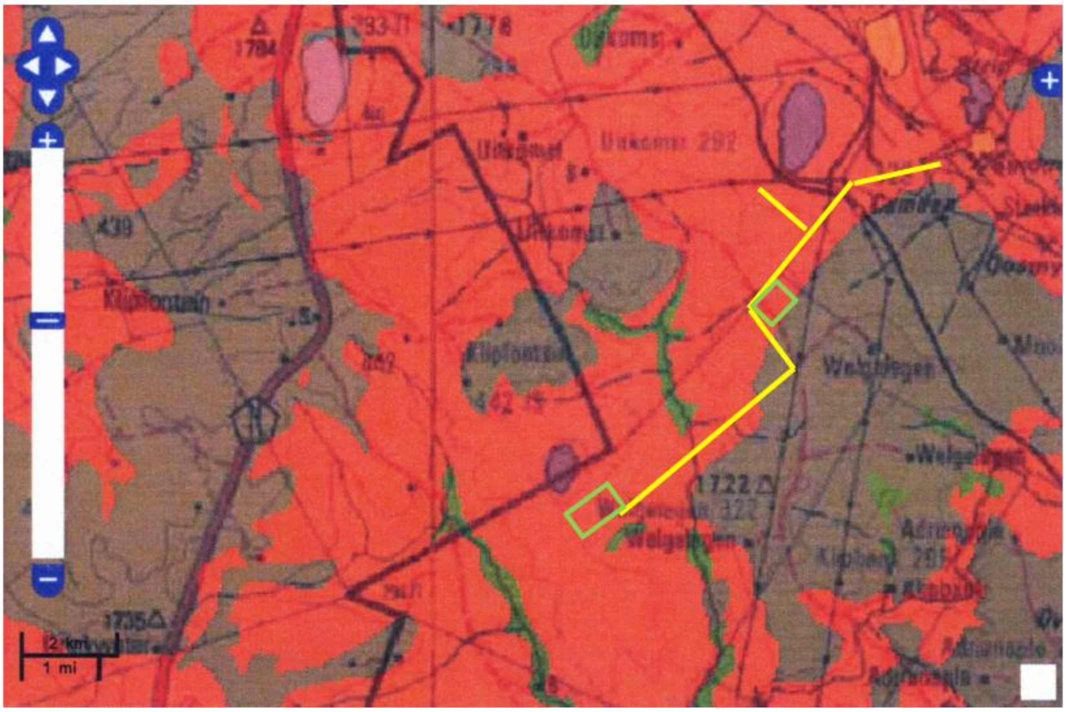


Figure 7-31: Palaeosensitivity of the site

CULTURAL LANDSCAPE

The greater area is mostly cultivated, and forms part of a landscape characterised by wide scale cultivation and mining activities. Development in the study area is limited to farming infrastructure such as access roads, fences, and agricultural developments.

7.3.5 VISUAL CHARACTER AND SENSITIVITY

VISUAL CHARACTER AND CULTURAL VALUE

The physical and land use-related characteristics of the study area as described above contribute to its overall visual character. Visual character largely depends on the level of change or transformation from a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural, undisturbed landscape. Visual character is also influenced by the presence of built infrastructure including buildings, roads and other objects such as telephone or electrical infrastructure. The visual character of an area largely determines the **sense of place** relevant to the area. This is the unique quality or character of a place, whether natural, rural, or urban which results in a uniqueness, distinctiveness or strong identity.

The predominant land use in the area (maize cultivation) has significantly transformed the natural landscape across much of the study area. In addition, the landscape becomes progressively more transformed towards the north-eastern boundary of the study area where Camden Power Station and mining activities have resulted in a high degree of visual degradation. The more industrial character of the landscape is an important factor in this context, as the introduction of the proposed facility would result in less visual contrast where other anthropogenic elements are already present, especially where the scale of those elements is similar to that of the proposed development.

The scenic quality of the landscape is also an important factor that contributes to the visual character or inherent sense of place. Visual appeal is often associated with unique natural features or distinct variations in form. As such, the pastoral landscape and rolling hills in parts of the study area are important features that could increase the visual appeal and visual interest in the area.

Cultural landscapes are becoming increasingly important concepts in terms of the preservation and management of rural and urban settings across the world. The concept of 'cultural landscape' is a way of looking at a place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). In this instance, the rural / pastoral landscape represents how the environment has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small towns, such as Ermelo, engulfed by an otherwise rural / pastoral environment, form an integral part of the wider landscape.

In light of this, it is important to assess whether the introduction of a solar GH&A facility into the study area would be a degrading factor in the context of the prevailing character of the cultural landscape. Broadly speaking, visual impacts on the cultural landscape in the area around the proposed development would be reduced by the fact that the visual character in much of the area has been significantly transformed and degraded mining and infrastructural development.

VISUAL CONTRAST

The visual contrast of a development refers to the degree to which the development would be congruent with the surrounding environment. This is based on whether or not the development would conform to the land use, settlement density, structural scale, form and pattern of natural elements that define the structure of the surrounding landscape. Visual compatibility is an important factor to be considered when assessing the impact of the development on receptors within a specific context. A development that is incongruent with the surrounding area could change the visual character of the landscape and have a significant visual impact on sensitive receptors.

In order to determine the likely visual compatibility of the proposed development, the study area was classified into the following zones of visual contrast:

- High –
  - undeveloped / natural / rural areas.
- Moderate –
  - areas within 500m of existing power lines (>=88kV);
  - areas within 500m of railway infrastructure;
  - cultivated areas and smallholdings.
- Low –
  - areas within 500m of urban / built-up areas;
  - areas within 500m of quarries / mines etc;
  - areas within 500m of Camden Power Station;

These zones are depicted in **Figure 7-32.**

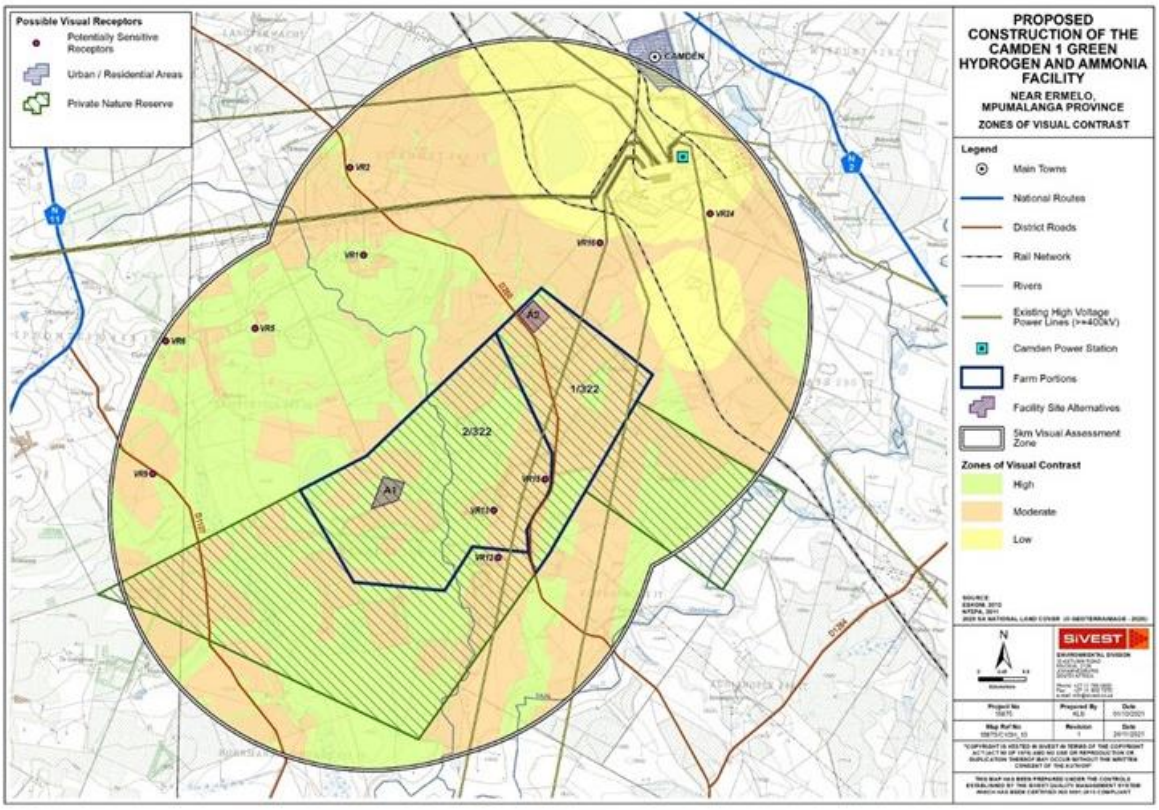


Figure 7-32: Zones of Visual Contrast for the Camden I GH&A Site

7.3.6 SOCIO-ECONOMIC

SOCIAL OVERVIEW OF THE STUDY AREA

The study area is located ~ 10 km to the south-east of the town of Ermelo, which is the administrative centre of the Msukaligwa Local Municipality. Ermelo is also known as the garden city of Mpumalanga and the gateway to the province. The only other settlement in the area is the rural settlement of Sheepmore located ~ 20 km to the east of the site.

Three national highways, namely the N2, N11 and the N17 intersect at Ermelo. The N2 freeway connects Ermelo with Richards Bay on the KwaZulu Natal coastline. The N11 South connects the town to Newcastle to the south and then onto the Ladysmith before linking up with the N3 to Durban. The N11 north connects to Middelburg and the N4 freeway west to Pretoria. The N17 West connects the town to the southern suburbs of Johannesburg and N17 East to eSwatini.

Ermelo is also a major railway junction between Mpumalanga and KwaZulu-Natal. The rail junction connects to Machadodorp which is on the Pretoria and Maputo railway line. The town also lies on the railway line that connects the Mpumalanga coalfields with the export Port of Richards Bay on the Indian Ocean.

The study area is flanked by the N2 to the north and north-east of the site, and the N11 to the west and south west of the site. The Richards Bay railway line traverse the site to the south of the Camden Power station site (**Figure 7-33**). The Eskom Camden Coal Power station is located immediately to the north and north-east of the site. Construction of the 1600 MW power station commenced in November/December 1962 and the first turbo-generator was commissioned in April 1967. The last of the eight units was commissioned in 1969. The Camden Power station became the starting point of the national power grid, consisting of a series of 400 kV lines which today interconnect the entire country. The power station has six 111.86m high cooling towers and four 154m high chimney (smoke stacks) that serve 8 boilers.

Between 1990 and 2006 the station was mothballed, but South Africa's energy crisis in the early 21st century prompted Eskom to recommission the station, starting with unit 6 in July 2005 and completing with unit 1 in July 2008.

The development of the Camden Power station also involved the construction of 356 permanent houses to the north of the power station to accommodate administration, operating and maintenance personnel. Community facilities including a community hall, sports facilities, included four tennis courts, a bowling green, swimming bath, shooting range, rugby, hockey, soccer, and cricket fields and jukskei, and the associated clubhouses and changerooms were also established. Several parks, situated throughout the residential property, provided playgrounds for some 500 children at Camden. Schooling was provided in Ermelo for these children, with a regular bus service operating between Camden and Ermelo[10].

The other land uses in the study area include coal mining and commercial agriculture. Commercial agriculture in the area between the N2 and N11 to the south and west of the Camden Power Station includes livestock and grain farming. There are a number of farmsteads associated with the farming operations in the area, some of which are no longer inhabited. The number of occupied farmsteads will be confirmed during the site visit undertaken during the assessment phase. A guest farm, the Drinkwater Guest Farm, is located adjacent to and east of the N11, ~ 14 km southwest of the Camden Power Station.

The social environment can therefore be described is a working agricultural / industrial (power related) environment. With the exception of the Drinkwater Guest Farm there do not appear to be any other tourist related activities located in the study area. Therefore, from a social perspective there appear to be a limited number of sensitive social receptors.

Figure 7-33: Camden Power Station

[10] https://www.eskom.co.za/sites/heritage/Pages/Camden.aspx

ADMINISTRATIVE CONTEXT

The study area is located within the Msukaligwa Local Municipality within the Mpumalanga Province. The MM is one of the seven Local Municipalities that make up the Gert Sibande District Municipality (**Figure 7-34**). The town of Ermelo is the administrative seat of the Msukaligwa Local Municipality.

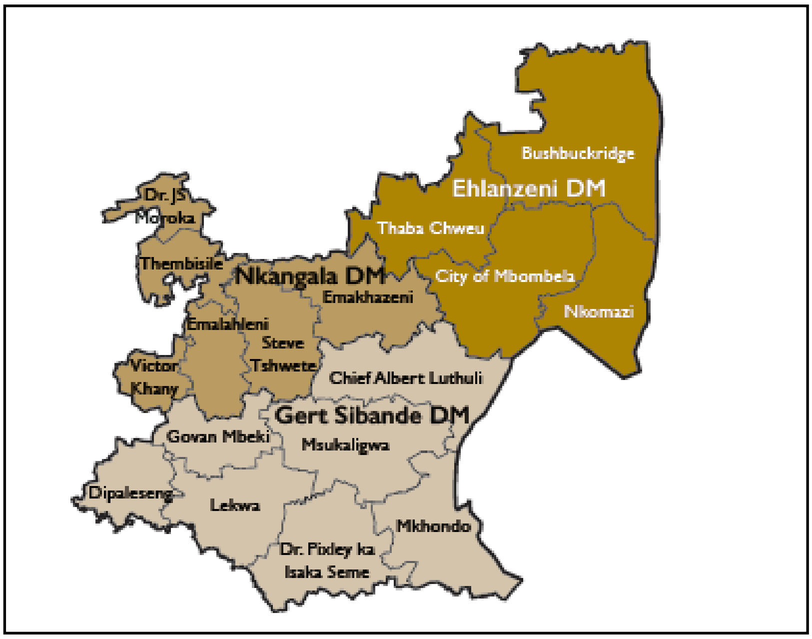


Figure 7-34: Location of Msukaligwa Municipality within the Gert Sibande District Municipality and Mpumalanga Province

DEMOGRAPHIC OVERVIEW

POPULATION

The population of the Msukaligwa Local Municipality in 2016 was 164 608 (Community Household Survey 2016). Of this total, 35.4% were under the age of 18, 60.4% were between 18 and 64, and the remaining 4.1% were 65 and older. The MM therefore had a high percentage of the population that fall within the economically active group of 18-65. The figures are higher than the figures for the GSDM and Mpumalanga (57.7% and 56.6% respectively). This is likely to be due to the employment opportunities associated with the mining and manufacturing activities in the Msukaligwa Local Municipality.

The dependency ratio is the ratio of non-economically active dependents (usually people younger than 15 or older than 64) to the working age population group (15-64). The higher the dependency ratio the larger the percentage of the population dependent on the economically active age group. This in turn translates to reduced revenue for local authorities to meet the growing demand for services. The traditional approach is based people younger than 15 or older than 64. The information provided provides information for the age group under 18. The total number of people falling within this age group will therefore be higher than the 0-15 age group. However, most people between the age of 15 and 17 are not economically active (i.e., they are likely to be at school).

Using information on people under the age of 18 is therefore likely to represent a more accurate reflection of the dependency ratio. Based on these figures, the dependency ratios for the Msukaligwa Local Municipality, the GSDM and Mpumalanga in 2016 were 65.4%, 73.5% and 77% respectively. The high dependency ratios reflect the limited employment and economic opportunities in the area and the province as a whole. As indicated above, a high dependency ratio also places pressure on local authorities in terms of service delivery.

In terms of race groups, Black Africans made up 91.6% of the population on the MM, followed by Whites, 6.9% and Asian or Indians, 0.9%, and Coloureds, 0.6%. This figures for the GSDM are similar. The main first language spoken in the Msukaligwa Local Municipality was isizulu, 79.1%, followed by Siswati, 7.3% and Afrikaans, 6.2%.

HOUSEHOLDS AND HOUSE TYPES

The total number of households in the Msukaligwa Local Municipality in 2016 was 51 090, which constituted approximately 20% of the total number of households in the GSDM. Of these 66.2% were formal houses, 9.1% flats in backyards, 6.6% traditional dwellings, and 9.4% shacks or informal dwellings. The figures for the GSDM were 67.2%, 4.6%, 6.7% and 13.4% respectively. The majority of dwellings in the Msukaligwa Local Municipality are therefore formal structures. A relatively large percentage of the properties in the MM (43.3%), while 5.9% were owned and in the process of being paid off. 22.1% of the households rented their properties, while 10.6% occupied their properties rent free. The rent-free figure is likely to be associated with farm workers. The relatively high number of properties that are owned and or in the process of being paid off reflects a relatively stable and established community.

In terms of household heads, approximately 38.9% of the households in the Msukaligwa Local Municipality and 39.1% of the households in the GSDM were headed by women. These figures similar to the provincial figure of 39.71%. The high percentage of households headed by women reflects the likelihood that the men have left the area in search of employment opportunities in Gauteng. Women headed households tend to be more vulnerable.

HOUSEHOLD INCOME

Based on the data from the 2011 Census, 12.6% of the population of the Msukaligwa Local Municipality had no formal income, 4.1% earned less than R 4 800, 7.1% earned between R 5 000 and R 10 000 per annum, 17.7% between R 10 000 and R 20 000 per annum and 20.9% between R 20 000 and 40 000 per annum (2016). The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household (~ 40 000 per annum). Based on this measure, in the region of 62.4% of the households in the Msukaligwa Local Municipality and 65.2% in the GSDM live close to or below the poverty line.

The low-income levels reflect the rural nature of the local economy and the limited formal employment opportunities outside in the urban areas. This is also reflected in the high unemployment rates. The low-income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low-income levels also result in reduced spending in the local economy and less tax and rates revenue for the Msukaligwa Local Municipality. This in turn impacts on the ability of the Msukaligwa Local Municipality to maintain and provide services.

Household income levels are likely to have been impacted by the COVID-19 pandemic. The number of households in the Msukaligwa Local Municipality and GSDM that live close to or below the poverty line is likely to have increased over the last 18 months. This, coupled with the high dependency ratio, is a major cause of concern for the area.

EMPLOYMENT

The official unemployment rate in the Msukaligwa Local Municipality in 2016 was 15.6%, while 42.6% were employed, and 36.4% were regarded as not economically active. However, the COVID-19 pandemic is likely to have resulted in an increase in unemployment rates in both the ULM and Ward 3. Recent figures released by Stats South Africa also indicate that South Africa’s unemployment rate is in the region of 36%, the highest formal unemployment rate in the world.

EDUCATION

In terms of education levels, the percentage of the population over 20 years of age in the Msukaligwa Local Municipality and GSDM with no schooling was 10.6% (2016), compared to 10.8% and 11.3% for the GSDM and Mpumalanga Cape Province. The percentage of the population over the age of 20 with matric was 34.12%, compared to 34.3% and 36.1% for the GSDM and Mpumalanga. The education levels for the Msukaligwa Local Municipality are therefore similar to the DM and Provincial figures.

MUNICIPAL SERVICES

ELECTRICITY

Based on 2016 survey, 87% of households in the Msukaligwa Local Municipality had access to electricity, compared to 90% for the GSDM and 93% for Mpumalanga.

ACCESS TO WATER

Based on the 2016 survey information, 81.7% of households in the Msukaligwa Local Municipality were supplied by a service provider, while 5.8% relied on their own service or natural sources (4%). The reliance on own services or natural sources reflects the rural nature of large parts the Msukaligwa Local Municipality.

SANITATION

72.3% of the households in the Msukaligwa Local Municipality had access to flush toilets (2016), while 18.8% relied on pit toilets and 3.2% had no access to formal sanitation. The high percentage of households that rely on pit toilets is linked to the relatively high percentage (9.4%) of households that live in shacks.

REFUSE COLLECTION

Only 59.4% of the households in the Msukaligwa Local Municipality had access to regular refuse removal service, while 16.5% disposed of their waste at their own dump and 7.1% had not access to facilities. The low percentage of households that have access to regular refuse removal services is linked to the relatively high percentage (9.4%) of households that live in shacks. The relatively higher percentage that dispose of their waste at their own dump reflects the rural nature of the area and the difficulty of providing municipal services to areas located at a distance from the main towns in the area.

HEALTH, EDUCATION AND COMMUNITY FACILITIES

HEALTH SERVICES

The Msukaligwa Local Municipality IDP indicates that there is 1 government and 1 private hospital in the Msukaligwa Local Municipality, 10 primary health care clinics, and 4 mobile clinics (**Table 7-18**).

Table 7-18: Health services in Msukaligwa Local Municipality

FACILITIES	NUMBER
Private Hospitals	1
Primary Health Care Clinics	10
Mobile Clinics	4
Government hospitals	1
Infectious Hospital (TB)	1
Dentists	4
Gynaecologist	1
Social Workers	12
Private Doctors	20

EDUCATIONAL FACILITIES

The Msukaligwa Local Municipality IDP indicates that there are 71 primary schools, 6 high schools, 12 combined schools and 11 secondary schools in the Msukaligwa Local Municipality. There is 1 FET College, but no tertiary facility (**Table 7-19**). The IDP notes that given the growth in the area there is a need for at least a tertiary institution within the GSDM. Development within Ermelo has also created a need for more primary and high schools.

Table 7-19: Educational Facilities in Msukaligwa Local Municipality

FACILITY	NUMBER
No. of Primary Schools	71
No. of High School	6
No. of Combined Schools	12

No. of Secondary Schools	11
No. of Tertiary Education Facilities	0
No. of FET Colleges	1
No. of Training Centres/Adult Education	9
No. of Private Schools	3
Day Care Centres	40

COMMUNITY FACILITIES

Table 7-20 lists the community facilities in the Msukaligwa Local Municipality. As indicated in the table, Ermelo as the administrative centre is relatively well catered for in terms of community facilities, including police stations, sports facilities, libraries, community halls and pension pay out points. However, Sheepmore, which is the closest rural settlement to the development area does not have a library and the sports facility is an informal soccer field.

Table 7-20: Community facilities

AREA / TOWN	POLICE STATION	PUBLIC SPORT FACILITIES	PUBLIC LIBRARIES	COMMUNITY HALLS	MPCC/TSC	POST OFFICE	PENSION PAY POINTS	COMMENTS
Breyton / KwaZanele	1	4	2	2	1	1	1	There is one informal soccer field at Breyton
Ermelo, Wesselton, Cassim Park and Thusiville	2	9	4	5	-	1	2	There are five informal soccer fields at Wesselton. The Thusiville library is completed but not yet operating
Chrissiesmeer / Kwachibikhulu	1	1	1	1	-	1	1	There is one informal soccer field as Chrissiesmeer
Davel / Kwadela	1	2	1	1	-	1	1	There is one informal soccer field at KwaDela. There is a complaint that the existing library at Davel is far from the majority of users who reside at KwaDela
Lothair / Silindile	1	1	1	1	1	1	1	The TSC is almost completed and postal services run by agency at Lothair
Sheepmoor	1	1	-	1	-	1	1	There is one informal soccer field at Sheepmoor. No library at Sheepmoor
Warburton / Nganga	-	1	-	-	-	1	-	Postal services run at agency at Warburton. The sport facility is an informal soccer field. No library at Warburton

ECONOMIC OVERVIEW

The economic growth rate for Msukaligwa Local Municipality was at 3.0% per annum on average over the period 1996 to 2017 and forecasted average annual GDP growth for 2017-2022 relatively low at 1.3%. The contribution of Msukaligwa Local Municipality to the Mpumalanga economy was around 4.3%, making it the fifth largest local economy in the province. It is the second largest economy in the District, contributing around 15.5%.21

The key economic sectors in the Msukaligwa Local Municipality in 2017 in terms of contribution to GDP were mining (20.3%), community services (18.5%), trade (including industries such as tourism) (18.2%) and finance (14.2%) (**Table 7-21**). Despite the importance of agriculture, it only contributed 6% to GDP in 2017. The IDP notes that the Msukaligwa Local Municipality has a comparative advantage in economic sectors such as agriculture, transport, and mining.

Table 7-21: Contribution of sectors to Msukaligwa Local Municipality GDP

ECONOMIC SECTOR	2014	2017	CHANGE
Agriculture	5,3%	6,0%	0,7%
Community Services	18,4%	18,5%	0,1%
Construction	2,7%	2,7%	0,0%
Finance	13,3%	14,2%	0,9%
Manufacturing	5,1%	5,1%	0,0%
Mining	20,8%	20,3%	-0,5%
Trade	18,5%	18,2%	-0,3%
Transport	11,3%	11,3%	0,0%
Utilities	4,5%	3,8%	-0,7%

Finance and Agriculture achieved the highest, although slight, growth in contribution from 2014 to 2017. The contribution of utilities, mining and trade declined slightly. In terms of employment, the trade sector (20.6%) was the most important sector in terms of employment, followed by community services (15.3%), mining (12.8%), finance (11.6%) and manufacturing (10.1%) (**Table 7-22**).

Table 7-22: Contribution to employment of sectors in Msukaligwa Local Municipality

EMPLOYMENT SECTOR	2014	2017	CHANGE
Agriculture	6%	6,3%	0,3%
Community Services	14,5%	15,3%	0,8%
Construction	7,9%	8,5%	0,6%
Finance	11,2%	11,6%	0,4%
Manufacturing	9,9%	10,1%	0,2%
Mining	14,7%	12,8%	-1,9%
Trade	21,1%	20,6%	-0,5%
Transport	4,5%	4,7%	0,2%

EMPLOYMENT SECTOR	2014	2017	CHANGE
Utilities	2,5%	2,4%	-0,1%

In terms of unemployment, the Msukaligwa Local Municipality unemployment rate was the 6th lowest among all the municipal areas of Mpumalanga. The unemployment rate deteriorated slightly from 23.1% in 2014 to 24.1% in 2017. Unemployment rates are higher for females at 29.8% and for males at 24.1%. However, youth unemployment at 34.5% is a key concern.

The IDP notes that in terms of future economic development, coal mining can be expected to remain an important sector for the short to medium term. However, the role of this sector is expected to decline in the medium to long term due to limited coal resources, and a move away from a coal-based economy locally and globally due the impact on climate. The current transport and logistics sector is also likely to be impacted on by a decline in coal mining.

7.3.7 HEALTH AND SAFETY RISK

The map below show that the Green Hydrogen and Ammonia facility are planned in relatively isolated locations. Activities in the area consist of farming, power generation and there are coal mining rights over some of the land involved in the greater Camden I development. The closest occupied farmhouse complex is approximately 1.2 km east southeast of the Camden I Green Hydrogen and Ammonia location option 1. The local access dirt road runs immediately south of Camden I Green Hydrogen and Ammonia location 2. The closest formal residential area is at the Camden Power station 5km to the east of the Camden I Green Hydrogen and Ammonia location 2. **Figure 7-35** below shows the locality of the proposed alternative sites.

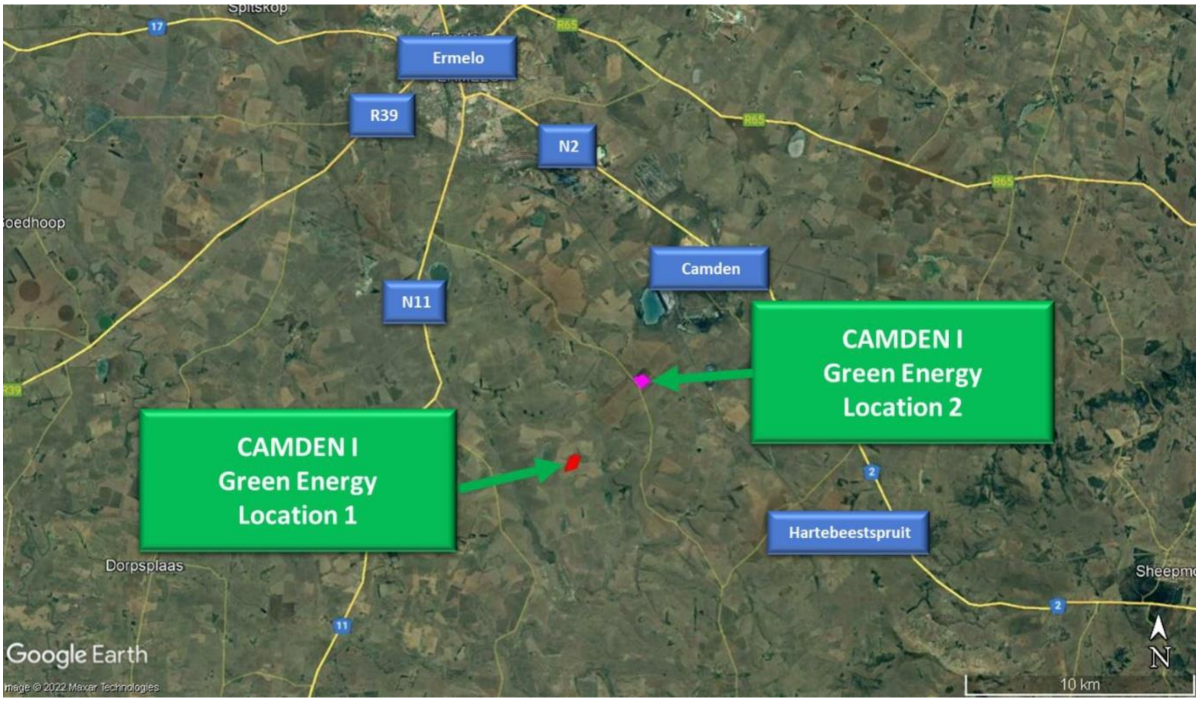


Figure 7-35: Locality of Proposed Alternatives

Across South Africa, lightning strikes are conceivable as a source of ignition of major hazards, refer to SANS10313:2012 lightning strike density table. The lightning ground flash density (ground strike rate) in Ermelo (12.8 Flashes/km^2/year) in very high. Nevertheless, ignition from on-plant sources is much more likely than lightning but lightning cannot be ignored as a source of risk particularly for tall structures in wide open flat areas.

The combination these three technologies, hydrogen electrolysis, LAES and Haber-Bosch, into a new arrangement in order to store and transport energy is however a relatively new concept. There have been a few demonstration plants built around the world. At this stage of the project development only the basic elements of the design are known, e.g. production rate, total storage capacities, possible range of operating pressures and temperatures etc. Details of the plant design, as would typically appear on piping and instrumentation diagrams, such as process conditions, control systems, emergency shutdown systems, and pipeline sizes are not yet available. Listed below are the associated risks with the operation of the facility these include but are not limited to:

Electrolyser

Water will either be extracted via borehole or will be piped to the site (possibly from the Usuthu Pipeline that supplies Camden Power Station or treated wastewater from the power-station/collieries etc) where it will be filtered before being stored for use in the electrolysis plant. There will be a reverse osmosis plant on site to treat water to a suitable standard for use in the brine makeup to the electrolysers. The brine will be circulated into the electrolysis unit where the water molecules will be split into hydrogen and oxygen gases at the anodic and cathodic sides of the unit. The gases will disengage from the brine phase and be extracted from the electrolyser using extraction fans/compressors.

Hydrogen

Hydrogen gas will then be compressed to about 100 bar and stored in one of 20 horizontal 40-ton storage tanks. The tanks will be specifically designed for hydrogen service and located in a dedicated storage area.

Oxygen

Oxygen gas generated on the other side of the electrolyser can either be vented or compressed and stored or cooled, condensed and stored cryogenically as a liquid. At this stage the project only makes allowance for venting.

Air Separation Plant

A standard air separation plant including cold box will be installed. The oxygen from the facility will join the oxygen from the electrolyser plant.

Nitrogen

Nitrogen will be stored cryogenically in one of 2 tanks of approximately 2000 tons each. Nitrogen liquid can be re-vapourised for use in the Haber-Bosch process and as purging gas throughout the plant.

Argon

Argon will be generated from the air separation plant and at this stage it will be vented.

Haber-Bosch Process

In the Haber-Bosch process nitrogen and hydrogen vapours are mixed in a catalytic reactor under 100 - 200 bar. To favour the production of ammonia, an operating temperature in the range of 350 - 525 °C is recommended. After production cooling and clean-up, the ammonia can be liquefied for ease of storage and safety. For this process it is assumed to be stored cryogenically in one of three 1250-ton tanks at atmospheric pressure and -34 °C.

LPG

There will be a need for hydrogen and ammonia pressure relief valves, hydrogen / ammonia purging etc. and for this purpose a flare may be required. LPG is likely to be needed to ensure a constant pilot flame in the flare.

Gantry and Road Tanker Loading

There will be an area where anhydrous ammonia, possibly nitrogen, oxygen and/or hydrogen may be loaded into various types of road tankers for despatch to customers, or importation for supply shortfall etc. On any site, the human interface is greatest at the gantry area and this area usually presents some of eth heist risks. Therefore, this facility will need to be state of the art with loading arms, break away couplings, curing, gas detectors and emergency shut down systems, over fill protection etc.

Other

As part of the facility there will be various support utilities such as, a small sewage treatment plant, maybe a small boiler, workshops, admin buildings, diesel powered generator, diesel for trucks/forklifts electrical infrastructure and a flammable store (e.g. for paints and maybe cylinder) etc.

Staff and shift arrangement

At this stage the numbers of persons on site are unknown. However, the green ammonia plant is not likely manually intense processes and there are likely to be very few persons on site, mostly during the day for maintenance activities etc. This assessment as assumed a maximum of 100 persons on the entire facility during the day and 20 at night. If the project is constructed in phases, it is noted that there may be significantly more persons on the site doing construction adjacent operating facilities. This will need to be carefully planned to ensure limited exposure of construction personnel to operating hazards.

Environmental hazards

Due to the fact that most of the materials generated on this site are actually gases that occur naturally in the atmosphere (except ammonia) no major chemical pollution impact would be expected from catastrophic events.

Ammonia is used as a fertilizer and may thus have effects on the vegetation in the area if released. It should be noted that the cryogenic materials are extremely cold and destruction of vegetation by freezing could be expected within approximately the same range as the adverse effects on humans. In a similar vein, hydrogen flash fires that extend off site will lead to destruction of vegetation and possible secondary veld fires.

As with any site with chemicals and equipment, a fire and the use of large amounts of firewater used in fighting fires on site, which may be severely contaminated and may then flow offsite into watercourses leading to offsite ground and water contamination. This needs to be considered in the on-site emergency plan.

Hazardous material interactions

On any site where different materials are used, it is conceivable (however unlikely) that at some time certain materials may inadvertently be mixed with other materials. On this site no materials will be arriving in bulk road trucks or other containers. Uncontrolled mixing from offloading is therefore not conceivable. Mixing may happen due to process upsets or incorrect operation of the plant. Uncontrolled mixing of oxygen and hydrogen may lead to fires/explosions etc. Although extremely unlikely, if oxygen, nitrogen or argon are produced as by-products to be sold it may be possible to load products into the incorrect road tankers. Mixing of oxygen and ammonia may lead to a fire and explosion. This scenario is included in the catastrophic rupture scenario for ammonia road tankers.

BESS

The **Figure 7-36** below outlines the two alternative locations for the proposed BESS systems.

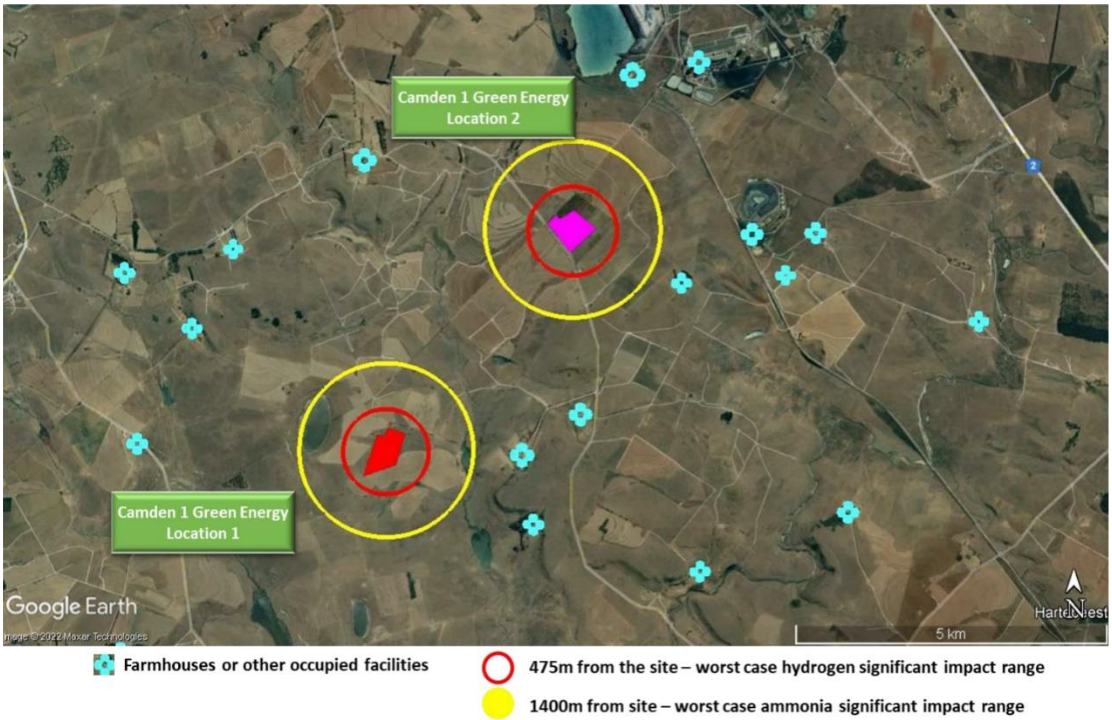


Figure 7-36: BESS alternatives sites in relation to nearby farmhouses

Vanadium redox battery technology

The electrolyte in the VRFB system is corrosive. It is composed of a sulphuric acid-based solution similar to common automotive lead acid batteries. Unlike traditional lead-acid batteries, VRBs do not include lead.

Therefore, VRBs do not have the toxicity issues of lead that conventional car batteries have. The only potential source of human toxicity in a VRB is Vanadium. Vanadium in various physio-chemical states can have a relatively high aquatic and human toxicity. Acute oral exposure to high doses can lead to hemorrhaging, while chronic exposure leads to adverse effects on the digestive system, kidneys and blood (diarrhea, cramps etc.).

Inhalation hazards lead to irritation of the respiratory tract, bronchospasm, pulmonary congestion. There is little evidence that vanadium compounds are reproductive toxics or teratogens. There is also no evidence that it is carcinogenic (Source USA EPA Risk Assessment Information Systems, Toxicity Profiles, Vanadium 1998).

In the electrolyte the concentration levels of Vanadium are so low that when it is mixed into liquid form in the final product and put into operation, the VRB is deemed non-toxic. In addition, VRBs have a lower concentration of sulfuric acid than traditional lead-acid batteries. Vanadium poses a hazard when it is in powder form, i.e. when making up the electrolyte solution. The Camden facilities will purchase electrolyte already made up and there will be no solid vanadium powder on site.

Toxicity or corrosion risks may be present from off-gassing produced by over-heating aqueous or vaporized electrolytes. In addition, flow batteries in fire scenarios may generate toxic gas from the combustion of hydrocarbons, plastics, or acidic electrolytes. Refer to sections on fire below for mitigation measures.

— Electrical shock/arc

  Electrical shock presents a risk to workers and emergency responders, if the energy storage system cannot be "turned off". This is referred to as "stranded energy" and presents unique hazards. Arc flash or blast is possible for systems operating above 100 V. Li-ion systems operate from 48 - 1000 V, depending on the battery design.

  In the area of shock hazard, a flow battery produces voltage only when electrolytes are in a cell stack. For most designs, if the motors are turned off and fluids drained from the cell stack, then the cell stacks have no measurable voltage at the terminals. This happens not only when the battery is forcible turned off but also in the standby mode as vanadium batteries do not include any metal plates to hold the chemical reactions / charges / voltages and can be fully drained when not in use.

  If not fully drained, vanadium flow batteries are also unique in terms of short circuiting in that the internal dynamics of the battery are such that the energy discharge is limited to the fluid in the battery at any given time and the is typically less than 1% of the total stored energy. Therefore, together with the relatively low energy density of the vanadium electrolyte, the immediate release of energy, which occurs as a result of electrical shorting, is somewhat limited. The high heat capacity of the aqueous electrolyte is also beneficial in limiting the temperature rise. Vanadium flow batteries have been tested under dead-short conditions resulting in normal operation with no danger to either equipment or personnel.

— Fire / deflagration

  Over 50% of the electrolyte solution is made up of water, which gives the electrolyte a non-flammable property. In the event of short circuiting, intense heat or high pressure, it is unlikely for the battery to catch fire. There is no "thermal runaway" risk when compared to other battery technologies. Whilst some heat may be discharged from the battery, it will not be at a level that is deemed unsafe.

  Like all other RFBs, VRFBs also have a battery management system. A battery management system ensures optimum and safe conditions for battery operation. Often a heat management system is integrated to avoid too high or too low temperatures.

— Hydrogen generation

  As with all other aqueous batteries, aqueous energy storage media from redox flow batteries are also subject to water limitations. In case of too high voltages or more precisely too high or too low half-cell potentials, the water is decomposed into its components, hydrogen and oxygen.

  The generation of hydrogen in particular is often present as a very small but undesirable side reaction and causes a charge carrier imbalance between positive and negative half-cells, which leads to a slow loss of capacity. It also presents a fire / explosion hazard.

  With VRFB, due to the flowability of the energy storage medium, the reaction products that would normally remain in the half-cell can be transported out of the cell and stored in separate tanks thus allowing the capability for a higher capacity than that attainable with conventional batteries. In addition, any deviations from safe operating parameter will trigger the shutdown of the system pumps ceasing to charge the electrolyte and thereby reducing the changes of accidental H_2 generation. In addition, the thermal mass of the electrolyte tanks can provide an additional barrier to overcharging conditions by allowing ambient temperature during the discharge times to cool the VRFB for the next charge cycle.

— Waste electrolyte

  Unfortunately, pentavalent vanadium ions have a tendency to react with each other, which leads to the formation of larger molecules which precipitate as solids and can thus damage the system. The reaction depends on the temperature and the concentration of $VO2+$ (state of charge) but is also a function of the proton concentration. Temperature and concentrations therefore need to be controlled within specified ranges. Should the concentration of undesirable components increase in the electrolyte, a part may need to be purged and replaced with fresh electrolyte.

— Electrolyte leaks

  Leaks must be expected in any hazardous-fluid handling equipment. Secondary containment is typically designed into the system and standard corrosive PPE is required for handling liquid. Reliable leak detection, annunciation, and containment is paramount.

  As with any chemicals plant a suitable design with detection, alarm and trip instrumentation that has been subject to thorough Hazop study should be in place, e.g. detection of dry running of pumps, detection of dead heading of pumps, prevention of reverse flow, detection of drop in tank levels etc.

<u>Solid state lithium battery technology</u>

Upon heating of the contents of a battery due to shorting, contaminants, external heat or exposure to water and reaction heat, the lithium salts in batteries begin to break down exothermically to release either oxygen (oxidants) that enhances combustion, possibly leading to explosion, or fumes such as hydrogen fluoride or chlorine that are toxic.

These exothermic break down reactions are self-sustaining above a certain temperature (typically 70 deg C) and can lead to thermal run away. In this process the battery gets hotter and hotter, the decomposition reactions happen faster and faster and excessive hot fumes are generated in the battery. Eventually the pressure in the battery builds up to the point where those gases need to vented, usually via the weakest point in the system. These vented fumes can be flammable due to vaporization of the electrolyte and can ignite as a flash fire or fire ball (if large amounts) leading to the fire spreading to any surrounding combustible materials, e.g. plastic insulation on cables, the electrolyte, the electrodes and possibly even the plastic parts of the battery casing etc. If the vented flammable vapours do not ignite immediately, they can accumulate within the surrounding structures. If this flammable mixture is ignited later, e.g. due to a spark, this can lead to a violent explosion of the module, cabinet, room, container etc.

In addition to being flammable the vented gases will contain toxic components. These could include:

— the products of combustion such as carbon dioxide/monoxide, hydrogen cyanide
— VOCs like benzene and ethylene,
— decomposition products such as hydrogen fluoride, hydrogen chloride, phosphorous pentafluoride, phosphoryl fluoride and oxides of aluminium, cobalt, copper etc.

The temperature in the batteries and of these vented gases can be extremely high, e.g. > 600 deg C. In the situation where oxygen is released internally as part of the decomposition (e.g. lithium perchlorate) the oxygen is available to react with the combustible electrolyte and if all this happens extremely fast in a self-sustaining manner within the confines of the device, an explosion of the device can result.

The very high temperature generated by one battery cell in thermal run away could lead to overheating of adjacent cells. This cell in turn then starts thermal decomposition and so the process propagates through the entire system. In order to prevent propagation, there are separation requirements between cells, modules etc. Separation could be with physical space or insulating materials etc.

— Electrolyte leaks

  Although extremely unlikely due to the structure of the batteries, should electrolyte liquid leak out of the batteries, it can be potentially flammable as well as corrosive etc. If ignited as fire, or explosion, the smoke would contain toxic components. If unignited it can still be extremely harmful especially if its decomposition products include hydrofluoric acid.

8 IMPACT ASSESSMENT

This impact assessment phase of the EIR process is aimed to assess those potential impacts that are most likely to be significant from an environmental and social perspective. The assessment of anticipated impacts associated with the proposed Project is a key component to the EIR process. This Chapter identifies and assesses those perceived environmental and social effects associated with the proposed Project. The assessment methodology is indicated in **Section 4.2**.

The issues assessed stem from those aspects presented in **Section 7** of this document as well as project description provided. Each significant issue that has been identified has been investigated further during this EIR process.

Potential impacts have been identified and assessed according to the phases of the project's development. For purposes of this report, these phases have been generically defined below.

— Construction Phase:

  The construction phase includes the preparatory works/activities typically associated the creation of surface infrastructure, access and electrical power. The activities most relevant to this phase include but not limited to : Topsoil stripping; Cut and fill activities associated with site preparation (if required).

— Operation Phase:

  The operational phase includes the daily activities associated with Camden I GH&A facility.

— Decommissioning Phase:

  The closure phase includes the activities associated with the removal/dismantling of machinery/equipment/infrastructure no long necessary to the operation.

8.1 ACTIVITIES MATRIX

The impacts below have been assessed according to environmental categories. **Table 8-1** provides an indication of how these environments are linked to the various NEMA listed activities outlined in **Chapter 2**.

Table 8-1: Activities Matrix (C – Construction; O – Operation; D – Decommissioning)

ACTIVITY DESCRIPTION	CLIMATE	AIR QUALITY	TOPOGRAPHY	GEOLOGY	SOIL AND AGRICULTURE POTENTIAL	SURFACE WATER	GROUNDWATER	REGIONAL VEGETATION	BIODIVERSITY	FAUNA	AVIFAUNA	SOCIAL	HERITAGE AND PALEONTOLOGY	VISUAL
GNR 983- Listing Notice 1														
Activity 9(i)	C, D	C, D	C, D	C	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D
Activity 10(i)	C, D	C, D	C, D	C	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D
Activity 11(i)	C, D	C, D	C, D	C	C, D	C, D	C, D	C, D	C, D	C, D	C, O, D	C, D	C, D	C, D
Activity 12(ii)(a)(c)	C, D	C, D	C, D	C	C, D	C,O, D	C, D	C, D	C, D	C,O, D	C, D	C,O, D	C, D	C, O, D
Activity 16	C, D	C, D	C, D	C	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D
Activity 19	C, D	C, D	C, D	C	C, D	C,O, D	C, D	C, D	C, D	C,O, D	C, D	C,O, D	C, D	C, O, D
Activity 24(ii)	C, D	C, D	C, D	C	C, D	C,O, D	C, D	C, D	C, D	C,O, D	C, D	C,O, D	C, D	C, O, D
Activity 25	C, D	C, D	C, D	C	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, O ,D
Activity 27	C,O,D	C,D	C,O,D	C	C,O,D	C,O,D	C,D	C,O,D	C,O,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D
Activity 28(ii)	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C,D	C, O,D

ACTIVITY DESCRIPTION	CLIMATE	AIR QUALITY	TOPOGRAPHY	GEOLOGY	SOIL AND AGRICULTURE POTENTIAL	SURFACE WATER	GROUNDWATER	REGIONAL VEGETATION	BIODIVERSITY	FAUNA	AVIFAUNA	SOCIAL	HERITAGE AND PALEONTOLOGY	VISUAL
Activity 30	C,D	C,D	C,D	C,D	C,O,D	C,O,D	C,D	C,O,D	C,O,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D
Activity 48(i)(a)(c)	N/A	C,D	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
Activity 56(i)(ii)	N/A	C,D	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
GNR 984- Listing Notice 2														
Activity 4	N/A	O	N/A	N/A	O	O	O	O	O	O	O	O	N/A	N/A
Activity 6	N/A	O	N/A	N/A	O	O	O	O	O	O	O	O	N/A	N/A
Activity 7(ii)	N/A	O	N/A	N/A	O	O	O	O	O	O	O	O	N/A	N/A
Activity 15	N/A	C,D	N/A	C	C,D	C,O,D	C,O,D	C,D	C,O,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D
GNR 985- Listing Notice 3														
Activity 4(f)(i)(aa)(bb)(cc)(ee)(ff)	N/A	C,D	C,O,D	C,D	C,D	C,O,D	C,O,D	C,O,D	C,O,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D
Activity 10(f)(i)(aa)(bb)(cc) (ee)(gg)(hh)	N/A	O	N/A	N/A	O	O	O	O	O	O	O	O	N/A	N/A

ACTIVITY DESCRIPTION	CLIMATE	AIR QUALITY	TOPOGRAPHY	GEOLOGY	SOIL AND AGRICULTURE POTENTIAL	SURFACE WATER	GROUNDWATER	REGIONAL VEGETATION	BIODIVERSITY	FAUNA	AVIFAUNA	SOCIAL	HERITAGE AND PALEONTOLOGY	VISUAL
Activity 12(f)(i)(ii)(iii)	N/A	C,D	C	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
Activity 14(ii)(a)(c)(f) (i)(aa)(bb)(dd)(ff)(hh)	N/A	C,D	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
Activity 15 (d)(ii)	N/A	C,D	C,O	C	C,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D
Activity 18(f)(i)(aa)(bb)(cc) (ee)(gg)	N/A	C,D	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
Activity 23(ii)(a)(c)(f) (i)(aa)(bb)(cc)(ee)(gg)	N/A	C,D	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D

8.2 AIR QUALITY

8.2.1 CONSTRUCTION PHASE

Emissions during construction are associated with land clearing, drilling, and blasting, ground excavation, cut and fill operations and the movement of heavy construction vehicles on temporary roads. Pollutants associated with construction activities are typically Total Suspended Particulates (TSP), PM10 and PM2.5 with lesser contributions of CO, NO_2, SO_2 and C_6H_6 from vehicle exhausts.

PM refers to solid or liquid particles suspended in the air. PM varies in size from particles that are only visible under an electron microscope to soot or smoke particles that are visible to the human eye. Particles can be classified by their aerodynamic properties into coarse particles, PM10 (particulate matter with an aerodynamic diameter of less than 10 µm) and fine particles, PM2.5 (particulate matter with an aerodynamic diameter of less than 2.5 µm). In addition to reduced visibility, particulate air pollution poses health risks associated with the respiratory system.

Heavy construction activity is a source of dust emissions that can have a significant but transient impact on local air quality. The amount of dust emitted from construction operations depends on the area of land being worked, the proportion of land lying exposed at any time, the clearing and dozing equipment used, the number and type of vehicles on temporary roads, and the duration of the construction phase. The majority proportion of dust emissions result from heavy vehicle traffic movement on temporary gravel roads at the construction site.

Considering the proposed site extent is small (0.2 km^2) and sensitive receptors are more than 1.4 km from the development site**,** atmospheric impacts from dust emissions during the temporary construction phase are anticipated to be low. With the implementation of appropriate control measures, the impact on neighbouring sensitive receptors will be reduced further but is still assessed to be low.

The impact of the construction phase on the generation of dust and particulate matter (PM) is shown in **Table 8-2**.

Table 8-2: Construction Impact on Generation of Dust and PM

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
GENERATION OF DUST AND PM									
Without Mitigation	1	2	1	2	5	**30**	**Low**	(-)	Easy
With Mitigation	1	1	1	2	5	**25**	**Low**	(-)	
Mitigation and Management Measures	— Limit the duration of the construction phase to as short a timeframe as possible. — Where possible, minimise the area under construction. — Make use of wet suppression techniques to minimise dust entrainment along unpaved roads and during periods of high wind speeds. — Where possible, minimise speed limits, vehicle weights and the number of vehicles using unpaved roads. — Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and soil/material stockpiles especially. This includes wetting of exposed soft soil surfaces and not conducting activities during high wind periods which will increase the likelihood of dust being generated; — All stockpiles (if any) must be restricted to designated areas and may not exceed a height of two (2) metres; — Ensure that all vehicles, machines and equipment are adequately maintained to minimise emissions;								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Ease of mitigation
GENERATION OF DUST AND PM								
	— It is recommended that the clearing of vegetation from the site should be selective, be kept to the minimum feasible area, and be undertaken just before construction so as to minimise erosion and dust potential; — All materials transported to, or from, site must be transported in such a manner that they do not fly or fall off the vehicle. This may necessitate covering or wetting friable materials. — No burning of waste, such as plastic bags, cement bags and litter is permitted; and — All issues/complaints must be recorded in the complaints register. — Once construction is complete, initiate rehabilitation (e.g. re-vegetation) procedures to reduce wind speed across exposed surfaces.							

8.2.2 OPERATIONAL PHASE

The only atmospheric pollutant applicable to the operational phase of Camden Green Energy facility is NH_3. Potential impacts on human health and vegetation from exposure to NH_3 are discussed below.

HUMAN HEALTH IMPACTS

NH3 is an alkaline chemical widely used in industrial applications as a feedstock for fertilizers, plastics, and explosives. It is a colourless, water-soluble gas with an unpleasant, sharp, and pungent odour. NH_3 vapour causes irritation to the eyes and respiratory tract with high concentrations causing conjunctivitis, laryngitis, and pulmonary oedema. NH_3 can combine with moisture in the eyes and mucous membranes to form ammonium hydroxide (NH_4OH). NH_4OH causes saponification and liquefaction of the exposed, moist epithelial surfaces of the eye and can easily penetrate the cornea and damage the iris and the lens. Damage to the iris may eventually lead to cataracts.

Inhalation exposure may result in an increase in systemic arterial blood pressure. Documented odour thresholds for NH_3 vary from 30 to 73,000 µg/m3 causing annoyance and potentially exacerbating pre-existing asthma. Reported health effects due to NH_3 gas exposure include eye, nose, and throat irritation, coughing, dermal irritation, and respiratory failure.

Generally, emissions from bulk storage and loading activities typically occur near the ground with ambient concentrations peaking within the operational boundary of a facility. It is unlikely that NH_3 emissions from a low-level emission source would reach sensitive receptors more than 1.4 km from the development site especially at concentrations required to induce health impacts or create an odour nuisance. As such, any potential NH_3 emissions from the proposed development will have a very low impact (if any) on human health. It is highlighted that, with the intended temperature-controlled storage and loading solutions proposed, emissions under a normal operating scenario are not anticipated.

EFFECTS ON VEGETATION

In the South African context, increased rates of nitrogen deposition and nutrient accumulation in the soil during high pollution episodes may threaten plant species that are accustomed to nutrient poor soils.

Although high pollution episodes are common in the HPA, the land surrounding the proposed development site is used for mining, crop cultivation or is vacant open veld earmarked for future mining ventures and is not considered to be sensitive. As such, any ambient NH_3 contributions from the proposed development will have a very low impact (if any) on neighbouring grasslands and crop production. It is highlighted that, with the intended temperature-controlled storage and loading solutions proposed, emissions under a normal operating scenario are not anticipated.

BULK STORAGE OF NH_3

Synthesised anhydrous NH_3 will be stored in temperature-controlled bulk storage tanks at -33.4°C, sufficiently low to prevent product evaporation. Storage tank vents will remain closed to sustain this low liquid temperature and prevent any mechanically induced turbulence inside the tanks. As such, NH_3 emissions from bulk storage vessels are not anticipated as the liquid cannot vaporise and cannot escape containment.

The impacts of the NH_3 emission generation for the operational phase are outlined in **Table 8-3** below.

Table 8-3: Operational Impact on Air Quality due to NH_3 Emissions

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Degradation of ambient air quality due to NH_3 emissions									
Without Mitigation	1	1	1	4	1	**7**	**Very Low**	(-)	Moderate
With Mitigation	N/A	N/A	N/A	N/A	N/A	**N/A**	**N/A**	N/A	
Mitigation and Management Measures	— ***Note: A post-mitigation scenario is not applicable for the control of NH_3 emissions during the operational phase. All emission controls are considered standard operating procedure and thus the pre-mitigation scenario is representative of normal operations as the proposed facility is designed to function*** — Maintain appropriate operational controls (e.g. appropriate temperature and pressure settings for storage vessels and loading gantries). — Conduct regular equipment inspections for visible/audible/odorous leaks. — Conduct regular checks and periodic replacement of components including pump seals, compressor seals, pipeline valves, open-ended valves, flanges, and other connections (as applicable) in line with manufacturer specifications. — Conduct training of the workforce at all levels (i.e. workers, foremen, managers) in awareness of air emissions. This can be included in site induction courses and should focus on promoting understanding as to why operational controls are in place and should be adhered to. — Complaints and any actions arising from a complaint must be recorded in a complaints register maintained by site management. — Undertake passive monitoring of NH_3 along the facility's fence line and at proximate receptors. A monthly monitoring frequency for a period of 12-months is recommended to provide sufficient data for follow up quantitative assessment of impacts. Monitoring requirements and the frequency thereof can be revised during at the PAEL review process. — Maintain meticulous record keeping of all inputs, throughputs, and production rates, including loading and dispatch quantities to enable a mass balance quantification of facility wide evaporative losses (if any) over time. — Assess and revise impacts when sufficient operational information is available to do so.									

8.2.3 DECOMMISSIONING PHASE

The impacts associated with the decommissioning phase will be the same as that of the construction phase.

8.3 NOISE EMISSIONS

8.3.1 CONSTRUCTION PHASE

Elevated noise levels are likely to be generated by the construction activities (machinery and vehicles) and the workforce. It is important to note that noise impacts (nuisance factor) may vary in the different areas as a result of the surrounding land uses and will be temporary in nature. Due to the temporary and limited nature of the Project activities, coupled with the fact that there are a limited number of noise receptors around the Project area, the impact is regarded as low.

During the construction phase of the facility various noise sources will be present onsite including earth-moving equipment (trucks, cranes, scrapers and loaders), compressors and generators, pumps, rotary drills, concrete mixers and materials handling activities among others. All of these sources will generate substantial amounts of noise and may impact on neighbouring sensitive receptors. As such, mitigation interventions are advised during the construction phase. These mitigation recommendations are detailed in the section that follows.

The construction impact on noise is indicated in **Table 8-4**.

Table 8-4: Construction Impact on Noise

<table>
<tr><th>Potential Impact:</th><th rowspan="2">Magnitude</th><th rowspan="2">Extent</th><th rowspan="2">Reversibility</th><th rowspan="2">Duration</th><th rowspan="2">Probability</th><th rowspan="2" colspan="2">Significance</th><th rowspan="2">Character</th><th rowspan="2">Ease of mitigation</th></tr>
<tr><th>Noise generated during construction</th></tr>
<tr><td>Without Mitigation</td><td>2</td><td>2</td><td>1</td><td>1</td><td>3</td><td>18</td><td>Low</td><td>(-)</td><td rowspan="2">Easy</td></tr>
<tr><td>With Mitigation</td><td>1</td><td>2</td><td>1</td><td>1</td><td>2</td><td>10</td><td>Very low</td><td>(-)</td></tr>
<tr><td>Mitigation and Management Measures</td><td colspan="9">— Planning construction activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. Information regarding construction activities should be provided to identified and nearby receptors likely to be affected.
— Such information includes:
  — Proposed working times.
  — Anticipated duration of activities.
  — Explanations on activities to take place and reasons for activities.
  — Contact details of a responsible person on site should complaints arise.
— When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum, as far as possible;
— Using noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines.
— Selecting equipment with the lowest possible sound power levels whilst still being suitable for the specific task.
— The equipment must be in maintained in good working order, within service dates, and inspected before use;
— Install noise reducing fittings on machinery (if required).</td></tr>
</table>

8.3.2 OPERATIONAL PHASE

Outcomes of the acoustic impact assessment are contained within **Table 8-5** outlining the impact of each parameter and the resulting risk level. The resultant environmental acoustic risks for residential receptors were ranked “very low” during the unmitigated and mitigated operational phase.

Table 8-5: Operational Phase Impacts on Noise

Potential Impact:	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Confidence**
Noise Emissions related to operation of GH&A Facility									
Without Mitigation	2	1	1	4	1	**8**	**Very Low**	(-)	Easy
With Mitigation	1	1	1	4	1	**7**	**Very Low**	(-)	
Mitigation and Management Measures	— The equipment must be in maintained in good working order, within service dates, and inspected before use; — Align working times with the substation related operational times; and — Installing acoustic louvres for natural or forced ventilation systems. — Developing a mechanism to record and respond to complaints. — Installing suitable mufflers on engine exhausts and compressor components. — Installing acoustic enclosures for equipment causing radiating noise, if required. — Improving the acoustic performance of constructed buildings through the application of sound insulation. — Installing acoustic screens alongside noisy equipment if required — Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective. (if required) — Install noise reducing fittings on machinery (if required).								

8.3.3 DECOMISSIONING PHASE

The noise impacts during the decommissioning phase are expected to be the same as the construction phase. Therefore, the same mitigation measures should be applied.

8.4 SOILS, LAND CAPABILITY AND AGRICULTURAL

The assessment of impacts in an environmental impact assessment is done according to a prescribed, semi-quantitative rating methodology that is supposed to cover all specialist disciplines and allow comparison of the impacts across them. However, the system was designed for biological components of the ecosystem such as plants and animals and does not rate agricultural impacts in a sensible or particularly useful way. As has been discussed above, the significance of the agricultural impact is simply the degree to which the future agricultural production potential of the site will be changed and that is predominantly a function of the size of the area of land that is impacted and the production potential of that impacted land. The dominant factor in this case is the relatively small size of the area of land that is impacted (20 ha) which is a small proportion of the affected farm.

The agricultural protocol requires an indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development. The development will result in production losses of 20 hectares of annual crops. No losses of agricultural employment are expected because the site occupies only a small proportion of a much larger farming operation and the cessation of cropping on the site will not significantly reduce the farm's labour requirement.

8.4.1 CONSTRUCTION PHASE

The construction impact is indicated in **Table 8-6**.

Table 8-6: Construction Impact on Agricultural production potential

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Decrease in agricultural production potential due to occupation of 20 hectares of land by the green hydrogen plant.									
Without Mitigation	2	1	3	4	5	**50**	**Moderate**	(-)	N/A
With Mitigation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mitigation and Management Measures	— The entire site will be excluded as agricultural production land by the development and there can therefore be no environmental management programme inputs/mitigation measures to protect the agricultural production potential of the site.								

8.4.2 OPERATIONAL PHASE

The operational impacts are expected to be the same as the construction impacts. No mitigation

8.4.3 DECOMISSIONING PHASE

The decommissioning impacts are expected to be the same as the construction impacts.

8.5 SURFACE WATER AQUATIC ASSESSMENT

The impacts on the surface water of the area due to the proposed Green Hydrogen Facility, are limited. The is mainly due to the overall layout avoided the delineated systems inclusive of the calculated buffers and the recommended 100m buffer. The section below indicates the resultant impact assessment should these recommendations be approved, however no direct impacts are anticipated as all aquatic systems have been avoided.

8.5.1 CONSTRUCTION PHASE

The potential for the loss of Very High Sensitivity systems, namely the wetlands through physical disturbance, the proposed layout has avoided these systems with the exception of one of the buffer areas near the southern entrance. The construction impact along with mitigation measures are outlined in **Table 8-7**.

Table 8-7: Construction Impact on very high sensitivity systems

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of Very High Sensitivity Systems									
Without Mitigation	4	4	5	4	2	**34**	**Moderate**	(-)	Moderate
With Mitigation	2	2	2	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	— Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Suitable dust and erosion control mitigation measures should be included in the EMP to mitigate these impacts. — The most significant form of mitigation would be to select development options that avoided all aquatic features that were rated with a Very High sensitivity — All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor. — It is further recommended that a comprehensive rehabilitation / monitoring plan be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed. — No runoff may be discharged or directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond. — Strict use and management of all hazardous materials used on site. — Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.) within demarcated / bunded areas — Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility. These must be situated outside of any delineated watercourses and pans/depressions or the buffers shown. — Strict control of the behaviour of construction workers. — Appropriate waste management measures must be implemented to control waste on site — Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (EMPr) for the project and strictly enforced. —								

The following section outlines the impact of the physical removal of riparian zones within watercourses, however this would be localised as the number of watercourses is of moderate sensitivity and located in areas with minimal vegetation (riparian) and/ or previously disturbed areas. The construction impact along with mitigation measures are outlined in **Table 8-8.**

Table 8-8: Construction Impact on riparian and or riverine systems

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Damage or loss of riparian and or riverine systems									
Without Mitigation	4	4	5	4	2	**34**	**Moderate**	(-)	Moderate

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Damage or loss of riparian and or riverine systems									
With Mitigation	2	2	2	2	2	**16**	**low**	(-)	
Mitigation and Management Measures	— Natural river levels upstream and downstream of the site should be maintained, thus allowing for continuity within the riverbed, i.e. not create any obstruction limiting any fauna from moving up or downstream. — Vehicle movement within the watercourse should be limited to the works area to prevent undue any compaction of soils — Bed and bank erosion protection should be included in the designs to prevent bank instability and sedimentation. — It is recommended that a comprehensive rehabilitation / monitoring plan be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed. — Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Suitable dust and erosion control mitigation measures should be included in the EMP to mitigate these impacts. — A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks. — No runoff may be discharged or directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond. — Strict use and management of all hazardous materials used on site. — Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.) within demarcated / bunded areas — Containment of all contaminated water by means of careful run-off management on site. — Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility. These must be situated outside of any delineated watercourses and pans/depressions or the buffers shown. — Strict control of the behaviour of construction workers. — Appropriate waste management measures must be implemented to control waste on site — Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (EMPr) for the project and strictly enforced. — Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region by local landowners / public works entities where possible — Install properly sized culverts with erosion protection measures at the present road / track crossings where already installed by local landowners / public works entities.									

During both construction and, to a limited degree, the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities, as well as maintenance activities, could be washed downslope via the watercourses and compromise the water quality. The construction impact along with mitigation measures are outlined in **Table 8-9.**

Table 8-9: Construction Impact on water quality

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Water Quality									
Without Mitigation	4	4	5	4	2	**34**	**Moderate**	(-)	Moderate
With Mitigation	2	2	2	2	2	**16**	**low**	(-)	
Mitigation and Management Measures	— Strict use and management of all hazardous materials used on site. — Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.) within demarcated / bunded areas — Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility. These must be situated outside of any delineated watercourses and pans/depressions or the buffers shown. — It is recommended that a comprehensive rehabilitation / monitoring plan be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed. — Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Suitable dust and erosion control mitigation measures should be included in the EMP to mitigate these impacts. — Strict control of the behaviour of construction workers. — Appropriate waste management measures must be implemented to control waste on site — Chemicals used for construction must be stored safely on site and surrounded by bunds. Chemical storage containers must be regularly inspected so that any leaks are detected early. — Littering and contamination of water sources during construction must be prevented by effective construction camp management. — Emergency plans must be in place in case of spillages onto road surfaces and water courses. — No stockpiling should take place within the delineated extent of a water course. — All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds. — Stockpiles must be located away from river channels. — Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (EMPr) for the project and strictly enforced.									

During the construction phase there will be an increase in hard surface areas, and infrastructure that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within the aquatic systems, which are currently ephemeral, i.e. aquatic vegetation species composition changes, which then results in habitat change / loss. The construction impact along with mitigation measures are outlined in **Table 8-10.**

Table 8-10: Construction Impact on Habitat Fragmentation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Habitat Fragmentation									
Without Mitigation	4	4	5	4	2	**34**	**Moderate**	(-)	Moderate
With Mitigation	2	2	2	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	— All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor. — It is further recommended that a comprehensive rehabilitation / monitoring plan be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed. — No stockpiling should take place within the delineated extent of a water course. — All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds. — Stockpiles must be located away from river channels. — Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Suitable dust and erosion control mitigation measures should be included in the EMP to mitigate these impacts. — A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks. — No runoff may be discharged or directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond. — Strict use and management of all hazardous materials used on site. — Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.) within demarcated / bunded areas — Containment of all contaminated water by means of careful run-off management on site. — Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility. These must be situated outside of any delineated watercourses and pans/depressions or the buffers shown. — Strict control of the behaviour of construction workers. — Appropriate waste management measures must be implemented to control waste on site — Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (EMPr) for the project and strictly enforced. — Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region by local landowners / public works entities where possible									

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Habitat Fragmentation									

8.5.2 OPERATIONAL PHASE

The operational phase will bring about an increase in hard surface areas, and or roads that require stormwater management increases runoff from a site through the concentration of surface water flows. These higher volume flows, with increased velocity can result in downstream erosion and sedimentation if not managed. The operational impact along with mitigation measures are outlined in in **Table 8-11**.

Table 8-11: Operational Impact on increased run off

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increased run off leading to erosion and sedimentation									
Without Mitigation	2	4	5	4	2	**30**	**Low**	(-)	Moderate
With Mitigation	1	2	2	2	2	**14**	**Very low**	(-)	
Mitigation and Management Measures	— All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor. — It is further recommended that a comprehensive rehabilitation / monitoring plan be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed. — Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Suitable dust and erosion control mitigation measures should be included in the EMP to mitigate these impacts. — A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks. — No runoff may be discharged or directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond. — Strict use and management of all hazardous materials used on site. — Containment of all contaminated water by means of careful run-off management on site. — Appropriate waste management measures must be implemented to control waste on site — Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (EMPr) for the project and strictly enforced.									

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increased run off leading to erosion and sedimentation									
	— Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region by local landowners / public works entities where possible — Install properly sized culverts with erosion protection measures at the present road / track crossings where already installed by local landowners / public works entities.								

8.5.3 DECOMISSIONING PHASE

The impacts associated with the decommissioning phase are expected to be the same as the construction phase

8.6 TERRESTRIAL BIODIVERSITY

8.6.1 CONSTRUCTION PHASE

Vegetation on site is within the Grassland Biome. Mesic grasslands in South Africa have a life-form composition that includes a high number of resprouting sub-terranean species that constitute more than 50% of the species richness at any single location and a higher proportion, if counted across a wider area. Secondary grassland that develops in previously cleared areas (for example, cultivated lands) usually develop a perennial grass cover, but the resprouting component of the flora almost never recovers. This means that any clearing of grassland vegetation, even if temporary, results in permanent loss of the local species composition. Clearing of natural grassland is therefore a permanent impact.

Habitat loss refers to physical disturbance of habitats through clearing, grading and other permanent to semi-permanent loss or degradation. Loss of habitat on site could lead to loss of biodiversity as well as habitat important for the survival of populations of various species. The construction impact along with mitigation measures are outlined in in **Table 8-12**.

Table 8-12: Construction Impact on natural habitats

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of indigenous natural vegetation									
Without Mitigation	1	1	3	5	4	**40**	**Moderate**	(-)	Moderate
With Mitigation	1	1	3	4	4	**36**	**Moderate**	(-)	
Mitigation and Management Measures	— Restrict impact to development footprint only and limit disturbance in surrounding areas. — Prior to commencement of construction, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval. — Prior to commencement of construction, compile an Alien Plant Management Plan, to be included into the EMPr during final approval.								

Major factors contributing to invasion by alien invader plants includes inter alia high disturbance (such as clearing for construction activities) and negative grazing practices. Exotic species are often more prominent near infrastructural disturbances than further away. Consequences of this may include:

- loss of indigenous vegetation;
- change in vegetation structure leading to change in various habitat characteristics;
- change in plant species composition;
- change in soil chemical properties;
- loss of sensitive habitats;
- loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
- fragmentation of sensitive habitats;
- change in flammability of vegetation, depending on alien species;
- hydrological impacts due to increased transpiration and runoff; and
- impairment of wetland function.

Low existing populations of alien plants were observed on site, but areas of farm infrastructure were not investigated in detail during the field survey. There is a high possibility that alien plants could be introduced to areas within the footprint of the proposed activities from surrounding areas in the absence of control measures. The potential consequences may be of moderate seriousness for affected natural habitats. Control measures could prevent the impact from occurring. These control measures are relatively standard and well-known. The construction impact along with mitigation measures are outlined in in **Table 8-13.**

Table 8-13: Construction impact on alien vegetation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Establishment and spread of declared weeds and alien invader plants									
Without Mitigation	2	2	3	1	3	**24**	**Low**	(-)	Easy
With Mitigation	1	1	3	1	2	**12**	**Very low**	(-)	
Mitigation and Management Measures	— Prior to commencement of construction, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control, including monitoring specifications. — Undertake regular monitoring to detect alien invasions early so that they can be controlled.								

8.6.2 OPERATIONAL PHASE

During the operational phase of the project, there will be continuous activity on site, including normal operational activities, maintenance and monitoring. There may also be minor additional construction. Rehabilitation of various sites, such as the construction camps, will also take place. These activities all have the potential to cause additional direct and/or indirect damage to natural habitat and vegetation. The operational impact along with mitigation measures are outlined in in **Table 8-14**.

Table 8-14: Operational Impact on habitats

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Continued disturbance to natural habitats due to general operational activities and maintenance									
Without Mitigation	1	1	3	5	3	**30**	**Low**	(-)	Moderate
With Mitigation	1	1	3	5	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Restrict impact to development footprint only and limit disturbance in surrounding areas.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Continued disturbance to natural habitats due to general operational activities and maintenance									
	— Prior to commencement of operation, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval. — Prior to commencement of operational, compile an Alien Plant Management Plan, to be included into the EMPr during final approval.								

The presence of disturbed surfaces on site creates ecological edges and corridors along which alien species can travel and become established. The operational impact along with mitigation measures are outlined in in **Table 8-15.**

Table 8-15: Operational impact on alien vegetation

Potential Impact	Magnitude	Extent	Reversibilit y	Duration	Probability	Significance		Character	Ease of mitigation
Establishment and spread of declared weeds and alien invader plants									
Without Mitigation	3	2	3	4	3	**36**	**Moderate**	(-)	Moderate
With Mitigation	1	1	3	2	2	**14**	**Very low**	(-)	
Mitigation and Management Measures	— Prior to commencement of operation, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. — Undertake regular monitoring to detect alien invasions early so that they can be controlled.								

Increased erosion (water and wind) and water run-off will be caused by the clearing of indigenous vegetation, creation of new hard surfaces and compaction of soil. Increased run-off and erosion could affect hydrological processes in the area and will change water and silt discharge into drainage lines and streams. The operational impact along with mitigation measures are outlined in in **Table 8-16.**

Table 8-16: Operational impact on runoff and erosion

Potential Impact	Magnitude	Extent	Reversibilit y	Duration	Probability	Significance		Character	Ease of mitigation
Continued runoff and erosion									
Without Mitigation	1	1	3	5	3	**30**	**Low**	(-)	Moderate
With Mitigation	1	1	3	5	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Prior to commencement of operation, compile and implement a stormwater management plan including monitoring specifications. — Monitor surfaces for erosion, repair and/or upgrade, where necessary.								

8.6.3 DECOMISSIONING PHASE

It is expected that the project will operate for a minimum of twenty to twenty-five years (a typical planned life-span for a project of this nature). Decommissioning will probably require a series of steps resulting in the removal of equipment from the site and rehabilitation of footprint areas. It is possible that the site could be returned to a rural nature, but it is unlikely that natural vegetation would become established at disturbed locations on site for a very long time thereafter. The reality is that it is not possible to determine at this stage whether rehabilitation measures will be implemented or not or what the future plans for the site would be nor is it possible at this stage to determine what surrounding land pressures would be. These uncertainties make it difficult to undertake any assessment to determine possible impacts of decommissioning. It is recommended that a closure and rehabilitation plan be compiled near to the decommissioning stage but in advance of when decommissioning is planned, and that this would be required to be implemented prior to closure of the project. The closure and rehabilitation plan must be in compliance with the regulatory requirements at the time of decommissioning.

During the decommissioning phase of the project, there will be a flurry of activity on site over a period of time, similar to during the construction phase, including dismantling and removal of equipment and rehabilitation. There may also be minor additional construction. Rehabilitation of various sites will also take place. These activities all have the potential to cause additional direct and/or indirect damage to natural habitat and vegetation. The decommissioning impact along with mitigation measures are outlined in in **Table 8-17.**

Table 8-17: Decommissioning Impact on habitats

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss and/or disturbance of indigenous natural vegetation during removal of infrastructure									
Without Mitigation	1	1	3	5	2	**20**	**Low**	(-)	Moderate
With Mitigation	1	1	3	5	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Prior to decommissioning commencing, compile a Rehabilitation Plan in compliance with the regulatory requirements at the time of decommissioning.								

The presence of disturbed surfaces on site creates ecological edges and corridors along which alien species can travel and become established. The decommissioning impact along with mitigation measures are outlined in in **Table 8-18.**

Table 8-18: Decommissioning impact on alien vegetation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Establishment and spread of declared weeds and alien invader plants									
Without Mitigation	2	2	3	4	4	**44**	**Moderate**	(-)	Moderate
With Mitigation	1	1	3	4	3	**27**	**Low**	(-)	
Mitigation and Management Measures	— Rehabilitate disturbed areas in accordance with the specifications of a Rehabilitation Plan.								

8.7 ANIMAL SPECIES

8.7.1 CONSTRUCTION PHASE

Construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in permanent local loss of habitat. The construction impact along with mitigation measures are outlined in in **Table 8-19.**

Table 8-19: Construction impact on faunal habitat

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of faunal habitat									
Without Mitigation	2	1	3	5	4	**44**	**Moderate**	(-)	Moderate
With Mitigation	2	1	3	5	3	**30**	**Low**	(-)	

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of faunal habitat									
Mitigation and Management Measures	— No driving of vehicles off-road outside of construction areas. — Apply mitigation measures recommended in the Terrestrial Biodiversity Assessment to minimize loss of natural vegetation.								

Construction activities will require use of heavy machinery and vehicles, as well as placement of various obstructions that may be hazardous and can directly impact on the faunal communities in the area. The construction impact along with mitigation measures are outlined in in **Table 8-20.**

Table 8-20: Construction impact on faunal mortality

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Direct mortality of fauna									
Without Mitigation	2	1	1	2	3	**18**	**Low**	(-)	Moderate
With Mitigation	1	1	1	2	3	**10**	**Very low**	(-)	
Mitigation and Management Measures	— It is a legal requirement to obtain permits for specimens or protected species that will be lost due to construction of the project. — Conduct a pre-construction walk-through of natural habitat within the development footprint prior to construction activities commencing in order to move any individual animals, such as tortoises, where required. — Personnel on site should undergo environmental induction training, including the need to abide by speed limits, to minimise risk of collisions with wild animals on roads in rural areas. — Proper waste management must be implemented, ensuring no toxic or dangerous substances are accessible to wildlife. This should also apply to stockpiles of new and used materials to ensure that they do not become a hazard. — No collecting, hunting or poaching of any animal species. — Personnel to be educated about protection status of species, including distinguishing features, to be able to identify protected species. — Appropriate lighting should be installed to minimize impacts on nocturnal animals, as per visual specialist assessment.								

8.7.2 OPERATIONAL PHASE

Direct mortality of fauna through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure. The operational impact along with mitigation measures are outlined in in **Table 8-21.**

Table 8-21: Operational impact on faunal mortality

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Direct mortality of fauna									
Without Mitigation	2	1	1	4	3	**24**	**Low**	(-)	Moderate
With Mitigation	1	1	1	4	2	**14**	**Very low**	(-)	
Mitigation and Management Measures	— It is a legal requirement to obtain permits for specimens or protected species that will be lost due to construction of the project.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Ease of mitigation
Direct mortality of fauna								
	— Personnel on site should undergo environmental induction training, including the need to abide by speed limits, the increased risk of collisions with wild animals on roads in rural areas. — Proper waste management must be implemented, ensuring no toxic or dangerous substances are accessible to wildlife. This should also apply to stockpiles of new and used materials to ensure that they do not become a hazard. — No collecting, hunting or poaching of any animal species. — Personnel to be educated about protection status of species, including distinguishing features, to be able to identify protected species. — Appropriate lighting should be installed to minimize impacts on nocturnal animals, as per visual specialist assessment.							

8.7.3 DECOMISSIONING PHASE

The decommissioning impacts are expected to be the same as the construction impacts.

8.8 PLANT SPECIES

8.8.1 CONSTRUCTION PHASE

During the construction phase, the loss of individuals of Species of Conservation Concern due to clearing will be highly likely. The construction impact along with associated mitigation measures are indicated in **Table 8-22.**

Table 8-22: Construction impact on plant habitat

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of individuals of Species of Conservation Concern									
Without Mitigation	2	2	5	5	3	**42**	**Moderate**	(-)	Moderate
With Mitigation	2	2	5	5	1	**14**	**Very low**	(-)	
Mitigation and Management Measures	— Where significant populations of SCC are found, collect the data for any flora permits or micro-siting of infrastructure that may be required. — Prior to construction commencing, compile a Plant Rescue Plan, including monitoring specifications (timeframe, frequency etc). — Undertake monitoring (as per the Plant Rescue Plan specifications) to evaluate whether further measures would be required to manage impacts. — It is a legal requirement to obtain permits for specimens or protected species that will be lost due to construction of the project. — A detailed pre-construction walk-through survey will be required during a favourable season where possible, to locate any individuals of protected plants, as well as for any populations of threatened plant species. This survey must cover the footprint of all approved infrastructure, including internal service roads and footprints of tower structures (final infrastructure layout). The best season is early to late									

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Ease of mitigation
Loss of individuals of Species of Conservation Concern								
	Summer if possible, taking administrative processes into account, but will be influenced by recent rainfall and vegetation growth. — It is possible that some plants lost to the development can be rescued and planted in appropriate places in rehabilitation areas, but the description and appropriateness of such measures must be included in a Plant Rescue Plan. Any such measures will reduce the irreplaceable loss of resources as well as the cumulative effect. Note that Search and Rescue is only appropriate for some species and that a high mortality rate can be expected from individuals of species that are not appropriate to transplant. — Prior to construction commencing, a Plant Rescue Plan must be compiled to be approved by the appropriate authorities as part of the EMPr approval. — For any plants that are transplanted, annual monitoring should take place to assess survival. This should be undertaken as per the frequency specified in the management plan and be undertaken by a qualified botanist. The monitoring programme must be designed prior to translocation of plants and should include control sites (areas not disturbed by the project) to evaluate mortality relative to wild populations. — No collecting or poaching of any plant species must be allowed. — The location of all transplanted rescued plants must be recorded, along with the identity of the plant. — The health / vigour of each transplanted individual should be monitored as per the frequency and duration specified in the management plan. — As a scientific control, an equal number of non-transplanted individuals of the same species, within similar habitats, should be monitored in the same way as the transplanted specimens. This will provide comparative data on the survival of wild populations relative to transplanted plants. — If populations of threatened plant species are found to occur on site, annual monitoring of population health should take place. This should be appropriate to the species concerned.							

8.8.2 OPERATIONAL PHASE

There are no operational impacts associated with the proposed development.

8.8.3 DECOMISSIONING PHASE

The decommissioning impacts are expected to be the same as the construction phase.

8.9 AVIFAUNA

8.9.1 CONSTRUCTION PHASE

Apart from direct habitat destruction, the construction activities could impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle.

Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Terrestrial species and owls are most likely to be affected by displacement due to disturbance. The priority species which are potentially vulnerable to this impact are Secretary bird, Denham's Bustard, White-bellied Bustard, Blue Crane, Grey Crowned Crane, Blue Korhaan and African Grass Owl. The impact is rated as Low pre-mitigation and will be reduced but remain at a Very Low-level post-mitigation. The construction impact along with associated mitigation measures are indicated in **Table 8-23.**

Table 8-23: Construction Impact on disturbance of priority species

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Displacement of priority species due to disturbance associated with the construction of the Facility									
Without Mitigation	2	1	1	2	3	**18**	**Low**	(-)	Moderate
With Mitigation	2	1	1	2	2	**12**	**Very low**	(-)	
Mitigation and Management Measures	— Conduct a pre-construction inspection to identify SCC that may be breeding within the project footprint to ensure that the impacts on breeding species (if any) are adequately managed. — Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. — Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum — Measures to control noise and dust should be applied according to current best practice in the industry. — The mitigation measures proposed by the vegetation specialist must be strictly enforced, including rehabilitation of disturbed areas.								

These activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility through transformation of habitat, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 25ha proposed facility is likely to be moderate due to the relatively small size of the footprint, but ideally high-quality grassland should be avoided if possible. Terrestrial species and owls are most likely to be affected by displacement due to habitat transformation. The priority species which are potentially vulnerable to this impact are Secretary bird, Denham's Bustard, White-bellied Bustard, Blue Crane, Grey Crowned Crane, Blue Korhaan and African Grass Owl. The impact is rated as Low pre-mitigation and will be reduced but remain at a Low-level post-mitigation. The construction impact along with associated mitigation measures are indicated in **Table 8-24.**

Table 8-24: Construction impact on habitat transformation

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Displacement of priority species due to habitat transformation associated with the construction of the Facility									
Without Mitigation	2	1	5	4	2	**24**	**Low**	(-)	Moderate
With Mitigation	2	1	5	4	2	**24**	**Low**	(-)	

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Displacement of priority species due to habitat transformation associated with the construction of the Facility									
Mitigation and Management Measures	— Conduct a pre-construction inspection to identify SCC that may be breeding within the project footprint to ensure that the impacts on breeding species (if any) are adequately managed. — Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. — Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum — Measures to control noise and dust should be applied according to current best practice in the industry. — The mitigation measures proposed by the vegetation specialist must be strictly enforced, including rehabilitation of disturbed areas.								

8.9.2 OPERATIONAL PHASE

Collisions are perhaps the biggest threat posed by high voltage lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Shaw et al. 2017). However, the small length of line (approximately 100m) significantly reduces the potential collision risk. The priority species which are potentially vulnerable to this impact are Secretary bird, Denham's Bustard, White-bellied Bustard, Blue Crane, Grey Crowned Crane, Wattled Crane, Southern Bald Ibis, Blue Korhaan, African Grass Owl and Cape Vulture. The impact is rated as Low pre-mitigation and it will decrease to Very Low post-mitigation. The operational impact along with associated mitigation measures are indicated in **Table 8-25**.

Table 8-25: Operational Impact on mortality due to collisions

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Mortality of priority species due to collisions with the up to 132kVkV overhead power line									
Without Mitigation	5	3	3	4	2	30	Low	(-)	Moderate
With Mitigation	5	3	3	4	1	15	Very low	(-)	
Mitigation and Management Measures	— Bird Flight Diverters must be fitted to the entire OHL according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). These devices must be installed as soon as the conductors and earthwires are strung. — If a steel monopole pole design is used, the approved vulture friendly pole/tower design D-DT-7649 in accordance with the Eskom Distribution Technical Bulletin titled Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration - Reference Number 240-170000467 relating to bird friendly structures, must be used. — If lattice type structures are used, it is imperative that a minimum vertical clearance of 1.8m is maintained between the jumper cables and/or insulator live ends, and the horizontal earthed components. Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Mortality of priority species due to collisions with the up to 132kVkV overhead power line									
	(if suitable insulation material is readily available), alternatively all jumper cables must be suspended below the crossarms.								

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The only priority species capable of bridging the clearance distances of an OHL constructed using this specification is the Cape Vulture, due to their size and gregarious nature. The impact is rated as Low pre-mitigation and it will decrease to Very Low post-mitigation due to the short length of line. The operational impact along with associated mitigation measures are indicated in **Table 8-26.**

Table 8-26: Operational impact on mortality due to electrocution

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Electrocution of priority species on the up to 132kV overhead powerline									
Without Mitigation	5	3	3	4	2	**30**	**Low**	(-)	High
With Mitigation	5	3	3	4	1	**15**	**Very low**	(-)	
Mitigation and Management Measures	— Bird Flight Diverters must be fitted to the entire OHL according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). These devices must be installed as soon as the conductors and earthwires are strung. — If a steel monopole pole design is used, the approved vulture friendly pole/tower design D-DT-7649 in accordance with the Eskom Distribution Technical Bulletin titled Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration - Reference Number 240-170000467 relating to bird friendly structures, must be used. — If lattice type structures are used, it is imperative that a minimum vertical clearance of 1.8m is maintained between the jumper cables and/or insulator live ends, and the horizontal earthed components. Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended (if suitable insulation material is readily available), alternatively all jumper cables must be suspended below the crossarms.								

8.9.3 DECOMMISSIONING PHASE

The impacts during the decommissioning phase are expected to be the same of that during the construction phase. The impacts along with associated mitigation measures are indicated in **Table 8-27.**

Table 8-27: Decommissioning impact on priority avifaunal species

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Displacement of priority species due to disturbance associated with the dismantling of the Facility									
Without Mitigation	2	1	1	2	3	**18**	**Low**	(-)	Moderate
With Mitigation	2	1	1	2	2	**12**	**Very low**	(-)	
Mitigation and Management Measures	— Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible. — Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. — Measures to control noise and dust should be applied according to current best practice in the industry. — Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. — The mitigation measures proposed by the vegetation specialist must be strictly enforced, including rehabilitation of disturbed areas.								

8.10 VISUAL

8.10.1 CONSTRUCTION PHASE

Large construction vehicles, equipment and construction material stockpiles will alter the natural character of the study area and expose visual receptors to impacts associated with construction. Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.

Dust emissions and dust plumes from increased traffic on the gravel roads serving the construction site may evoke negative sentiments from surrounding viewers. Surface disturbance during construction would expose bare soil resulting in visual scarring of the landscape and increasing the level of visual contrast with the surrounding environment. Potential visual pollution resulting from littering on the construction site.

The construction impact along with associated mitigation measures are indicated in **Table 8-28**.

Table 8-28: Construction Impact on the Visual surroundings

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Visual deterrence									
Without Mitigation	3	2	3	4	3	**40**	**Moderate**	(-)	Moderate
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— Carefully plan to minimise the construction period and avoid construction delays. — Position laydown areas and related storage/stockpile areas in unobtrusive positions in the landscape, where possible. — Vegetation clearing should take place in a phased manner. — Make use of existing gravel access roads where possible. — Limit the number of vehicles and trucks travelling to and from the proposed sites, where possible.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Visual deterrence									
	— Ensure that dust suppression techniques are implemented on all access roads, in all areas where vegetation clearing has taken place and on all soil stockpiles. — Maintain a neat construction site by removing litter, rubble and waste materials regularly.								

8.10.2 OPERATIONAL PHASE

The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. The proposed facility and associated infrastructure will alter the visual character of the surrounding area and expose potentially sensitive visual receptor locations to visual impacts.

Dust emissions and dust plumes from maintenance vehicles accessing the site via gravel roads may evoke negative sentiments from surrounding viewers. The night-time visual environment will be altered as a result of operational and security lighting at the proposed facility.

The operational impact along with associated mitigation measures are indicated in **Table 8-29**.

Table 8-29: Operational Impact on Visual surroundings

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Visual deterrence									
Without Mitigation	3	3	3	4	4	**52**	**Moderate**	(-)	Easy
With Mitigation	3	3	3	4	4	**52**	**Moderate**	(-)	
Mitigation and Management Measures	— Restrict vegetation clearance on the site to that which is required for the correct operation of the facility. — As far as possible, limit the number of vehicles which are allowed to access the site. — Ensure that dust suppression techniques are implemented on all gravel access roads. — As far as possible, limit the amount of security and operational lighting present on site. — Light fittings for security at night should reflect the light toward the ground and prevent light spill. — Lighting fixtures should make use of minimum lumen or wattage whilst adhering to safety and security requirements. — Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. — If economically and technically feasible, make use of motion detectors on security lighting. — The buildings should not be illuminated at night and should be painted in natural tones that fit with the surrounding environment. — Non-reflective surfaces should be used where possible.								

8.10.3 DECOMISSIONING PHASE

The impacts associated with the decommissioning phase are expected to the same of that of the construction phase.

8.11 WASTE MANAGEMENT

8.11.1 CONSTRUCTION PHASE

The waste generated during this phase will be mostly construction related waste and must be manged effectively to prevent pollution of the site. The construction impact and associated mitigation measures are outlined in **Table 8-30.**

Table 8-30: Construction Impact on general waste

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
General Waste generated									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	Easy
With Mitigation	1	2	3	3	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— General waste on the site must be always contained in bin/skips and should not be allowed to stand on site for more than 30 days — There will need to be waste segregation (e.g. electronic equipment, chemicals, oil contaminated rags, paper, plastic) and management on the site. — Waste management plan to be in place e.g. liquid waste treatment or suitable removal and disposal will be provided.								

The usage of numerous hazardous chemicals will be required during this phase. The construction impact and associated mitigation measures are outlined in **Table 8-31.**

Table 8-31: Construction impact on hazardous waste generation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Hazardous Waste generated									
Without Mitigation	4	2	3	2	3	**33**	**Moderate**	(-)	Easy
With Mitigation	3	2	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Spill clean-up procedures to be in place before commencing construction. — Spillages of oils, fuels, paints, and other hazardous chemicals should be cleaned up in the correct manner according to industry standards, and disposed thereafter appropriately with proof retained — There will need to be waste segregation (e.g. electronic equipment, chemicals, oil contaminated rags, paper, plastic) and management on the site. — Reportable Quantities in terms of NEMA must be known for the relative hazardous chemicals present on site								

The construction impact and associated mitigation measures are outlined in **Table 8-32.**

Table 8-32: Construction impact on sanitation waste

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Sanitation Waste generated									
Without Mitigation	2	2	3	2	3	**27**	**Low**	(-)	Easy
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. — Sewage and any kitchen liquids must have suitable containment and suitable treatment/disposal — There will need to be waste segregation (e.g. electronic equipment, chemicals, oil contaminated rags, paper, plastic) and management on the site.								

8.11.2 OPERATIONAL PHASE

The operational impact associated with general waste along with associated mitigation measures is indicated in **Table 8-33.**

Table 8-33: Operational Impact general waste

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
General waste									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	Easy
With Mitigation	1	2	3	3	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— General waste on the site must be always contained in bin/skips and should not be allowed to stand on site for more than 30 days — There will need to be waste segregation (e.g. electronic equipment, chemicals, oil contaminated rags, paper, plastic) and management on the site. — Waste management plan to be in place e.g. liquid waste treatment or suitable removal and disposal will be provided.								

During the operation of the facility, multiple sources of hazardous waste may be encountered. The operational impact associated with hazardous waste along with associated mitigation measures is indicated in **Table 8-34.**

Table 8-34: Operational impacts on hazardous waste generation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Hazardous waste									
Without Mitigation	4	2	3	2	3	**33**	**Moderate**	(-)	Easy
With Mitigation	3	2	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Waste management plan to be in place e.g. liquid waste treatment or suitable removal and disposal will be provided.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Ease of mitigation
Hazardous waste								
	— Spill clean-up procedures to be in place before bringing chemical containers on site, including spill kits – non-combustible materials, hazmat disposal. — Spillages of oils, fuels, paints, and other hazardous chemicals should be cleaned up in the correct manner according to industry standards, and disposed thereafter appropriately with proof retained — There will need to be waste segregation (e.g. electronic equipment, chemicals, oil contaminated rags, paper, plastic) and management on the site. — Reportable Quantities in terms of NEMA must be known for the relative chemicals present at the facility — Process controls in place for the BESS to prevent contamination and deterioration of electrolyte leading to excessive purging.								

8.11.3 DECOMISSIONING PHASE

The waste generated during the decommissioning phase is expected to be similar to the construction phase.

8.12 TRAFFIC

The overall significance of each impact during the Construction Phase of the Camden I GH&A facility as detailed in **Table 8-35** and **Table 8-36,** is Low without mitigation, and Very Low with mitigation. The impacts are limited to the peak construction period only, site only/local or regional, and fully reversible.

The proposed mitigating measures are easy to implement but will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes, generation of dust on unsurfaced roads.

It is recommended that access to the Camden I facility for the construction and operation phase be obtained via either the D260 or D1107 off the N11 or the D1264 off the N2. Refer to Figure 3 5. These routes have accesses to the Class 1 National Road network. The use of these roads will also not require an application for temporary or permanent access of the National roads.

If an alternate access off the National roads is required for the construction and/or operational phases, the access location/s will require assessment in terms of sight distance, topography, access geometry and overall safety and suitability. This assessment will require a formal access application and approval from SANRAL.

The preferred method of road transport for the ammonia is the ISOtainer

8.12.1 CONSTRUCTION PHASE

Construction traffic will include vehicles for material and component deliveries, construction staff and all other associated personnel. Trips will include the delivery of over-sized components such as storage tanks and plant equipment manufactured off site. The route/s between the origin of the material and components and the facility may be National, Provincial or Local roads, and each authority will be required to provide the necessary permits for the transportation of any oversized or weight components.

However, due to access to the facility off low to medium trafficked National roads, and low trafficked district roads, the traffic impact during the workday AM and PM peak hours are expected to be low.

The transportation of any overweight/size freight to the site such as storage tanks and plant equipment will require assessment in due course. The route/s between the origin (port of entry) of the oversize/weight components and the site may be National, Provincial or Local roads. The transportation of any overweight freight to the site is limited to generators, and the volumes are expected to be negligible.

It is recommended that an abnormal vehicle route management plan be undertaken when the port/s of entry are confirmed. This plan will cover all aspects such as horizontal and vertical vehicle requirements, bridges along the route, speed limits, etc. These plans and the application for the abnormal permits is normally the responsibility of the logistics company that will transport the components to site.

The construction impact and associated mitigation measures are indicated in **Table 8-35**.

Table 8-35: Construction Impact on vehicle trips on-site

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Noise, dust & exhaust pollution due to vehicle trips on-site									
Without Mitigation	2	1	1	1	5	**25**	**Low**	(-)	Easy
With Mitigation	1	1	1	1	2	**8**	**Very low**	(-)	
Mitigation and Management Measures	— All unsurfaced roads must be regularly sprayed with water to prevent dust generation — All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution — All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

The construction impact and associated mitigation measures are indicated in **Table 8-36**.

Table 8-36: Construction impact on additional trips on the national and district roads

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Noise, dust & exhaust pollution due to additional trips on the national and district roads									
Without Mitigation	2	2	1	1	5	**30**	**Low**	(-)	Easy
With Mitigation	1	2	1	1	2	**10**	**Very low**	(-)	
Mitigation and Management Measures	— All unsurfaced roads must be regularly sprayed with water to prevent dust generation — All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution — All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

8.12.2 OPERATIONAL PHASE

The number of permanent and support staff that will work on-site is not known. However, as during the construction phase, the routes to the facility and access is off low to medium trafficked National roads, and low trafficked district roads, therefore the traffic impact during the workday AM and PM peak hours are expected to be low. The transportation of the manufactured liquid ammonia from the plant may be via road, rail or a combination of the two, by means of Standard pressurised road tanker or ISOtainers (for road transport), or via pressured rail containers (ISOtank).

ROAD TRANSPORT - ISOTAINERS

ISOtainers can transport 12 tons of ammonia per 20ft pressurised tank, 2 tanks per vehicle. For a production capacity of 100 000 tons per annum, approximately 8 334 two-way trips are required per annum. If the ammonia is transported during workdays only, 251 days a year, a total of 34 trips (Total IN & out) will be required per day. This very low daily trip generation is expected to have a negligible impact on the Provincial district and National roads. It should be noted that the unsurfaced district roads from the plant to the N11 and/or the N2 may require more regular maintenance. Given these low volumes the Provincial Road authority should be responsible for this routine maintenance.

The overall significance of each impact during the Operation Phase of the Camden I GH&A facility as detailed in **Table 8-37** and **Table 8-38**, is Moderate without mitigation, and Low with mitigation. The impacts are for the duration of the Project life, site/local and regional, and fully reversible.

The proposed mitigating measures are moderate to implement (maintenance of district roads) and will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and generation of dust on unsurfaced roads.

The operational impact due to road transport of ISOtainer vehicle trips to site and associated mitigation measures are indicated in **Table 8-37**.

Table 8-37: Operational Impact due to vehicle trips on-site

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Road transport of ISOtainers generating noise, dust & exhaust pollution due to vehicle on-site									
Without Mitigation	3	2	3	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	2	2	1	4	3	**27**	**Low**	(-)	
Mitigation and Management Measures	— All unsurfaced roads must be regularly sprayed with water to prevent dust generation — All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution — All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

The operational impact due to ISOtainer transport on national and district roads and associated mitigation measures are indicated in **Table 8-38**

Table 8-38: Operation impact due to additional trips on the national and district roads

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Road transport of ISOtainers generating noise, dust & exhaust pollution on the national and district roads									
Without Mitigation	3	3	3	4	4	**52**	**Moderate**	(-)	Moderate
With Mitigation	2	3	1	4	3	**30**	**Low**	(-)	
Mitigation and Management Measures	— All vehicles that travel to site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution — All vehicles that travel to site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

ROAD TRANSPORT – STANDARD PRESSURISED TANKERS

Standard pressurised road tankers can transport 1.1 tons of ammonia per 40ft pressurised tank, 1 tank per vehicle. For a production capacity of 100 000 tons per annum, approximately 181 818 two-way trips are required per annum. If the ammonia is transported during workdays only, 251 days a year, a total of 725 trips (Total IN & out) will be required per day. The final location of the plant will determine the route/s to the National Road network (N11 and N2). The total volume of traffic per route may therefore be less. It is however a substantial volume of heavy vehicle traffic that should ideally not use unsurfaced district roads. Standard pressurised road tanker transport of ammonia from site to railway facility or regional/national market

The overall significance of each impact during the Operation Phase of the Camden I GH&A facility as detailed in **Table 8-39** and **Table 8-40**, is Moderate and High without mitigation, and Low with mitigation. The impacts are for the duration of the Project life, site/local and regional, and fully reversible.

The operational impact due to road transport of standard pressurised tankers trips on site and associated mitigation measures are indicated in **Table 8-39**

Table 8-39: Operational impact due to vehicle trips on site

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Road transport of standard pressurised tankers generating Noise, dust & exhaust pollution on the site									
Without Mitigation	3	2	3	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	2	2	1	4	3	**27**	**Low**	(-)	
Mitigation and Management Measures	— All unsurfaced roads must be regularly sprayed with water to prevent dust generation — All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution — All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

The operational impact on national and district roads due to transportation of standard pressurised tankers and associated mitigation measures are indicated in **Table 8-40**

Table 8-40: Operation impact due to additional trips on the national and district roads

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Road transport of standard pressurised tankers generating noise, dust & exhaust pollution on the national and district roads									
Without Mitigation	4	3	1	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	2	2	1	4	3	**27**	**Low**	(-)	
Mitigation and Management Measures	— All vehicles that travel to site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution — All vehicles that travel to site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

High traffic volumes from/to site will reduce safety of the intersections. High traffic volumes from/to site will increase vehicle delay, thereby worsen the operation of the intersections. The following recommendations are made to improve the safety of the access intersections off the N11 and N2 during the construction and operation phases, pending the final increased traffic volumes from the various Camden I facilities. Note these upgrades should be the responsibility of the Provincial Road Authority and SANRAL, as these are general safety improvements. The developer has however stated that they will undertake these upgrades, if permitted to do so by the relevant authorities

The operational impact on traffic and associated mitigation measures are indicated in **Table 8-41**

Table 8-41: Operation impact on local district and national road intersections

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Safety & capacity of local district and National road intersections									
Without Mitigation	5	3	1	4	5	**65**	**High**	(-)	Moderate
With Mitigation	2	2	1	4	3	**27**	**Low**	(-)	
Mitigation and Management Measures	— N11 / D260 Provide additional warning signs as follows: — Install a Stop Signs (R1.1) on the D260 at the intersection with the N11 — Install a side road junction warning signs (W108) on the southern approach of the N11, located approximately 100m from the intersection. — Install truck crossing warning sign (W345) with the W108 sign. — Install truck crossing warning sign (W345) with the staggered junction warning sign located on the northern approach of the N11. — N11 / D1170 — Provide additional warning signs as follows: — Ensure that the Stop Signs (R1.1) on the D1170 at the intersection with the N11 is visible. — Install a truck crossing warning sign (W345) with the W107 sign located on the northern approach of the N11. — Install a truck crossing warning sign (W345) with the W108 junction warning sign located on the southern approach of the N11. — N2 / D1264 — Provide additional warning signs as follows: — Install a Stop Signs (R1.1) on the D1264 at the intersection with the N2 — Install a truck crossing warning sign (W345) with the W108 sign located on the northern approach of the N2. — Install a truck crossing warning sign (W345) with the W107 junction warning sign located on the southern approach of the N2. —								

8.12.3 DECOMISSIONING PHASE

It is not possible to determine the volume of traffic that will be generated during the decommissioning phase. It is however expected that the volumes will be lower than during the construction phase, and the resultant transport impact on the local road network will be lower than during the Construction phase. Any damage to the unsurfaced access roads caused by the decommissioning phase traffic should be repaired at the cost of the developer.

8.13 HERITAGE

8.13.1 CONSTRUCTION PHASE

Two ruins are recorded in the Project area (**Figure 7-27**). Based on the current layout, CA002 and possibly CA012 could be impacted on by the proposed project. The heritage significance of the recorded ruins at CA002 is low and CA012 is of medium significance and the sites should be indicated on development plans and avoided during construction. After mitigation the impacts on the recorded features will be low. Impacts to heritage resources without mitigation within the project footprint will be permanent and negative and occur during the construction activities. No impacts are anticipated for operation or decommissioning phases.

The construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can have a negative and irreversible impact on heritage features if any occur. Impacts include destruction or partial destruction of non-renewable heritage resources. The construction impact and associated mitigation measures are indicated in **Table 8-42.**

Table 8-42: Construction Impact on existing ruins

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Destruction or damage to recorded ruins									
Without Mitigation	3	1	5	5	1	**14**	**Very low**	(-)	Easy
With Mitigation	3	1	5	5	1	**14**	**Very low**	(-)	
Mitigation and Management Measures	— Implementation of a Chance Find Procedure for the Project — The study area should be monitored by the ECO during construction. — The final layout should be subjected to a heritage walkthrough. — If during construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager. — It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find and confirm the extent of the work stoppage in that area. — The senior on-site Manager will inform the ECO of the chance find and its immediate impact on construction activities. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.									

8.13.2 OPERATIONAL PHASE

No operational impacts are anticipated with the GH&A facility on heritage resources in the area.

8.13.3 DECOMISSIONING PHASE

The decommissioning phase is expected to have the similar impacts as the construction phase.

8.14 PALAEONTOLOGY

The proposed route and sites predominantly lie on the potentially fossiliferous Vryheid Formation (Ecca Group, Karoo Supergroup) that could preserve fossil plants of the Vryheid Formation. A short section of the site and route lie on the non-fossiliferous Jurassic dolerite.

Based on the fossil record but confirmed by the site visit and walk through, there are NO FOSSILS of the Glossopteris flora even though fossils have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the shales of the Vryheid Formation (Ecca Group, Karoo Supergroup) therefore, a Fossil Chance Find Protocol will be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once excavations and drilling for foundations and amenities have commenced, then they should be rescued, and a palaeontologist called to assess and collect a representative sample. There is no preferred site for the facilities, as far as the palaeontology is concerned.

The impact pre-mitigation is low, and post-mitigation (collection of fossils) very low but positive. If fossils are recovered, removed and placed in a recognised institution such as a museum or university palaeontology collection this will be a positive impact because the fossils will be available for research. Otherwise, they would have remained unknown to science. There is no preferred alternative for the facility site.

8.14.1 CONSTRUCTION PHASE

Once fossils have been removed there will be not further impact on the palaeontological heritage. Therefore, the impact is only applicable to the construction phase. The operation and de-commissioning phases will NOT impact the palaeontology.

The construction impact and associated mitigation measures are indicated in **Table 8-43.**

Table 8-43: Construction Impact on Palaeontological finds

Potential Impact **Encountering Fossils**	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Without Mitigation	2	1	3	4	2	**20**	**Low**	(-)	Easy
With Mitigation	1	1	3	1	6	**6**	**Very low**	(+)	
Mitigation and Management Measures	— If fossils occur in the footprint of any section of the project, the route for the grid connection (overhead powerline pole foundations/below ground water piping), the hydrogen and ammonia facilities, access roads or infrastructure, they can be removed as per the Fossil Chance Find Protocol in the EMPr, and the project can continue. If no fossils are found, then no mitigation is required. — When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, fossils of plants, insects, bone or coalified material) should be put aside in a suitably protected place. This way the project activities will not be interrupted. — Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones. This information will be built into the EMP's training and awareness plan and procedures. — Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment. — If there is any possible fossil material found by the developer/environmental officer then the qualified									

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Ease of mitigation
Encountering Fossils								
	palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible. — Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits. — If no good fossil material is recovered, then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils. — If no fossils are found and the excavations have finished, then no further monitoring is required.							

8.14.2 OPERATIONAL PHASE

There will be no impacts on palaeontology in the area when the facility in operational.

8.14.3 DECOMISSIONING PHASE

The decommissioning phase are not expected to have any impacts on the palaeontology in the area.

8.15 SOCIO-ECONOMIC

8.15.1 CONSTRUCTION PHASE

The construction phase for the Hydrogen and Ammonia facility will extend over a period of approximately 18 months and create in the region of 150-250 employment opportunities that will benefit members from the local communities in the area, specifically Ermelo. These opportunities will include opportunities for low, semi and highly workers. Most of the employment opportunities will accrue to Historically Disadvantaged (HD) members of the community. A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in the local towns in the area, specifically Ermelo. Given relatively high local unemployment levels and limited job opportunities in the area, this will represent a significant, if localised, social benefit. Based on information from similar projects the total wage bill will be in the region of R 30 million (2022 Rand values). A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in the local towns in the area.

The capital expenditure for the Green Hydrogen and Ammonia facility will be approximately R 3.75-4 billion (2022 Rand value) and will create opportunities for local businesses. Due to the presence of the mining and energy sector, there are likely to suitably qualified companies in Ermelo that can provide the required services and products. The local service sector will also benefit from the construction phase. The potential opportunities would be linked to accommodation, catering, cleaning, transport, and security, etc. associated with the construction workers on the site. The hospitality industry in the area will also benefit from the provision of accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other (non-construction) personnel involved on the project. Experience from other construction projects indicates that the potential opportunities are not limited to on-site construction workers but also to consultants and product representatives associated with the project. The construction impacts and associated mitigation measures are indicated in **Table 8-44**.

Table 8-44: Construction Impact on employment, skills development, and business creation opportunities

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Improvement on employment, skills development, and business creation									
Without Mitigation	3	3	n/a	2	3	**24**	**Low**	(+)	Easy
With Mitigation	3	3	n/a	2	4	**32**	**Moderate**	(+)	
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area. — Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. — Before the construction phase commences the proponent should meet with representatives from the Municipality to establish the existence of a skills database for the area. If such as database exists, it should be made available to the contractors appointed for the construction phase. — The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project. — Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase. — The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. — The proponent should liaise with the Municipality with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction service providers. These companies should be notified of the tender process and invited to bid for project-related work. —									

The presence of construction workers poses a potential risk to family structures and social networks. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour, mainly of male construction workers. The construction impacts and associated mitigation measures are indicated in **Table 8-45**.

Table 8-45: Construction impact on local communities due to presence of construction workers

Potential Impact Local communities impacted by construction workers	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	3	3	3	2	3	**33**	**Moderate**	(-)	Moderate
With Mitigation	2	3	3	3	2	**22**	**Low**	(-)	
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. — The SEP and CHSSP should include a Grievance Mechanism that enables stakeholders to report resolve incidents. — Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories. — The proponent and contractor should develop a Code of Conduct (CoC) for construction workers. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be subject to appropriate disciplinary action and/or dismissed. All dismissals must comply with the South African labour legislation. The CoC should be signed by the proponent and the contractors before the contractors move onto site. The CoC should form part of the CHSSP. — The proponent and the contractor should implement an HIV/AIDS, COVID-19 and Tuberculosis (TB) awareness programme for all construction workers at the outset of the construction phase. The programmes should form part of the CHSSP. — No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site. —									

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. While the proposed project on its own does not constitute a large construction project, the establishment of a number of renewable energy projects in the area may attract job seekers to the area. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social impact. However, the way in which they conduct themselves can impact on the local community. The construction impacts and associated mitigation measures are indicated in **Table 8-46.**

Table 8-46: Construction impact on local communities as a result of job seekers

Potential Impact Influx of job seekers into local community	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	3	3	2	2	**24**	**Low**	(-)	Easy
With Mitigation	1	3	3	2	2	**18**	**Very low**	(-)	
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Influx of job seekers into local community									
	— The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities. — The proponent should implement a policy that no employment will be available at the gate. —								

The presence on and movement of construction workers on and off the site poses a potential safety threat to local famers and farm workers in the vicinity of the site. In addition, farm infrastructure, such as fences and gates, may be damaged and stock losses may also result from gates being left open and/or fences being damaged, or stock theft linked either directly or indirectly to the presence of farm workers on the site. The potential risks (safety, livestock, and farm infrastructure) can be effectively mitigated by careful planning and managing the movement of construction on and off the site workers during the construction phase. The construction impacts and associated mitigation measures are indicated in **Table 8-47.**

Table 8-47: Construction impact on livestock and farm infrastructure

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Damage to livestock and farm infrastructure									
Without Mitigation	3	2	3	2	3	**30**	**Moderate**	(-)	Easy
With Mitigation	2	2	3	2	3	**27**	**Low**	(-)	
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. — The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. — All farm gates must be closed after passing through. — Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site. — The proponent should establish a Code of Conduct (CoC) for workers — The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors, and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities — The proponent should implement a Grievance Mechanism that provides local farmers with an effective and efficient mechanism to address issues related to report issues related to damage to farm infrastructure, stock theft and poaching etc. — The Environmental Management Plan (EMP) must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested. — Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Damage to livestock and farm infrastructure									
	the conditions contained in the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. — Contractors appointed by the proponent must ensure that construction workers who are found guilty of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the CoC. All dismissals must be in accordance with South African labour legislation. — No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.								

The presence of construction workers and construction-related activities on the site poses an increased risk of grass fires that could, in turn pose, a threat to livestock, crops, wildlife and farm infrastructure. The local landowners indicated that the area is very susceptible to grass fires during the winter months (May-October) and that the veld can take up to 3 years to recover to full productivity. The impacts will be largely local and can be effectively mitigated. The construction impacts and associated mitigation measures are indicated in **Table 8-48.**

Table 8-48: Construction impact on possible veld fires

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Veld fires risk to livestock, farm infrastructure and grazing									
Without Mitigation	3	2	3	2	3	**30**	**Moderate**	(-)	Easy
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. — The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc., during the construction phase will be compensated for. The agreement should be signed before the construction phase commences. — Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas. — Smoking on site should be confined to designated areas. — Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months. — Contractor should provide adequate fire-fighting equipment on-site, including a fire fighting vehicle. — Contractor should provide fire-fighting training to selected construction staff. — No construction staff, with the exception of security staff, to be accommodated on site overnight. — As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Veld fires risk to livestock, farm infrastructure and grazing									
	any damage caused to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities.								

The construction activities on site and movement of heavy construction vehicles during the construction phase has the potential to create noise and dust impacts, damage local roads and create safety impacts for other road users. Based on the findings of the SIA the potential dust and noise impacts associated with the construction phase are likely to be limited. The traffic related impacts associated with the transport of materials to the site can also be effectively managed if the required mitigation measures are implemented.

In terms of impacts to local roads, where possible construction traffic for all projects would need to be co-ordinated with farming activities in order to avoid harvesting periods when unimpeded access to silos at Ermelo and Overvaal is required. The De Emigratie Road and Overvaal Road are of key importance. The critical period is from May to August. The relevant roads also serve as primary access to and link between a number of study area farms, i.e., are used on a daily basis. The construction impacts and associated mitigation measures are indicated in **Table 8-49.**

Table 8-49: Construction impact on dust, noise, and safety

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Generation of dust and noise, and safety of employees and community members									
Without Mitigation	3	3	3	2	3	**33**	**Moderate**	(-)	Easy
With Mitigation	2	3	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. — Timing of construction activities should be planned to avoid / minimise impact on access to the silos at Ermelo and Overvaal, specifically access along the De Emigratie Road and Overvaal Road. The critical period is from May to August. — Ongoing communication with landowners and road users during construction period. This should be outlined in the SEP. — The proponent should implement a Grievance Mechanism that provides local farmers and other road users with an effective and efficient mechanism to address issues related to construction related impacts, including damage to local gravel farm roads. — Repair of all affected road portions at the end of construction period where required. — Dust suppression measures must be implemented on un-surfaced roads, such as wetting on a regular basis and ensuring that vehicles used to transport building materials are fitted with tarpaulins or covers. — All vehicles must be roadworthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.								

The activities associated with the construction phase and establishment of the proposed project and associated infrastructure will result in the disturbance and loss of land available for crops and grazing. The impact on farmland associated with the construction phase can also be mitigated by ensuring that disturbed areas are fully rehabilitated on completion of the construction phase. Recommended mitigation measures are outlined below

Affected landowners also indicated that new linear infrastructure such as power lines and pipelines should ideally be located along existing cadastral boundaries. The construction impacts and associated mitigation measures are indicated in **Table 8-50.**

Table 8-50: Construction impact on farmlands

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Loss of farmlands									
Without Mitigation	3	2	3	2	4	**40**	**Moderate**	(-)	Moderate
With Mitigation	2	2	3	2	3	**27**	**Low**	(-)	
Mitigation and Management Measures	— The loss of high-quality agricultural land should be avoided and or minimised by careful planning in the final layout of the proposed facilities where possible. — Affected landowners should be notified about the timing of construction related activities in advance. — The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised. — An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase. — All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. — The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up by the Environmental Consultants appointed to manage the EIA. — The implementation of the Rehabilitation Programme should be monitored by the ECO.								

8.15.2 OPERATIONAL PHASE

The aim of the project is to produce commercially usable green hydrogen and ammonia that can be used as a fuel for transport in hydrogen fuel cells and or in different industrial uses. The ammonia will be primarily used for the production of ammonium nitrate (fertiliser) and manufacture of plastics, explosives, textiles, pesticides, and other chemicals. Ammonia can also be used as a stable 'carrier' of hydrogen, allowing hydrogen to be readily stored and transported. The proposed project will therefore create opportunities to improve energy security in South Africa by generating alternative energy sources and reduce the carbon footprint associated with current energy generation. The project will also produce green ammonium nitrate for the South African farming and industrial sector and support the transmission of South Africa's fossil fuel-based economy to renewable energy. The operational impact and associated mitigation measures are indicated in **Table 8-51.**

Table 8-51: Operational Impact of green hydrogen and ammonia production

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Development of infrastructure produce green hydrogen and ammonia for SA									
Without Mitigation	4	4	n/a	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	4	4	n/a	4	5	**60**	**High**	(+)	

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Development of infrastructure produce green hydrogen and ammonia for SA									
Mitigation and Management Measures	— As a policy level, government should be encouraged to develop and implement economic incentives to support investment in and the development of green hydrogen and ammonia initiatives. — Maximise opportunities for local content and procurement. — Maximise employment opportunities for local community members. — Implement training and skills development programs for members from the local community.								

The proposed development will create approximately 25 - 40 permanent employment opportunities during the operational phase. The majority of opportunities are likely to benefit members from the local communities in Ermelo and surrounding towns in the MM. The operational budget for green hydrogen and ammonia plant is estimated to be in the region of R 190-200 million per annum. The operational phase will therefore create business and procurement opportunities which will benefit local companies both at a local and national level. The generation of green hydrogen and ammonia will also create significant downstream opportunities for local companies, specifically companies operating in the chemical, industrial, agricultural and transport sector. The project will also create an opportunity for South Africa to develop skills and expertise in the field of the use of renewable energy to produce green hydrogen and ammonia. The operational impact and associated mitigation measures are indicated in **Table 8-52.**

Table 8-52: Operational impact on employment skills development and business opportunities

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Creation of employment, skills development and business opportunities									
Without Mitigation	3	4	n/a	4	4	44	**Moderate**	(+)	Moderate
With Mitigation	4	4	n/a	4	5	60	**High**	(+)	
Mitigation and Management Measures	— As a policy level, government should be encouraged to develop and implement economic incentives to support investment in and the development of green hydrogen and ammonia initiatives. — Maximise opportunities for local content and procurement. — Maximise employment opportunities for local community members. — Implement training and skills development programs for members from the local community.								

The proponent will enter into rental agreements with the affected landowners for the use of the land for the establishment of the proposed projects. In terms of the rental agreement the affected landowners will be paid an annual amount dependent upon the production/generation on site (or similar arrangements). The additional income will reduce the risk to his livelihoods posed by droughts and fluctuating market prices for livestock, crops, and farming inputs, such as fuel, feed etc. Given the risks posed by climate change the additional income represents a significant benefit for the affected landowner. The operational impact and associated mitigation measures are indicated in **Table 8-53.**

Table 8-53: Operational impact on affected farm owners

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
The generation of additional income by farm affected owners									
Without Mitigation	2	2	n/a	4	3	24	**Low**	(+)	Easy
With Mitigation	3	2	n/a	4	5	45	**Moderate**	(+)	

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
The generation of additional income by farm affected owners									
Mitigation and Management Measures	— Implement agreements with affected landowners. — The loss of high-quality agricultural land should be avoided and or minimised by careful planning in the final layout of the proposed facilities, where possible								

The proposed facility will impact on the areas existing rural sense of place. The potential impact of lights at night was raised as a concern. However, the impact on the areas sense of place should be viewed within the context of the impact of the Camden Power Station and associated transmission lines on areas sense of place. The areas sense of place has also been impacted by large-sale coal mining operations. The potential visual impact on the areas sense place is therefore likely to be limited. In addition, most of the local farmsteads are also screened by the rolling topography or trees. The operational impact and associated mitigation measures are indicated in **Table 8-54.**

Table 8-54: Operational impact on visual and sense of place

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	2	3	4	3	**33**	**Moderate**	(-)	Easy
With Mitigation	2	2	3	4	3	**33**	**Moderate**	(-)	
Mitigation and Management Measures	— Restrict vegetation clearance on the site to that which is required for the correct operation of the facility. — As far as possible, limit the number of vehicles which are allowed to access the site. — Ensure that dust suppression techniques are implemented on all gravel access roads. — As far as possible, limit the amount of security and operational lighting present on site. — Light fittings for security at night should reflect the light toward the ground and prevent light spill. — Lighting fixtures should make use of minimum lumen or wattage whilst adhering to safety and security requirements. — Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. — If economically and technically feasible, make use of motion detectors on security lighting. — The buildings should not be illuminated at night and should be painted in natural tones that fit with the surrounding environment. — Non-reflective surfaces should be used where possible.								

Based on the overall findings of the acoustic impact study, the risks during both day and night-time are ranked as “very low”. As such, it is envisaged that the operation of the facility can be authorised without any major impacts or complaints. The facility is adequately positioned away from sensitive receptors and will not negatively impact the noise climate at the receptors. The study also identifies mitigation options to further minimise noise from the facility. The operational impact and associated mitigation measures are indicated in **Table 8-55.**

Table 8-55: Operational impacts from noise generation of the facility

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Noise generated									
Without Mitigation	2	2	3	4	2	**26**	**Low**	(-)	Easy
With Mitigation	2	2	3	4	2	**26**	**Low**	(-)	
Mitigation and Management Measures	— The equipment must be in maintained in good working order, within service dates, and inspected before use; — Align working times with the substation related operational times; and — Install noise reducing fittings on machinery (if required).								

Incidents during the operational phase have the potential to release ammonia gas and other potentially harmful substances that may pose a health risk to adjacent landowners and local communities in the area. A Qualitative risk assessment has been done, and a Major Hazard Installation will be done post-EA, once final designs are concluded, this will also comply with the latest version of the MHI regulations. The design and operation of the facility should be informed by the findings and recommendations of the HIA. The operational impact and associated mitigation measures are indicated in **Table 8-56.**

Table 8-56: Operational impacts on health and safety

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Incidents releasing harmful substances affecting health and safety of adjacent landowners									
Without Mitigation	4	2	3	4	3	**39**	**Moderate**	(-)	Complex
With Mitigation	2	2	3	4	2	**26**	**Low**	(-)	
Mitigation and Management Measures	— The recommendations and mitigation measures included in the Risk assessment undertaken by ISHCON, should be implemented								

8.15.3 DECOMISSIONING PHASE

The impacts associated with the decommissioning phase are expected to be the same as the construction phase.

8.16 HEALTH AND SAFETY

The two alternatives have been assessed from a SHE risk assessment point of view by the specialist and where there is a choice of location that is further from public roads, water courses or isolated farmhouses, that would be preferred. The **Figure 8-1** below shows the closest occupied farmhouse complex is approximately 1.8 km east of the Camden I Green Hydrogen and Ammonia location option 1 and 1.5 km southeast of location option 2. The local access dirt road runs immediately south of Camden I Green Hydrogen and Ammonia location 2. There is active coal mining activity over 2km to the east location Option 2 and Camden power station is located approximately 3km to the northeast of location option 2. The closest formal residential area is at the Camden Power station 4.5km to the northeast of the location 2.

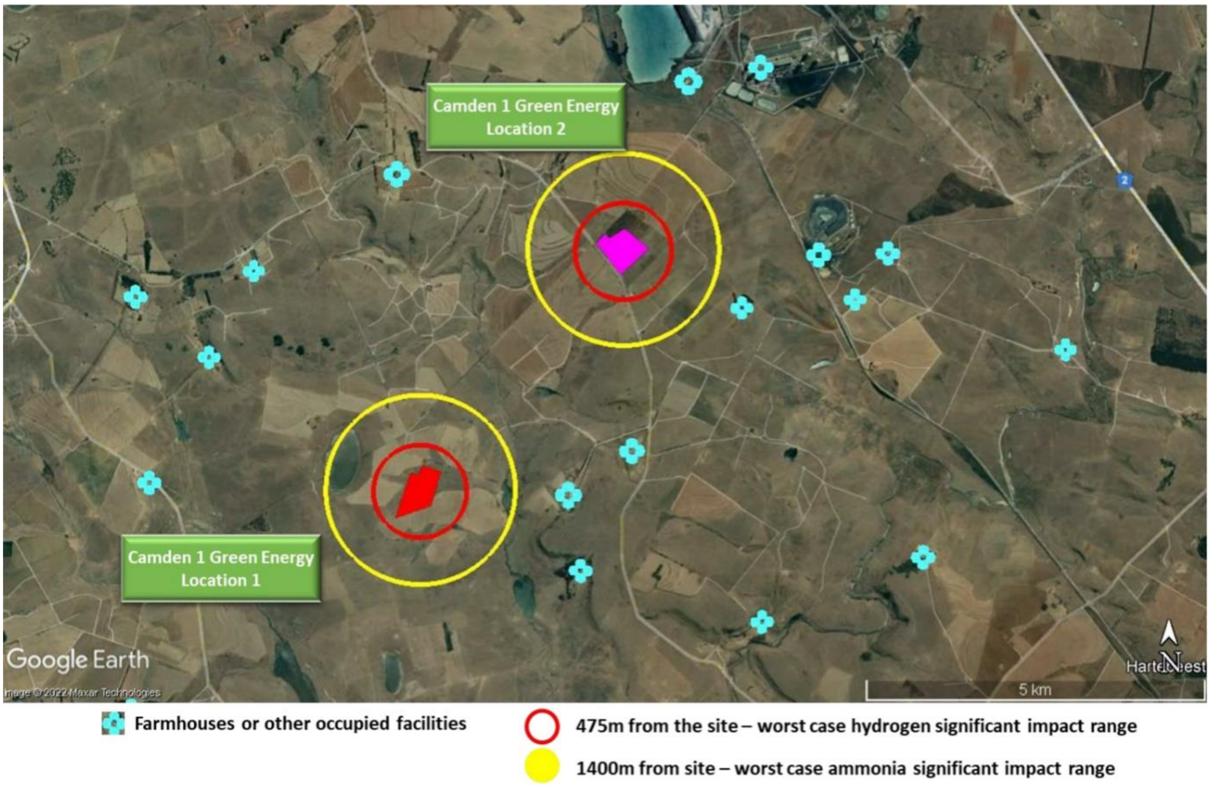


Figure 8-1: Worst case significant impact circles around the Green Hydrogen (Red) and Ammonia (Yellow) facilities in relation to the location of Farmhouses (Blue) in the area

8.16.1 CONSTRUCTION PHASE

GREEN HYDROGEN AND AMMONIA FACILITY

Exposure during construction to materials such as cement, paints, solvents, welding fumes, truck fumes etc can result in Employee / contractor illness. The construction impact along with associated mitigation measures are indicated in **Table 8-57.**

Table 8-57: Construction Impact on Human Health

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Chronic exposure to toxic chemical or biological agents									
Without Mitigation	3	1	3	4	4	**44**	**Moderate**	(-)	Moderate
With Mitigation	1	1	3	4	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— The construction phase must be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. — A SHEQ policy and procedure must be compiled and implemented. — A detailed construction risk assessment must be undertaken prior to work. — Specify/Provide relevant PPE. — Ensure that relevant SHE appointees are in place. — Contractor's safety files must be in place and kept up to date. — All necessary health controls/ practices must be in place, e.g. ventilation of welding and painting areas.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Chronic exposure to toxic chemical or biological agents									
	— SHE monitoring and reporting programs must be implemented. — Emergency response plan must be put in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.								

Exposure to drilling, piling, generators, air compressors during construction could lead to an adverse impact on hearing of workers as well as a possible nuisance factor in near-by areas. The construction impact along with associated mitigation measures are indicated in **Table 8-58.**

Table 8-58: Construction Impact on Noise

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to noise									
Without Mitigation	3	1	5	5	4	**56**	**Moderate**	(-)	Easy
With Mitigation	2	1	5	5	2	**26**	**Low**	(-)	
Mitigation and Management Measures	— Health risk assessment to determine if equipment continuous noise exceeds 85dB at workstation and 61dB at boundary of the site — Employees to be provided with hearing protection if working near equipment that exceeds the noise limits. —								

During construction workers will be exposed to heat during the day and cold in winter. This could result in Heat stroke or Hypothermia. The construction impact along with associated mitigation measures are indicated in **Table 8-59.**

Table 8-59: Construction Impact on exposure to temperature extremes

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health -exposure to temperature extremes and/or humidity									
Without Mitigation	3	2	3	1	2	**18**	**Low**	(-)	Easy
With Mitigation	2	2	3	1	1	**8**	**Very low**	(-)	
Mitigation and Management Measures	— Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental — Adequate potable water to be provided during all phases of the project. Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the plants during all phases of the project.								

The construction large projects bring many contractor workers into a small, isolated community. This may lead to a lack of sufficient accommodation, entertainment etc, resulting in an increase in alcohol abuse and violence. The construction impact along with associated mitigation measures are indicated in **Table 8-60**.

Table 8-60: Construction Impact on worker's psychological state

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to psychological stress									
Without Mitigation	2	3	3	2	2	**20**	**Low**	(-)	easy
With Mitigation	2	3	3	2	2	**20**	**Low**	(-)	

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to psychological stress									
Mitigation and Management Measures	— Depending on size of contract and scope, project may need to provide regular/periodic transport to town and nearby cities. — Local community involvement and as far as possible preferably use of local persons as contract workers on the project.								

During construction employees Lifting heavy equipment and getting into awkward angles will be prone to back and other injuries. The construction impact along with associated mitigation measures are indicated in **Table 8-61.**

Table 8-61: Construction impact on ergonomics of workers

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to ergonomic stress									
Without Mitigation	4	1	3	2	3	**30**	**Low**	(-)	Moderate
With Mitigation	4	1	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Training in lifting techniques. — Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise, employees may revert to unsafe practices. — Isolated location, maintenance of construction equipment to ensure safe operation is critical. Ensure this is in place prior to project beginning. — Development of local service providers as far as possible. — First aid provision on site.								

The construction phase brings the possibility of involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g. tyre fire). Fire due to uncontrolled welding or other hot-work. This will result in injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire. The construction impact along with associated mitigation measures are indicated in **Table 8-62.**

Table 8-62: Construction impact on works due to fire exposure

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to fire radiation									
Without Mitigation	4	2	3	5	4	**56**	**Moderate**	(-)	Complex
With Mitigation	4	2	3	5	2	**28**	**Low**	(-)	

Mitigation and Management Measures	— Fuels stored on site in dedicated, demarcated and bunded areas.
	— Suitable fire-fighting equipment on site near source of fuel, e.g. diesel tank, generators, mess, living quarters, workshops etc
	— The company responsible for the facility at this stage is to have:
	  — Emergency plan to be in place prior to commencement of construction.
	  — Fuel spill containment procedures and equipment to be in place.
	  — Hot-work permit and management system to be in place.								

During construction, employees can be exposed to human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants may also be encountered. These can result in illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The construction impact along with associated mitigation measures are indicated in **Table 8-63.**

Table 8-63: Construction impact on employees from exposure to biological agents

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Human and Equipment Safety - exposure to acute toxic chemical and biological agents									
Without Mitigation	4	2	3	2	3	**33**	**Moderate**	(-)	Complex
With Mitigation	3	2	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. — Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. — Prior to construction determine the dangerous species in the area and what responses are needed to bites/exposure/attacks. — Awareness training for persons on site, safety induction to include animal hazards. — First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. — Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts								

Exposure to construction moving equipment, heavy loads, elevated loads and working at heights. This could result in injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses. The construction impact along with associated mitigation measures are indicated in **Table 8-64.**

Table 8-64: Construction impact as a result of exposure to kinetic energy release

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Human and Equipment Safety - exposure to violent release of kinetic or potential energy									
Without Mitigation	5	1	5	5	4	**64**	**High**	(-)	complex
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	
Mitigation and Management Measures	— The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. — SHEQ policy in place. — A detailed construction risk assessment prior to work. — SHE procedure in place. — PPE to be specified. — SHE appointees in place. — Contractors safety files in place and up to date. — SHE monitoring and reporting programs in place. — Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc. — Civil and building structures to National Building Regulations and building Standards Act 103 of 1977 — SANS 10400 and other relevant codes. — Other constructions such as roads, sewers etc also to relevant SANS standards.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to violent release of kinetic or potential energy									
	— All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc to be in place before construction begins — Emergency response plan to be in place before construction begins.								

During the construction phase employees will make use of electrical machines, generators etc. Hot dry area static generation is highly likely and as well as Lightning strikes. This may result in Electrocution, ignition and burns, injury and/or death, or incur damage to electrical equipment. The construction impact along with associated mitigation measures are indicated in **Table 8-65.**

Table 8-65: Construction impact of exposure to electromagnetic waves

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to electromagnetic waves									
Without Mitigation	5	2	5	5	3	**51**	**Moderate**	(-)	Complex
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	
Mitigation and Management Measures	— Standard maintenance of condition of electrical equipment and safe operating instructions. — Ability to shut off power to systems in use on site. — If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained. — Outside work must be stopped during thunderstorms. — Lighting conductors may be required for the final installation, to be confirmed during design phase.								

Dust from construction and generally hot dry areas will result in adverse impacts on employee health. The construction impact along with associated mitigation measures are indicated in **Table 8-66.**

Table 8-66: Construction impact on employees due to dust generation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to air									
Without Mitigation	3	2	1	1	4	**28**	**Low**	(-)	Easy
With Mitigation	2	2	1	1	2	**12**	**Very low**	(-)	
Mitigation and Management Measures	— May need to use dampening on roads etc. as per normal construction practices. — May need PPE (dust masks) for specific construction workers.								

The construction phase will make use of diesel for equipment, paints and solvents. There is also a possibility of Transformer oil spills and Sewage and kitchen/mess area wastewater generation. This could lead to environmental damage, particularly to the surface and underground water in the area if not managed correctly. The construction impact along with associated mitigation measures are indicated in **Table 8-67.**

Table 8-67: Construction impact on water

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to water									
Without Mitigation	2	2	3	2	3	**27**	**Low**	(-)	Moderate
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— Normal construction site practices for preventing and containing fuels/paint/oil etc spills. — Bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area is particularly important. — Spill clean-up procedures to be in place before commencing construction. — Sewage and any kitchen liquids must have containment and suitable treatment/disposal								

The construction phase will generate solid waste. Improper management of this waste will result in pollution of the area. The construction impact along with associated mitigation measures are indicated in **Table 8-68.**

Table 8-68: Construction impact on waste generation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment – waste generation									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	Easy
With Mitigation	1	2	3	3	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance. — There will need to be waste segregation (e.g. electronic equipment, chemicals) and management on the site.								

The construction phase will require the usage of water and power, however if the usage is not controlled it will result in wastages. The construction impact along with associated mitigation measures are indicated in **Table 8-69.**

Table 8-69: Construction impact on resource usage

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - waste of resources e.g. water, power etc									
Without Mitigation	1	1	1	2	4	**20**	**Low**	(-)	Easy
With Mitigation	1	1	1	2	2	**10**	**Very low**	(-)	
Mitigation and Management Measures	— Water usage to be monitored on site during construction. — Handling protocols to be provided by supplier. — Water management plan and spill containment plans to be in place.								

The construction site will likely have bright surfaces reflecting light and tall structures in a flat area. This may result in irritation to the public. The construction impact along with associated mitigation measures are indicated in **Table 8-70.**

Table 8-70: Construction impact on aesthetics

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Public - Aesthetics									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	Moderate
With Mitigation	2	2	3	3	3	**30**	**Low**	(-)	
Mitigation and Management Measures	— Confirm height limitations for buildings, structures, tanks and electrical infrastructure, in terms of visual aspects. — Sheeting, structures and tanks likely to be painted, not left as reflective steel. — Visual impact assessment to include green hydrogen and ammonia installation when design details become available.								

The result of possible defective technology could be extreme project delays and financial loss. The construction impact along with associated mitigation measures are indicated in **Table 8-71.**

Table 8-71: Construction impact of extreme project delays

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Investors - Financial									
Without Mitigation	5	1	3	4	3	**39**	**Moderate**	(-)	Moderate
With Mitigation	3	1	3	4	2	**22**	**Low**	(-)	
Mitigation and Management Measures	— Design by experienced contractors using internationally recognized and proven technology. — Project management with deviation monitoring.								

During the construction phase there is a potential hi-jacking of valuable loads while en-route to site. While on site, theft of construction equipment and installation facilities is also a possibility. Civil unrest or violent strike by employees can also arise. The construction impact along with associated mitigation measures are indicated in **Table 8-72.**

Table 8-72: Construction impact on security

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Employees and investors - Security									
Without Mitigation	4	1	3	2	4	**40**	**Moderate**	(-)	Complex
With Mitigation	4	1	3	2	4	**27**	**Low**	(-)	
Mitigation and Management Measures	— Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. — Isolated location both helps and hinders security, planning should be made with this in mind. — Night lighting to be provided both indoors and outdoors where necessary.								

During the construction phase, fires, explosions, noxious smoke, large spills, traffic accidents and equipment/structural collapse are possibilities. These can be the result of inadequate emergency response to small event leads to escalation. Consequences of these include injuries which can turn to fatalities, and small losses become extended down time. The construction impact along with associated mitigation measures are indicated in **Table 8-73.**

Table 8-73: Construction impact on emergencies

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Emergencies									
Without Mitigation	4	2	3	4	3	**39**	**Moderate**	(-)	Complex
With Mitigation	4	2	3	4	2	**26**	**Low**	(-)	
Mitigation and Management Measures	— Emergency procedures need to be practiced prior to commencement of construction								

The Green energy field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. This could result in unknown hazards manifest due to using "cheaper supplier or less developed technology". The construction impact along with associated mitigation measures are indicated in **Table 8-74.**

Table 8-74: Construction impact on legal matters

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Legal									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	Moderate
With Mitigation	3	1	3	3	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Use only internationally reputable technology suppliers who comply with all known regulations/guideline at the time of purchasing. — Ensure only latest state of the art technology systems are used.								

SOLID STATE LITHIUM-ION BATTERIES

During construction, the solid-state battery containers can be damaged on route e.g. dropped in port (drops do happen about 1/2000 containers) and importing possibly approximately 100 containers for the site. With this it is possible, although unlikely, that one will be dropped, traffic accident on-route. Involvement in an external fire e.g. at the port or on route. Data indicates installed facility events are 0.001/year. Transport of 100 units per installation assumed to take 4 weeks each so f=0.008 once in 125 years so likelihood is very low.

Consequences – Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire. The construction impact along with associated mitigation measures are indicated in **Table 8-75.**

Table 8-75: Construction impact on employees due to exposure to fire from damaged batteries

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - solid state lithium-ion battery - exposure to fire radiation									
Without Mitigation	5	2	5	5	2	**34**	**Moderate**	(-)	Complex
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	
Mitigation and Management Measures	— Solid state battery design includes abuse tests such as drop test, impact, rapid discharge etc. Propagation tests for systems, e.g. heat insulating materials between cells/modules. Factory acceptance test prior to prior to leaving manufacture. Batteries are usually stored at 50% charge to prolong life but may be shipped fully discharged. — This level of detail should be understood so as to assess the risk during transport and storage. — The developer should ensure suitably competent transport companies are appointed.								

Potential Impact Human and Equipment Safety - solid state lithium-ion battery - exposure to fire radiation	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation

	— The company responsible for transportation should ensure:
	— Compliance with National Road Traffic Act regulation 8 – dangerous goods.
	— Port Authorities should be alerted to the overall project and the hazardous nature of the contents of battery containers being imported. Note. If, as per one of the typical suppliers (Tesla) indications, the containers are classified as IMDG Class 9 – the containers will not receive any special care in the ports and may be stored next to flammables.
	— Port emergency response in particular need training on mitigating battery hazards.
	— Prior to bringing any containers into the country a full Emergency response plan should be in place for the full route from the ship to the site. Drivers trained in the hazards of containerized batteries. Emergency plan to determine and address:
	  — What gases would be released in a fire and are there inhalation hazards
	  — Extinguishing has two important elements, put out fire and to provide cooling. Different approaches may be needed for small fire – e.g. put out, and for large fires e.g. cool with copious quantities of water. Note inert gases and foam may put out the initial fire but fail to control thermal runaway or to cool the batteries resulting in reignition.
	As a minimum the following must be known:
	— What initial fire extinguishing medium should be used
	— Are there any secondary gases or residues from use of extinguishers?
	— If water is appropriate, may need outside connections to inside sprinklers?
	— First responders need to know what media to use, especially if water totally unsuitable and if there are no connection points for water etc.
	— Must the container be left unopened or opened?
	— PPE to be specified including possible exposure to chemicals and fumes as well as radiate heat.
	— Containment of residues/water/damaged equipment.
	— Suitable safe making a disposal plan considering after the event, how do responders deal with partially charged damage units, contaminated surfaces (e.g. HF residues).								

During transportation to site, the solid-state lithium battery containers can generate flammable gases by thermal run away and can reach explosive limits. This can result in ignition on hot surfaces, static. Consequences include potential fatalities amongst first responders. Damage to container, transport truck or other nearby items. The construction impact along with associated mitigation measures are indicated in **Table 8-76.**

Table 8-76: Construction impact on potential explosions

Potential Impact Human and Equipment Safety- solid state lithium-ion battery - exposure to explosion over pressures	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	5	4	5	5	3	**57**	**Moderate**	(-)	N/A
With Mitigation	5	4	5	5	1	**19**	**Low**	(-)	

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety- solid state lithium-ion battery - exposure to explosion over pressures									
Mitigation and Management Measures	— During transport this is only likely to happen due to possible inappropriate emergency response, e.g. opening containers when they may be the type that should be left to burn out. — For simplicity one transport route would be preferable. The route needs to be assessed in terms of responding local services, rest places for drivers, refuelling if required, break down services available etc. — Once an import route has been chosen, e.g. Richards Bay or Durban and along N2/N3/N11 etc, then the appointed transport company should ensure key emergency services on route could be given awareness training in battery fire/accident response. — Emergency response planning and training referred to above may be important for key locations such as the mountain passes / tunnels.								

During the transportation of the batteries to site they may be damaged, solid-state batteries when damaged release fumes, leak electrolyte, are completely broken exposing hazardous chemicals. Thermal runaway and hazardous fumes released. Consequences can vary from mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage. The construction impact along with associated mitigation measures are indicated in **Table 8-77.**

Table 8-77: Construction impact on employees due to exposure to toxic chemicals

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - solid state lithium-ion battery- exposure to acute toxic chemical agents									
Without Mitigation	4	3	3	5	3	**45**	**Moderate**	(-)	Complex
With Mitigation	4	3	3	5	2	**30**	**Low**	(-)	
Mitigation and Management Measures	— Appointed transport company to ensure transport in accordance with Regulation 8 of the National Road Traffic Act 93 of 1996, Dangerous Goods. — Not permitted to transport prescribed goods in manner not consistent with the prescriptions, e.g. consignor and consignee responsibilities. Prescription found in SANS 10228/29 and international codes for battery transport etc. — Transport in sealed packages that are kept upright, protected from movement damage etc. — Also packaged to ensure no short-circuiting during transport. — Transport to prevent excessive vibration considerations as battery internal may be damaged leading to thermal run-away during commissioning. — Pre-assembled containers will most likely be supplied. These will be fitted with the necessary protective measures by the supplier considering marine and road transport as well as lifting, setting down etc. — Route selection to consider possible incidents along the way and suitable response, e.g. satellite tracking, mobile communication, 24/7 helpline response. — Standard dangerous goods requirements for Hazmat labels, Trem cards, driver trained in the hazards of the load.								

Battery containers may be damaged during transportation to site. Consequences can result in delays and wastage of materials. The construction impact along with associated mitigation measures are indicated in **Table 8-78.**

Table 8-78: Construction impact on resource wastage

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - waste of resources e.g. water, power etc									
Without Mitigation	1	1	1	2	4	**20**	**Moderate**	(-)	Easy
With Mitigation	1	1	1	2	2	**10**	**Low**	(-)	
Mitigation and Management Measures	— Handling protocols to be provided by battery supplier. — End of Life plan needs to be in place before any battery containers enter the country as there may be damaged battery unit from day 1. — Water management plan and spill containment plans to be in place.								

During construction, fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse situations associated with the BESS is possible. An inadequate emergency response to small event leads to escalation. Consequences will be injuries turn to fatalities, small losses become extended down time. The construction impact along with associated mitigation measures are indicated in **Table 8-79.**

Table 8-79: Construction impacts on emergencies

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Emergencies related to solid state Li-ion batteries									
Without Mitigation	4	2	3	5	4	**56**	**Moderate**	(-)	Complex
With Mitigation	4	2	3	5	2	**28**	**Low**	(-)	
Mitigation and Management Measures	— All safety measures listed above. — Small events not handled correctly and escalate into larger events. — Emergency procedures need to be practiced prior to commencement of construction. — If batteries are stored at 50% charge, thermal run away can happen while in storage on site waiting for installation. In addition, if involved in an external fire thermal run away can happen even with uncharged batteries. — Except during shipping, ideally the units should not be stored any closer to each other than they would be in the final installation so that propagation is prevented, i.e. laydown area needs to be considered. — The company in charge of the containers at each stage in the transport process needs to be very clear so that responsibility for the integrity of the load and protection of the persons involved in transfer and coordination of emergency response on-route. E.g. if purchased from Tesla where does hand over occur to the South African contractor / owner, at the factory door in USA, at the port in RSA, at the site fence. — For example, who will be accountable if there's thermal runway event on a truck with a container that stops in a small town for driver refreshments								

8.16.2 OPERATIONAL PHASE

GREEN HYDROGEN AND AMMONIA FACILITY

During the operation and maintenance, materials, spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases etc. may be used by employees, improper usage of these can result in occupational illness. The operational impact along with associated mitigation measures are indicated in **Table 8-80.**

Table 8-80: Operational impact on employee's health

Potential Impact Human Health - chronic exposure to toxic chemical or biological agents.	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	1	3	4	5	**50**	**Moderate**	(-)	Moderate
With Mitigation	1	1	3	4	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— The operation and maintenance phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993. — Ensure a SHEQ policy is in place. — A detailed risk assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning. — SHE procedure in place, e.g. PPE specified, management of change, integrity monitoring. — Ensure SHE appointees are in place. — Training of staff in general hazards on site. — All necessary health controls/ practices to be in place, e.g. ventilation of confined areas, occupational health monitoring if required and reporting programs in place. — Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as: — appointment of emergency controller, — emergency isolation systems for electricity, — emergency isolation and containment systems for electrolyte, — provision of PPE for hazardous materials response, — provision of emergency facilities for staff at the main office building, — provision of first aid facilities, — first responder contact numbers etc								

The usage of slightly compromised equipment during the operational phase (e.g. small ammonia leaks) will allow toxic vapours to accumulate in buildings or structures, solids/liquids on surfaces. Furthermore, maintenance of components is essential to prevent corrosive (e.g. water treatment chemicals) and mildly toxic liquid on surfaces as well. Dermatitis, skin /eye/lung irritation could be the impact on employees. The operational impact along with associated mitigation measures are indicated in **Table 8-81.**

Table 8-81: Operational impact employees due to exposure to toxic agents

Potential Impact Human Health - chronic exposure to toxic chemical or biological agents	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Without Mitigation	2	1	3	5	4	**44**	**Moderate**	(-)	Complex
With Mitigation	1	1	3	5	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Maintenance procedures will be in place should equipment need to be opened, e.g. pumps drained and decontaminated prior to repair in workshop etc. — PPE will be specified for handling contaminated parts and other equipment on site. — Training of staff in hazards of chemicals on site. — Labelling of all equipment. — Confined space entry procedures if entering tanks								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - chronic exposure to toxic chemical or biological agents									
	— Safety Data Sheets (SDSs) to be available on site. — Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. — Maintenance manuals with make safe, decontamination and repair procedures. — Proposed maintenance schedules daily, weekly, monthly, annual etc. — Provided portable equipment for calibration and for testing/verification of defective equipment.								

Employee exposure to moving parts inside buildings, pumps, compressors, cooling systems etc, during the operation phase could result in adverse impact on hearing of workers. Nuisance factor at near-by residences or other activities could also be possible. The operational impact along with associated mitigation measures are indicated in **Table 8-82.**

Table 8-82: Operational impact on employees due to noise generation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to noise									
Without Mitigation	2	1	5	5	4	**52**	**Moderate**	(-)	Easy
With Mitigation	2	1	5	5	2	**26**	**Low**	(-)	
Mitigation and Management Measures	— Design to ensure continuous noise does not exceed 85dB in the plant or at any other location on site or 61 dB at the site boundary, e.g. emergency generator, air compressor etc. — Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.								

Operation during the day brings about exposure to Heat. Furthermore, the Electrolysis plant and Haber process generate heat within enclosed building / structures. Cold temperatures in winter are likely. Heat stroke and Hypothermia can result from the afore mentioned. Lastly, night work will require thermal lighting. The operational impact along with associated mitigation measures are indicated in **Table 8-83.**

Table 8-83: Operational impact on employees due to exposure in temperature extremes

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to temperature extremes and/or humidity									
Without Mitigation	4	2	3	1	2	**20**	**Low**	(-)	Easy
With Mitigation	3	2	3	1	1	**9**	**Very low**	(-)	
Mitigation and Management Measures	— Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. — Night work is likely. Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure. — PPE for operations and maintenance staff to be suitable for the weather conditions. — Adequate potable water to be provided during all phases of the project. — PPE for operations and maintenance staff to be suitable for the weather conditions.								

During the operation phase Isolated workstations and monotonous repetitive work can lead to low performance and system productivity suffers. The operational impact along with associated mitigation measures are indicated in **Table 8-84.**

Table 8-84: Operational impact on employee psychological state

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to psychological stress									
Without Mitigation	2	3	3	2	2	**20**	**Low**	(-)	Easy
With Mitigation	1	3	3	2	1	**9**	**Very low**	(-)	
Mitigation and Management Measures	— Staff rotation to other activities within the site may be necessary. — Performance monitoring of inspections / maintenance tasks in particular will be necessary.								

Employees lifting heavy equipment during the operational phase and getting into awkward angles during maintenance, stretching reaching to high level and bending to low level is likely to occur. Working at height may be undertaken if equipment is located on top of tanks, roofs or elevated electrical equipment (e.g. pylons). The consequences of this can be back and other injuries. The operational impact along with associated mitigation measures are indicated in **Table 8-85.**

Table 8-85: Operational impact on employees' ergonomics

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health - exposure to ergonomic stress									
Without Mitigation	5	1	3	2	3	**33**	**Moderate**	(-)	Easy
With Mitigation	4	1	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Training in lifting techniques. — Training in working at heights. — If equipment is at height (see OHS Act General Safety Regulation 6), ensure suitable safe (electrically and physically) ladders / harnesses etc. are available. — Working at height procedure to be in place								

The following are possible fire radiation situations during the operational phase. Encountering the involvement in an external fire e.g. veld fire, maintenance vehicle fire, electrical systems fire. Operator negligence, mechanical failure or other cause of loss of containment of flammable hydrogen / ammonia. Enhanced flammability due to leaks of oxygen. Incorrect extinguishing medium, escalate the fire. Consequences of the above include flash or jet fire. Radiation burns due to highly flammable materials on site. Possible offsite effects on members of the public. Damaged equipment. Contaminated fire water run-off. Fire spreads to other units or offsite if grass/vegetation not controlled. The operational impact along with associated mitigation measures are indicated in **Table 8-86.**

Table 8-86: Operational impact of fire radiation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to fire radiation									
Without Mitigation	5	2	5	5	3	**51**	**Moderate**	(-)	Complex
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	
Mitigation and Management Measures	— Facilities to be declared a Major Hazard Installation and to comply with all the regulatory requirements, e.g. MHI QRA to be done by AIA to SANS 1461, Notifications/registration etc.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to fire radiation									
	— Full Process Safety Management system with all elements to be implemented to highest international best practice levels. — Extremely flammable hydrogen systems to be designed to latest applicable international codes. — Grass cutting and fire breaks around the installations to prevent veld fires. — No combustible materials to be stored in or near the main chemical infrastructure especially hydrogen system. — Separation of site diesel tank, transformers from hydrogen / ammonia and vice versa. — Detailed FMEA/Hazop/Bowtie to done during design at the component level and system levels. — Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. — Site Acceptance Testing as part of commissioning of each unit and the overall system. — Hazardous Area Classification (SANS 10108) studies done and equipment suitably specified and maintained. — Suitable ingress protection level provided for electrical equipment, e.g. IP55 - 66. — Monitoring of critical parameters on SCADA, data needs to be stored for trend analysis. — Protective systems are only as good as their reliability and functionality testing is important, e.g. testing that all plant alarms trips work. — Refer to construction phase above and apply as suitable. — Emergency Response plan in compliance with SANS 1514 to be compiled, e.g. plan from transport and construction phase to be extended to operational phase to include the hazards of the systems containing large quantities of highly hazardous chemicals.								

During the operation of the facility, ingress of oxygen into hydrogen or ammonia systems can result in ignition and internal explosion. Loss of containment of hydrogen (possibly also ammonia), ignition and confined explosion within structures or semi confined if cloud drifts is also a possibility. The loss of containment of oxygen leading to enhance flammability is another possibility. These aforementioned can lead to potential fatalities including possibly member of the public, significant impacts up to 350m from the site. Damage to nearby equipment and possible secondary events such a large toxic ammonia as clouds could result. The operational impact along with associated mitigation measures are indicated in **Table 8-87.**

Table 8-87: Operational impact on potential explosions due to Hydrogen, Ammonia or Oxygen leaks

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to explosion over pressures									
Without Mitigation	5	3	5	5	3	**54**	**Moderate**	(-)	Moderate
With Mitigation	5	3	5	5	1	**18**	**Low**	(-)	
Mitigation and Management Measures	— As for fire (**Table 8-86**) above. — Occupied building study to confirm suitable location / design of main control room.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to explosion over pressures									
	— Emergency response plan and employee training referred to above is critical.								

During the operation of the facility transformer shorting / overheating / explosion is a possibility. This could result in potential fatalities, e.g. amongst first responders and damage to nearby equipment. The operational impact along with associated mitigation measures are indicated in **Table 8-88.**

Table 8-88: Operational impact on potential explosions due to transformer faults

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to explosion over pressures									
Without Mitigation	5	1	5	5	1	**32**	**Moderate**	(-)	Moderate
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	
Mitigation and Management Measures	— Electrical equipment will be specified to suit application. — Emergency response plan and employee training referred to above is critical.								

During the operation of the facility, human pathogens and diseases, sewage, food waste will likely be encountered by employees. Snakes, insects, wild and domesticated animals and harmful plants are also likely to be encountered. Employees who interact with the above can display illness and at worst without mitigation, possibly result in fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The operational impact along with associated mitigation measures are indicated in **Table 8-89.**

Table 8-89: Operational impact on employees from exposure to biological agents

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to acute toxic chemical and biological agents									
Without Mitigation	4	1	3	2	3	**30**	**Low**	(-)	Moderate
With Mitigation	3	1	2	2	2	**16**	**Low**	(-)	
Mitigation and Management Measures	— All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. — Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. — Awareness training for persons on site, safety induction to include animal hazards. — First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. — Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts								

During the operational phase of the facility the following may occur, design or construction faults, mechanical failure, failure to follow correct procedures leading to loss of containment of hazardous chemicals (e.g. ammonia, nitrogen), large leaks, catastrophic failures, entry into unpurged confined spaces etc. these may result in impacts can vary from mild skin irritation from exposure to small leaks to large numbers of fatalities for exposure to catastrophic releases, significant impacts up to 1.4km from the site. The operational impact along with associated mitigation measures are indicated in **Table 8-90.**

Table 8-90: Operational impact on employees' exposure to hazardous chemicals

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to acute toxic/hazardous chemicals									
Without Mitigation	5	3	5	5	4	**68**	**High**	(-)	Moderate
With Mitigation	5	3	3	5	1	**16**	**Low**	(-)	
Mitigation and Management Measures	— Facilities to be declared a Major Hazard Installation and to comply with all the regulatory requirements. — Suitable PPE (e.g. overalls, gloves, eyeglasses) to be specified for all operations in process areas. — PPE to be increased (e.g. full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g. sampling, maintenance. — All operators/maintenance staff trained in the hazards of chemicals on site and correct operating / maintenance procedures. — Emergency Response Plan to be in place to SANS 1514. — 24/7 helpline response available for customers of hazardous goods. — Standard dangerous goods requirements for Hazmat labels. — Shelter-in-place facilities to be provided for all persons on site. — Offsite - closest potentially affected neighbours to be provided with emergency response information (i.e. shelter in place).									

Employees will be exposed to moving equipment, pumps, heavy equipment at elevation, nip points, working at heights during the operational phase of the facility. Traffic accidents. Earthquake / tremors are also possibilities. The above could lead to injury and fatality in unlikely worst case, e.g. traffic accidents or fall from heights. Damage to equipment, spills, environment pollution are also potential impacts. The operational impact along with associated mitigation measures are indicated in **Table 8-91.**

Table 8-91: Operational impact on employees due to exposure to kinetic or potential energy

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to violent release of kinetic or potential energy									
Without Mitigation	5	1	5	5	3	**48**	**Moderate**	(-)	Moderate
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	
Mitigation and Management Measures	— All moving equipment will be guarded/protected as per OHS Act requirements. — Hot surfaces will be insulated for personnel protection. — Maintenance equipment to be serviced and personnel suitably trained in the use thereof. — Normally just small vehicles on site, bakkies, grass cutting, cherry-pickers etc. Possibly large cranes if large equipment or elevated structure removed/replaced. — Traffic signs, rules etc in place on site. — All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works etc to be in place. — Emergency response plan. — Civil design to take seismic activity into account.									

The operational phase will bring about the usage of electrical machines, generators etc. In hot dry areas, static generation is highly likely. Lightning strikes are also a possibility. The consequences of the above are potential electrocution, ignition and burns, injury and death. Damage to electrical equipment may also be a result. The operational impact along with associated mitigation measures are indicated in **Table 8-92.**

Table 8-92: Operational impact on employees due to exposure to electromagnetic waves

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to electromagnetic waves									
Without Mitigation	5	2	5	5	3	**51**	**Moderate**	(-)	Complex
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	
Mitigation and Management Measures	— Codes and guidelines for electrical insulation must be implemented. — PPE to suit. — Electromagnetic fields, impact on other equipment e.g. testing devices, mobile phones – malfunction, permanent damage. — Software also needs maintenance, patches, updates. — Consider suitably located Emergency stop buttons for the plant and the other equipment on site. — PPE to consider static accumulation for entering the plant, and particularly in the hydrogen areas. — Lightning strike rate in proposed development area is very high. — All outside work must be stopped during thunderstorms. — Lighting conductors may be required for the installation, to be confirmed during design								

During the operation of the facility, oxygen is a by-product and may be vented. Cryogenic storage may release a small amount of stored material that cannot be re-condensed in the boil-off gas system. Production upsets may lead to imbalances resulting in venting or flaring of hydrogen, ammonia etc. During start-up / shut-down there may be venting / flaring of out of specification products. Consequences: minor release of pollutants. The operational impact along with associated mitigation measures are indicated in **Table 8-93.**

Table 8-93: Operational impact on air emissions

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to air									
Without Mitigation	3	1	1	1	3	**18**	**Low**	(-)	Easy
With Mitigation	3	1	1	1	1	**6**	**Very low**	(-)	
Mitigation and Management Measures	— Design to minimize heat ingress and loss of cryogenic fluids — Design of hydrogen and ammonia systems to minimise direct releases, e.g. flare excess.								

The operational phase will result in generation of water treatment brine, cooling water blow-down, floor washings and laboratory waste (if included in the design). Maintenance waste generated can include oils, spills from coolant system, diesel trucks, transformers and parked vehicles oil drips. Fire water runoff control may also form part of the operational phase. Kitchen waste and sewage will be produced. There also may be accidental refrigerant release. The consequences of the above will result in pollution if not contained. Excessive disposal costs if emissions not limited. The operational impact along with associated mitigation measures are indicated in **Table 8-94.**

Table 8-94: Operational impact on water

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to water									
Without Mitigation	3	2	3	2	3	**30**	**Low**	(-)	Moderate
With Mitigation	3	2	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Tank areas fully bunded to 110% of largest tank, or more.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to water									
	— Curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area is particularly important. — Sewage and any kitchen liquids - containment and suitable treatment/disposal. — Procedures for dealing with damaged/leaking equipment as well as clean-up of spills, hazmat services. — Normal site practices for preventing and containing diesel/paint etc spills. — Waste management plan to be in place e.g. liquid waste treatment or suitable removal and disposal will be provided. — The National Environment Management Act (NEMA) has a list of substances with Reportable spill Quantities, ensure compliance with this. — Storm water management system to be in place.								

Operational waste will be generated during the operation of the facility. These can include but not limited to admin solid waste, packaging from new components, spent catalyst, filters, hoses, gaskets and other old plant components. The operational impact along with associated mitigation measures are indicated in **Table 8-95.**

Table 8-95: Operational impact on waste generation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment – waste generation									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	Easy
With Mitigation	2	2	3	3	1	**10**	**Very low**	(-)	
Mitigation and Management Measures	— There will need to be solid waste segregation (e.g. electronic equipment, chemicals, oil contaminated rags, paper, plastic) and management on the site.								

The operational phase will require the usage of water and power. Uncontrolled usage of both will result in excessive costs and disposal of large volumes of hazardous waste (by-product). The operational impact along with associated mitigation measures are indicated in **Table 8-96.**

Table 8-96: Operational impact on resource consumption

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - waste of resources e.g. water, power etc									
Without Mitigation	2	1	1	2	4	**24**	**Low**	(-)	Easy
With Mitigation	2	1	1	2	2	**12**	**Very low**	(-)	
Mitigation and Management Measures	— Water usage to be monitored on site. — Water management plan and spill containment plans to be in place. — Investigate End of Life plan for decommissioned equipment – reuse / recovery / repurpose.								

Once the facility is operational, the visual impact of the structures and buildings will be apparent to those passing by. The operational impact along with associated mitigation measures are indicated in **Table 8-97.**

Table 8-97: Operational impact on aesthetics

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Public - Aesthetics									
Without Mitigation	3	2	3	4	4	**48**	**Moderate**	(-)	Moderate
With Mitigation	1	2	3	4	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Confirm height limitations for buildings / structures and electrical infrastructure, in terms of visual aspects. — Sheeting likely to be painted, not left as reflective steel. — Visual impact assessment to include green hydrogen and ammonia installation when design details become available. — Refer to Visual Impact Assessment which is to include the Green Energy installation once design details are available								

The operational phase could be affected by defective technology and subsequently extreme project delays. This can result in financial loss. The operational impact along with associated mitigation measures are indicated in **Table 8-98.**

Table 8-98: Operational impact on financial state

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Investors - Financial									
Without Mitigation	5	1	3	4	3	**39**	**Moderate**	(-)	Easy
With Mitigation	3	1	3	4	2	**22**	**Low**	(-)	
Mitigation and Management Measures	— Design by experienced contractors using internationally recognized and proven technology. — Project management with deviation monitoring. — Project insurance.								

During the operational phase of the facility there is a potential for hi-jacking of valuable and hazardous loads (e.g. road tanker of ammonia). On site, theft of equipment is possible. Civil unrest or violent strike by employees is another likelihood. Cyber security attacks on facility systems can also occur. The consequences of this can include financial loss, ransom money lost, loss of life. Injury to burglars or members of the public if stolen hazardous loads not contained. Damage to equipment and possibly setting off explosions or loss of containment incident on site. The operational impact along with associated mitigation measures are indicated in **Table 8-99.**

Table 8-99: Operational impact on security

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Employees and investors - Security									
Without Mitigation	3	1	3	2	4	**36**	**Moderate**	(-)	Moderate
With Mitigation	3	1	3	2	2	**18**	**Low**	(-)	
Mitigation and Management Measures	— Cyber security protection of plant control systems, firewalls etc. — Fencing around infrastructure to SANS standard and Eskom Guidelines. — Consider motion detection lights and CCTV. — The hazardous nature of the facility should be clearly indicated – e.g. Skull and Cross Bones or other signs. — Isolated location both helps and hinders security.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Employees and investors - Security									
	— Night lighting to be provided both indoors and outdoors where necessary.								

The following have been identified as possible emergency incidents during the operation of the facility. Fires, explosions, toxic vapour clouds, asphyxiating vapour clouds, large spills, traffic accidents, equipment/structural collapse. Consequences of this can include inadequate emergency response to small event leads to escalation, injuries turn to fatalities, small losses become extended down time. The operational impact along with associated mitigation measures are indicated in **Table 8-100.**

Table 8-100: Operational impact on facility emergencies

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Facility emergencies									
Without Mitigation	4	2	3	4	3	**39**	**Moderate**	(-)	Complex
With Mitigation	4	2	3	4	2	**26**	**Low**	(-)	
Mitigation and Management Measures	— Major Hazard Installation Registration and compliance with all emergency response requirements. — Full on-site Emergency Response Plan to be in place as per SANS 1514, e.g. emergency co-ordinator, first responder team, equipment (BA sets, hazmat suits), Command Centre etc. — Off-site emergency response plant to be compiled and implement by local authorities. — Emergency plan to be tested and fully operational before cold commissioning — Annual MHI Emergency Drill. Monthly small emergency drills. — Evacuation siren, audible at closest neighbouring farms, to be in place and tested weekly. — Gas escape Shelter-in-place rooms to be designed and installed. Integrity levels to vary depending on location. — Control room to be suitably located or made explosion proof, to also be airtight as a gas escape room. — Firefighting systems to suitable international codes, e.g. NFPA. — First aid facilities and due to isolated location on-site clinic / medical stabilization facilities ((e.g. medical oxygen, burn treatment, defibrillator). — Escape doors must open outwards. — More than one exit from buildings.								

The Green energy field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences could include encountering unknown hazards manifest due to using “cheaper supplier or less developed technology”. The operational impact along with associated mitigation measures are indicated in **Table 8-101.**

Table 8-101: Operational impact on legal matters

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Legal									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	Moderate
With Mitigation	3	1	3	3	2	**20**	**Low**	(-)	

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Legal									
Mitigation and Management Measures	— Use only internationally reputable technology suppliers who comply with all known regulations/guideline at the time of purchasing. — Ensure only latest state of the art technology systems are used.								

SOLID STATE LITHIUM-ION BATTERIES

During the operational phase, compromised/damaged battery compartments can result in vapours accumulating in the containers leading to corrosive solids/liquids on surfaces. Employees can encounter this during maintenance of battery components, whereby corrosive and mildly toxic liquid are present on surfaces. Consequences can include dermatitis, skin /eye/lung irritation. The operational impact along with associated mitigation measures are indicated in **Table 8-102.**

Table 8-102: Operational impact on employees due to expose to toxic agents

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health -Solid state Li-Ion batteries chronic exposure to toxic chemical agents									
Without Mitigation	3	1	3	5	4	**40**	**Moderate**	(-)	Complex
With Mitigation	1	1	3	5	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Solids state batteries sealed, individual batteries in modules which are also sealed, pre-packed in the container. — Maintenance procedures will be in place should equipment need to be opened, e.g. pumps drained and decontaminated prior to repair in workshop etc. — PPE will be specified for handling battery parts and other equipment on site. — Training of staff in hazards of chemicals on site. — Possible detectors with local alarms if regulated occupational exposure limits are exceeded etc prior to entry for inspection of battery containers. — Labelling of all equipment. — Confined space entry procedures if entering tanks and possibly battery containers — There needs to be careful thought given to procedures to be adopted before entering into the BESS or a container under normal circumstances (confined space) but particularly after a BMS shut down where there may be flammable or toxic gases present, a fire etc. — Safety Data Sheets (SDSs) to be available on site. — Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. — Maintenance manuals with make safe, decontamination and repair procedures. — Proposed maintenance schedules daily, weekly, monthly, annual etc. — Provided portable equipment for calibration and for testing/verification of defective equipment, e.g. volt/current meters, infrared camera								

During the operation of the facility there are chances of involvements in an external fire e.g. veld fire, maintenance vehicle fire, electrical systems fire. Manufacturing defects or damage to batteries leading to shorting and heating can also be an issue along with high humidity condensation of water or ingress of water or flooding leading to shorting. Dust accumulation on electrical parts leading to overheating. Excessive electrical loads and/or surges. Operator abuse, Battery management System (BMS) failure or software failure. Incorrect extinguishing mediums can escalate the fire. Consequences include contaminated run off. Radiation burns unlikely to be severe as no highly flammable materials on site. Damaged equipment. Fire spreads to other units or offsite if grass/vegetation not controlled. The operational impact along with associated mitigation measures are indicated in **Table 8-103.**

Table 8-103: Operational impacts on employees due to exposure to fire risk

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Human and Equipment Safety -Solid state Li-Ion batteries- exposure to fire radiation									
Without Mitigation	5	1	5	5	4	**64**	**High**	(-)	Complex
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	
Mitigation and Management Measures	— Grass cutting and fire breaks around the BESS installations to prevent veld fires. No combustible materials to be stored in or near the batteries or electrical infrastructure. Separation of site diesel tank, transformers from BESS and vice versa. — There are BESS design codes from the USA and standards of practice that can be used e.g. UL9540, NFPA 855 and DNV GL RP 43. — Detailed FMEA/Hazop/Bowtie to done during design at the component level and system levels. Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. — Site Acceptance Testing as part of commissioning of each unit and the overall system. — Abuse tests conducted by supplier. — BMS should be checking individual cell voltage as well as stack, module, container, system voltages/current etc. BMS tripping the cell and possibly the stack/ building unit or module/rack/container, if variations in voltage. Diagnostics easily accessible. — Diagnostics able to distinguish cell from stack or cell from module faults. Protective systems are only as good as their reliability and functionality testing is important, e.g. testing that all battery trips actually work. — Fire resistant barrier between the batteries and the PCS side if in the same container, or separate containers. — Suitable ingress protection level provided for electrical equipment, e.g. — IP55 - 66. If air cooling into container, suitable dust filters to be provided. Smoke detectors linked to BMS & alerts in control room. — Effects of battery aging to be considered. Solid state battery life starts to be impacted above 40 deg C and significant impacts above 50 deg C with thermal run away starting at 65-70 deg C. BMS trips system at 50 deg C. — Temperature monitoring to be in place. Regular infrared scanning. Data needs to be stored for trend analysis. — Most events will be small not resulting in injuries, but this is possible if the event is not controlled. — Prior to commencement of cold commissioning, emergency plan from transport and construction phase to be extended to operational phase and to include the hazards of the electrically live system.									

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety -Solid state Li-Ion batteries- exposure to fire radiation									
	— Procedure to address solid state container fires - extinguishing, ventilating, entering as appropriate or not. PPE for container firefighting include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. — A planned fire response to prevent escalation to an explosion or an environmental event. — Suitable supply of fire extinguishing medium and cooling medium — Consider fire water for cooling adjacent equipment – BESS units. — Can use fogging nozzles to direct smoke. — Ensure procedures in place for clean up after event Lingering HF and other toxic residues in the soil and on adjacent structures. — Procedures to be in place for IR scanning to determine if batteries are still smouldering / are sufficient cooled to handle. — Smoke or gas detector systems that are not part of the original battery container package, need to be linked to the main control panel for the entire system so that issues can be detected and responded to rapidly								

Causes - Power Conversion System (PCS – DC to AC) cooling failure electrical fire. Consequences - Fire starts in PCS or another section or room and spreads to battery area. The operational impact along with associated mitigation measures are indicated in **Table 8-104.**

Table 8-104: Operational impact on potential fires

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety -Solid state Li-Ion batteries- exposure to fire radiation									
Without Mitigation	5	2	5	5	4	**68**	**High**	(-)	Moderate
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	
Mitigation and Management Measures	— Modern lithium container design put the PCS in another part of the container with a fire rated wall separating it from the battery. — Alternately the PCS is another container altogether. — Ensure that in the event of a Failure of cooling on PCS or fires on other electrical equipment such as cooling system pump motors etc, and failure to trip the entire system and raise the alert.								

During the operation phase there is a possibility of transformer shorting / overheating / explosion. The possibility of flammable gases generated by thermal run away reaching explosive limits. Subsequent ignition on hot surfaces, static. Lithium Cobalt Oxide generates O_2 during decomposition which will result in escalation. Consequences include potential fatalities amongst first responders. Damage to container or other nearby items, e.g. other container. The operational impact along with associated mitigation measures are indicated in **Table 8-105.**

Table 8-105: Operational impact on employees due to possible explosions

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - Solid state Li-Ion batteries- exposure to explosion over pressures									
Without Mitigation	5	1	5	5	1	**32**	**Moderate**	(-)	Moderate
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	
Mitigation and Management Measures	— Electrical equipment will be specified to suit application. — Emergency response plan and employee training referred to above is critical. — This is only really likely do happen due to possible inappropriate emergency response, e.g. opening containers when they may be the type that should be left to burn out. — Ensure Modern state of the art containers have ventilation systems for vapours. — Undertake a hazardous area classification of the inside of the container to confirm the rating of electrical equipment, due to possible leaks of electrolyte or generation of flammable gases under thermal run away. — Emergency response plan and employee training referred to above is critical — Suitable training of selected emergency responders who may be called out to the facilities is critical.								

During the operation of the facility, damaged batteries components can leak electrolyte and can be completely broken exposing hazardous chemicals. Hazardous fumes released on thermal run away as outlined in fire risks above. The consequences include impacts that can vary from mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure. In the case of toxic fumes inhalation, serious lung damage will result. The operational impact along with associated mitigation measures are indicated in **Table 8-106.**

Table 8-106: Operational phase impacts on employee's exposure to toxic chemicals

Potential Impact	Magnitude	Extent	Reversibilit y	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety - exposure to acute toxic chemical agents									
Without Mitigation	4	3	3	5	3	**45**	**Moderate**	(-)	Moderate
With Mitigation	3	3	3	5	2	**28**	**Low**	(-)	
Mitigation and Management Measures	— Acid resistant PPE (e.g. overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas. — PPE to be increased (e.g. full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g. sampling, maintenance. — All operators/maintenance staff trained in the hazards of chemicals on site. — Batteries contained, modules contained and all inside a container that acts as bund. — Refer to fire risk above as all the protective measures apply to prevent toxic smoke. — Fumes tend to be directed upwards by the structure of the container. — Refer to fire risks above as all the measures apply to mitigate toxic smoke. — 24/7 helpline response must be available. — Standard dangerous goods requirements for Hazmat labels. — All operators/maintenance staff trained in the hazards.								

VANADIUM REDOX FLOW BATTERIES (VRFB)

The possibility of encountering compromised battery compartments during the operational phase is likely. Vapours can accumulate in the containers and lead to solids/liquids on surfaces which employees come into contact with. The maintenance of battery components can also expose employees to corrosive and mildly toxic liquid on surfaces. The consequences can be dermatitis, skin /eye/lung irritation. The operational impact along with associated mitigation measures are indicated in **Table 8-107.**

Table 8-107: Operational impact on employees due to exposure to toxic chemicals

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Human Health – VRFB- chronic exposure to toxic chemical agents									
Without Mitigation	2	1	3	5	4	**44**	**Moderate**	(-)	Complex
With Mitigation	1	1	3	5	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— VRFB Batteries facilities normally within buildings but may be containerized. — Maintenance procedures will be in place should equipment need to be opened, e.g. pumps drained and decontaminated prior to repair in workshop etc. — PPE will be specified for handling battery parts and other equipment on site. — Training of staff in hazards of chemicals on site. — Labelling of all equipment. — Put in place confined space entry procedures if entering tanks and possibly battery containers — Safety Data Sheets (SDSs) to be available on site. — Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. — Maintenance manuals with make safe, decontamination and repair procedures to be easily accessible — Proposed maintenance schedules daily, weekly, monthly, annual etc. — Provided portable equipment for calibration and for testing/verification of defective equipment, e.g. volt/current meters, infrared cameras									

During the operation phase employees will be exposed to heat during the day. Batteries also generate heat within enclosed building / containers. During winter temperatures, will drop and employees working nightshift will be exposed to cold. Night work also requires lighting. Possible consequences could be heat stroke suffered by employees or hypothermia. The operational impact along with associated mitigation measures are indicated in **Table 8-108.**

Table 8-108: Operational phase impacts on employees exposed to temperature fluctuations

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Human Health -VRFB exposure to temperature extremes and/or humidity									
Without Mitigation	4	2	3	1	2	**20**	**Low**	(-)	Easy
With Mitigation	3	2	3	1	1	**9**	**Very Low**	(-)	
Mitigation and Management Measures	— Night work is likely for VRFB installation. Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure. — Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces.									

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human Health -VRFB exposure to temperature extremes and/or humidity									
	— Adequate potable water to be provided during all phases of the project. — PPE for operations and maintenance staff to be suitable for the weather conditions.								

During the operation of the facility, the Power Conversion System (PCS – DC to AC) cooling can suffer failure and result in an electrical fire. The consequences can result in fire starting in PCS or another section or room and spreads to battery area. The operational impact along with associated mitigation measures are indicated in **Table 8-109.**

Table 8-109: Operational impact on employees due to exposure to possible electrical fires

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Human and Equipment Safety -VFRB- exposure to fire radiation									
Without Mitigation	5	2	5	5	3	**51**	**Moderate**	(-)	Moderate
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	
Mitigation and Management Measures	— VRFB building systems PCS should be in another area separating it from the batteries and other equipment — Ensure trip systems are in working order — Ensure that emergency alarms are in good working order to								

During the operational phase the cooling water blow-down can find its way into nearby water courses. During the maintenance of the facility, waste will be generated, e.g. oils. Spills from batteries, coolant system, diesel trucks, transformers. Fire water runoff (containing chemicals) can also flow into nearby watercourses. Refrigerant release from equipment during operation is also possible. VRFB electrolyte purging will sometimes be required to prevent deterioration. Consequences of the above entering the environment and watercourses will result in pollution if not contained and excessive disposal costs if not limited. The operational impact along with associated mitigation measures are indicated in **Table 8-110.**

Table 8-110: Operational impact on watercourses

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to water									
Without Mitigation	3	2	3	2	3	**30**	**Low**	(-)	Moderate
With Mitigation	3	2	3	2	2	**20**	**Low**	(-)	
Mitigation and Management Measures	— Electrolyte areas fully bunded to 110% of largest tank, or more. — Bunding under any outdoors tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area is particularly important. — Procedures should be in place for dealing with damaged/leaking equipment as well as clean-up of spills. — Waste management plan to be in place e.g. liquid waste treatment or suitable removal and disposal will be provided. — Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, hazmat disposal. — Reportable Quantities from NEMA should be known in case of emergency — Process controls in place to prevent contamination and deterioration of electrolyte leading to excessive purging.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to water									
	— Ensure proposed locations of the BESS facilities are a suitable distance from the closest water course. — In the event of a major spill if this is too close it may not allow time for mitigation to be taken. Adequate secondary and possibly tertiary containment systems may then be needed on site.								

During the operational phase, the disposal of batteries, components or containers may be required. Excessive purging of deteriorated or contaminated electrolyte may performed. This can result in delays and excessive costs and disposal of large volumes of hazardous waste. The operational impact along with associated mitigation measures are indicated in **Table 8-111.**

Table 8-111: Operational impact on the wastage of resources

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment -VFRB- waste of resources e.g. water, power etc									
Without Mitigation	2	1	1	2	4	**24**	**Low**	(-)	Easy
With Mitigation	2	1	1	2	2	**12**	**Very Low**	(-)	
Mitigation and Management Measures	— Water usage to be monitored on site. — Handling protocols to be provided by supplier of electrolyte. — Water management plan and spill containment plans to be in place. — Investigate End of Life plan for electrolyte - reuse / recovery / reconditioning. — Similarly, for decommissioned containers / equipment – reuse / recovery / repurpose								

8.16.3 DECOMISSIONING PHASE

The decommissioning phase of the facility can be managed by implementing the preventative and mitigative measures as per construction and operational phases. However, the impacts outlined below differ.

SOLID STATE LITHIUM-ION BATTERIES

The decommissioning phase may lead to equipment and batteries reached end of life and may leak. This can cause environment damage, injuries, fatalities. The decommissioning impact along with associated mitigation measures are indicated in **Table 8-112.**

Table 8-112: Decommissioning impact on Emissions

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to earth									
Without Mitigation	4	3	3	5	4	**60**	**Moderate**	(-)	Complex
With Mitigation	4	3	3	5	2	**30**	**Low**	(-)	
Mitigation and Management Measures	— Preventative maintenance system to be in place. — End of Life shutdown procedure including a risk assessment of the specific activities involved. — Re-purpose the solid-state batteries / containers and equipment with associated Environmental impact considered.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Environment - emissions to earth									
	— Disposal according to local regulations and other directives such as the European Batteries Directive. — End of life can be pre-defined and the monitoring can be in place to determine if it has been reached. — Affected by temperature and time, cycles. — Disposal according to local regulations and other international directives.								

GREEN HYDROGEN AND AMMONIA FACILITY

Disposal of hazardous "waste" is rife with difficulties and numerous regulations that need to be complied with. The decommissioning impact along with associated mitigation measures are indicated in **Table 8-113.**

Table 8-113: Decommissioning impact on waste disposal

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Disposal of hazardous waste									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	Complex
With Mitigation	3	1	3	3	3	**30**	**Low**	(-)	
Mitigation and Management Measures	— Applicants should seek the opinion from a waste consultant on how to correctly dispose of hazardous waste. — Preventative maintenance system to be in place. — End of Life shutdown procedure including a risk assessment of the specific activities involved. —								

8.17 BATS

The primary impacts predicted for these facilities are destruction of bat roosting and foraging habitats during construction which can also lead to accidental bat fatalities if a roost is destroyed. This applies for micro roosts that may be present in tall vegetation (such as trees), buildings. Light pollution is also a significant factor to be considered.

8.17.1 CONSTRUCTION PHSSE

Construction activities, temporary and long term, such as construction yards, will clear vegetation supporting bat insect prey. The construction impact and associated mitigation measures are outlined below in **Table 8-114**

Table 8-114: Construction impact on bat habitat

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of foraging habitat by clearing of vegetation.									
Without Mitigation	3	1	2	4	4	**40**	**Moderate**	(-)	Easy
With Mitigation	3	1	1	4	3	**27**	**Low**	(-)	
Mitigation and Management Measures	— Adhere to the sensitivity map criteria.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Loss of foraging habitat by clearing of vegetation.									
	— Rehabilitate cleared vegetation where possible at areas such as laydown yards. — Vegetation should be allowed to recover where it was cleared after the construction and decommissioning of the facility. — All lights on substation and/or Operations and Management (O&M) buildings, should be down-hooded and connected to motion sensors (where safe to do so), to minimise light pollution.								

Construction activities may possibly disturb or destroy bat roosts in tall trees. Forcing bats to find alternative roosts. The construction impact and associated mitigation measures are outlined below in **Table 8-115**

Table 8-115: Construction impact on bat roosting

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Roost destruction during earthworks.									
Without Mitigation	3	1	3	4	3	**33**	**Moderate**	(-)	Easy
With Mitigation	3	1	3	4	1	**11**	**Very low**	(-)	
Mitigation and Management Measures	— Adhere to the sensitivity map criteria. — Vegetation should be allowed to recover where it was cleared after the construction and decommissioning of the facility. — All lights on substation and/or Operations and Management (O&M) buildings, should be down-hooded and connected to motion sensors (where safe to do so), to minimise light pollution.								

8.17.2 OPERATIONAL PHASE

Floodlights and other lights at buildings or structures that are placed close to wind turbines (applicable to the proposed Camden I and Camden II WEF's), will attract bats preying on insects and therefore significantly increase the likelihood of these bats being impacted on by the wind turbines. Habitat creation in the roofs of nearby buildings can cause a similar increased risk factor.

The operation impact and associated mitigation measures are outlined below in **Table 8-116**

Table 8-116: Operational Impact on Bat mortalities

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Increased bat mortalities due to light attraction and habitat creation.									
Without Mitigation	4	1	4	4	4	**52**	**Moderate**	(-)	Easy
With Mitigation	4	1	4	4	2	**26**	**Low**	(-)	
Mitigation and Management Measures	— All lights on substation and/or Operations and Management (O&M) buildings, should be down-hooded and connected to motion sensors (where safe to do so), to minimise light pollution.								

9 CUMULATIVE IMPACT ASSESSMENT

Although the S&EIR process is essential to assessing and managing the environmental and social impacts of individual projects, it often may be insufficient for identifying and managing incremental impacts on areas or resources used or directly affected by a given development from other existing, planned, or reasonably defined developments at the time the risks and impacts are identified.

IFC PS 1 recognizes that, in some instances, cumulative effects need to be considered in the identification and management of environmental and social impacts and risks. For private sector management of cumulative impacts, IFC considers good practice to be two pronged:

- effective application of and adherence to the mitigation hierarchy in environmental and social management of the specific contributions by the project to the expected cumulative impacts; and
- best efforts to engage in, enhance, and/or contribute to a multi-stakeholder, collaborative approach to implementing management actions that are beyond the capacity of an individual project proponent.

Even though Performance Standard 1 does not expressly require, or put the sole onus on, private sector clients to undertake a cumulative impact assessment (CIA), in paragraph 11 it states that the impact and risk identification process "*will take into account the findings and conclusions of related and applicable plans, studies, or assessments prepared by relevant government authorities or other parties that are directly related to the project and its area of influence*" including "*master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant*."

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities (IFC GPH).

Evaluation of potential cumulative impacts is an integral element of an impact assessment. In reference to the scope for an impact assessment, IFC's Performance Standards specify that "*Risks and impacts will be analysed in the context of the project's area of influence. This area of influence encompasses…areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and (iv) areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.*" (IFC 2006).

A cumulative impact assessment is the process of (a) analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen Valued Environmental and Social Components (VECs) over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible (IFC GPH).

Cumulative impacts with existing and planned facilities may occur during construction and operation of the proposed OHPL. While one project may not have a significant negative impact on sensitive resources or receptors, the collective impact of the projects may increase the severity of the potential impacts.

Potential cumulative impacts identified are summarised below. Other planned or existing projects that can interact with the Project will be identified during stakeholder engagement and finalisation of the S&EIA process.

NOISE

The cumulative noise impact on the identified receptors in the area will not be significantly affected by the proposed developments in the area. The proposed Camden I WEF will be the other source of noise on the site to consider. However, the impacts can be brought to an acceptable level provided the recommended mitigation measures stipulated by the specialist are implemented. The cumulative is outlined in **Table 9-1** below.

Table 9-1: Cumulative impact on acoustic environment

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative acoustic impacts									
Without Mitigation	2	2	1	4	4	**36**	**Moderate**	(-)	Easy
With Mitigation	2	2	1	4	2	**18**	**Low**	(-)	

SURFACE WATER /AQUATIC

For the proposed GH&A facility, a number of projects have been assessed within a 35km radius and or other sites were accessed during the course of travelling between the various projects.

All of the projects have indicated that their intention with regard to mitigation, i.e. selecting the best possible sites to minimise the local and regional impacts, or improving the drainage or hydrological conditions within these rivers, and therefore the cumulative impact could be seen as a net benefit. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects such as stormwater management. The cumulative impact is outlined below in **Table 9-2.**

Table 9-2: Cumulative aquatic impacts

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative Aquatic impacts									
Without Mitigation	4	4	5	4	2	**34**	**Moderate**	(-)	Moderate
With Mitigation	2	2	2	2	2	**16**	**Low**	(-)	

SOILS, LAND CAPABILITY AND AGRICULTURAL POTENTIAL

The cumulative assessment for this project is an assessment only of the impacts associated with this project, but seen in the context of all surrounding impacts. It is concerned with this project's contribution to the overall impact, within the context of the overall impact, but it is not simply the overall impact itself.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this:

What loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

This development is an integral part of the Camden wind energy facilities. A cumulative impact assessment needs to consider it as such and not in isolation. DFFE compliance for wind energy facilities requires considering all renewable energy project applications within a 30 km radius. According to the DFFE database, the Camden 1 and 2 wind energy facilities are the only renewable energy projects within a 30 km radius. Furthermore, the Ummbila Emoyeni Renewable Energy Wind Facility is located approximately 32km from the project. In quantifying the cumulative impact, the area of land taken out of agricultural use as a result of these 2 projects (total generation capacity of up to 500 MW) will amount to a total of approximately 150 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30km radius (approximately 282,700 ha), this amounts to only 0.05% of the surface area. That is considered to be within an acceptable limit in terms of loss of agricultural land.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it is approved.

AVIFAUNA

The total area of similar habitat (excluding opencast mining and urban areas) available to birds in the 30km radius around the project area is approximately 4 258 km². The land parcels affected by the planned renewable energy facilities, which include the 25ha that will be taken up by the Facility, within this radius takes up a total of 124km², which is 2.9% of the available habitat. The impact on avifauna of the currently planned renewable energy projects within this area, including the proposed Facility, is therefore considered to be Low, and the impact could be reduced if the recommended mitigation at the two Camden wind projects and the Camden I SEF is diligently implemented. The cumulative impact along with associated mitigation measures are outlined below in **Table 9-3.**

Table 9-3: Cumulative avifaunal impacts GH&A facility

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Cumulative Avifaunal impacts from GH&A facility									
Without Mitigation	3	1	5	4	2	**26**	**Low**	(-)	Moderate
With Mitigation	2	1	5	4	2	**24**	**Low**	(-)	

The existing high voltage lines in the 30km radius around the proposed Facility run into hundreds of kilometres. The up to 132kV contribution (maximum 100m) to the total length of high voltage lines within a 30km radius is Very Low. However, the density of all planned and existing high voltage lines within a 30km radius, and by implication the cumulative impact on avifauna, is considered to be Moderate. The cumulative impact is outlined below in **Table 9-4.**

Table 9-4: Cumulative impact on avifauna from 132kV powerline

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Cumulative Avifaunal impacts from 132kV powerline									
Without Mitigation	5	3	3	4	2	**30**	**Low**	(-)	Moderate
With Mitigation	5	3	3	4	1	**15**	**Very Low**	(-)	

ANIMAL SPECIES

Cumulative construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in possible loss of habitat for populations of SCC. The cumulative construction impact is outlined below in **Table 9-5.**

Table 9-5: Cumulative impacts on faunal habitat from construction clearing due to a number of projects

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Type of impact
Loss of faunal habitat									
Current project	2	1	3	5	4	**44**	**Moderate**	(-)	direct
Combination of projects	3	3	3	5	4	**56**	**Moderate**	(-)	

During the construction phase, the cumulative impact of the surround developments will likely impact negatively on the mortality of the fauna in the area. Operation of machinery and equipment can result in Collisions and accidental killing. The cumulative impact is outlined below in **Table 9-6.**

Table 9-6: Cumulative impacts of direct faunal mortality due to a number of projects: construction phase

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Type of impact
Faunal mortality									
Current project	2	1	1	2	3	**18**	**Low**	(-)	direct
Combination of projects	3	3	1	2	4	**36**	**Moderate**	(-)	

The routine maintenance of the sites once the facilities are operational, could result in further loss of the faunal habitats in the area. The cumulative operational impact is outlined below in **Table 9-7.**

Table 9-7: Cumulative impacts of direct faunal mortality due to a number of projects: operational phase

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Type of impact
Loss of faunal habitat									
Current project	2	1	1	4	3	**24**	**Low**	(-)	direct
Combination of projects	3	3	1	4	4	**44**	**Moderate**	(-)	

PLANT SPECIES

Construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in possible loss of populations of SCC. The cumulative impact is outlined below in **Table 9-8.**

Table 9-8: Cumulative impacts on SCC from construction clearing due to a number of projects

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Type of impact
Loss of individuals of Species of Conservation Concern									
Current project	2	2	5	5	1	**14**	**Very low**	(-)	direct
Combination of projects	3	3	5	5	3	**48**	**Moderate**	(-)	

BIODIVERSITY

The regional terrestrial vegetation type in the broad study area is listed as Vulnerable and is impacted across its range by historical activities. Loss of habitat will definitely occur for the project, which will be a small area in comparison to the total area of the vegetation type. However, the total loss of habitat due to a number of projects together will be greater than for any single project, so a cumulative effect will occur. The area lost in total will be very small compared to the total area of the vegetation type concerned. The cumulative effect will therefore be low for vegetation loss. The cumulative impact is outlined below in **Table 9-9.**

Table 9-9: Cumulative impact on indigenous vegetation

Potential Impact Clearing of natural habitat for construction	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Type of impact
Current project	1	1	3	4	4	**36**	**Moderate**	(-)	Indirect
Combination of projects	2	3	3	5	5	**65**	**High**	(-)	

There are various ecological processes that may be affected at a landscape level by the presence of multiple projects. This includes population processes, such as migration (movement of species through the landscape), pollination (can be disrupted if insect pollinators are blocked from movement)and dispersal, but also more difficult to interpret factors, such as spatial heterogeneity (the diversity of habitats and their spatial relationship to one another), community composition (the species that occur in the landscape) and environmental gradients, that can become disrupted when landscapes are disturbed at a high level. Disturbance can alter the pattern of variation in the structure or function of ecosystems. Fragmentation is the breaking up of a habitat, ecosystem, or land-use type into smaller parcels. An important consequence of repeated, random clearing is that contiguous cover can break down into isolated patches. This happens when the area cleared exceed a critical level and landscapes start to become disconnected. Spatially heterogenous patterns can be interpreted as individualistic responses to environmental gradients and lead to natural patterns in the landscape. Disrupting gradients and creating disturbance edges across wide areas is very disruptive of natural processes and will lead to fundamental changes in ecosystem function.

The current project has been designed to mostly occupy areas that are already disturbed. Where infrastructure is located in natural areas, it is near to edges or follows existing roads. There are few places where it intrudes significantly into natural areas. The cumulative impact is outlined below in **Table 9-10.**

Table 9-10: Cumulative impacts on ecological processes

Potential Impact Disruption of ecological processes at landscape level	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Type of impact
Current project	2	1	3	4	3	**30**	**Low**	(-)	Direct
Combination of projects	2	3	3	4	4	**52**	**Moderate**	(-)	

There is a moderate possibility that alien plants could be introduced to areas within the footprint of the proposed infrastructure from surrounding areas in the absence of control measures. The greater the number of projects, the more likely this effect will happen; therefore, the effect is cumulative. For the current site, the impact is predicted to be low due to the current absence of invasive species on site and the high ability to control any additional impact. The significance will therefore be low, especially if control measures are implemented. However, the increased overall disturbance of the landscape will create opportunities and, if new invasions are not controlled, can create nodes that spread to new locations due to the heightened disturbance levels. The cumulative impact is outlined below in **Table 9-11.**

Table 9-11: Cumulative impacts due to establishment and spread of declared weeds and alien invader plants

Potential Impact Establishment and spread of declared weeds and alien invader plants	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Type of impact
Current project	1	1	3	2	2	**14**	**Very low**	(-)	Indirect

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Type of impact
Establishment and spread of declared weeds and alien invader plants									
Combination of projects	3	3	3	4	4	**52**	**Moderate**	(-)	

HERITAGE AND PALAEONTOLOGY

Cumulative impacts or effects can be described as "changes to the environment that are caused by an action in combination with other past, present and future human actions". They are the result of multiple activities whose individual direct impacts may be relatively minor but which, in combination with others result are significant environmental effects (DEAT 2004:5).

Cumulative impacts considered as an effect caused by the proposed action that results from the incremental impact of an action when added to other past, present, or reasonably foreseeable future actions. (Cornell Law School Information Institute, 2020). Cumulative impacts occur from the combination of effects of various impacts on heritage and palaeontological resources. The importance of identifying and assessing cumulative impacts is that the whole is greater than the sum of its parts. In the case of this project, impacts can be mitigated to an acceptable level. However, this and other projects in the area can have a negative impact on heritage and palaeontological sites in the area where these sites have been destroyed unknowingly. The cumulative impact is outlined in **Table 9-12** below.

Table 9-12: Cumulative impact on heritage and palaeontology

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Damage or loss of Heritage or palaeontological finds									
Without Mitigation	3	1	5	5	3	**42**	**Moderate**	(-)	Easy
With Mitigation	3	1	5	5	2	**28**	**Low**	(-)	

VISUAL & LANDSCAPE

Proposed mining, industrial and renewable energy developments in the broader area will alter the natural character of the study area towards a more industrial landscape and expose a greater number of receptors to visual impacts. Visual intrusion of mining, industrial and renewable energy developments may be exacerbated, particularly in more natural undisturbed settings.

Additional mining, industrial and renewable energy facilities in the area would generate additional traffic on gravel roads thus resulting in increased impacts from dust emissions and dust plumes. The night-time visual environment could be altered as a result of operational and security lighting serving new developments in the broader area.

In assessing cumulative impacts, consideration must also be given to any planned renewable energy facilities (REFs). These facilities have the potential to cause large-scale visual impacts, and although the level of transformation already present in the landscape will reduce the contrast and overall visual impact of the new development, the incremental change in the landscape will be increased and the visual impacts on surrounding visual receptors would be exacerbated. Although the South African Renewable Energy EIA Application Database from DFFE does not record any existing or proposed renewable projects within 35kms of the Facility, a cumulative assessment must include all elements of the proposed Camden Renewable Energy Complex as well as the Ummbila Emoyeni Renewable Energy Wind Facility located approximately 32km from the project. This complex, including wind and solar facilities as well as associated grid connection infrastructure, will affect a large portion of the study area.

From a visual perspective, the concentration of renewable energy facilities, in conjunction with the green hydrogen and ammonia production facilities as proposed will further change the visual character of the area and alter the inherent sense of place, extending an increasingly industrial character into the broader area, and resulting in significant cumulative impacts. It is however anticipated that these impacts could be mitigated to acceptable levels with the implementation of the recommended mitigation measures. In addition, it is possible that these developments in close proximity to each other could be seen as one large Renewable Energy Facility rather than several separate developments. Although this will not necessarily reduce impacts on the visual character of the area, it could potentially reduce the cumulative impacts on the landscape. The cumulative impact is outlined below in **Table 9-13.**

Table 9-13: Cumulative visual impact

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Cumulative Visual impact									
Without Mitigation	5	3	3	5	4	**64**	**High**	(-)	Moderate
With Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)	
	— Implementation of the mitigation measures as recommended for each new development by the relevant visual specialists.								

TRAFFIC

The maximum traffic generation of the Camden I and Camden II facility is expected to occur at the same time, as the facilities will be developed and operated concurrently. It should be noted that the Significance of the transport impact of the Camden II facility is expected to be similar to the Camden I WEF during construction, namely Low (without with mitigation), and Very Low (with mitigation). However, the result will be the overall increase in traffic on the D260 and N11 during the construction and operational phases as indicated below in **Table 9-14.**

Table 9-14: Cumulative impact on traffic

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Ease of mitigation**
Increased traffic due to surrounding developments									
Without Mitigation	2	2	1	1	5	**30**	**Low**	(-)	Moderate
With Mitigation	1	2	1	1	2	**10**	**Very low**	(-)	
	— Implementation of the mitigation measures as recommended for each new development by the relevant visual specialists.								

SOCIAL

The establishment of the proposed Green Hydrogen and Ammonia facility together with the proposed Camden wind and solar facilities will create the potential for combined and sequential visibility impacts. However, the impact on the areas sense of place should be viewed within the context of the impact of the Camden Power Station and associated transmission lines on areas sense of place. The areas sense of place has also been impacted by large-sale coal mining operations. The potential visual impact on the areas sense place is therefore likely to be limited. In addition, none of the affected landowners interviewed raised concerns about potential visual impacts associated with the proposed project. The potential cumulative impact on the areas sense of place is therefore likely to be limited. The cumulative impact along with associated mitigation measures are outlined below in **Table 9-15.**

Table 9-15: Cumulative impact on sense of place and the landscape

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative change in the Sense of place and the landscape									
Without Mitigation	2	2	3	4	3	**33**	**Low**	(-)	Easy
With Mitigation	2	2	3	4	3	**33**	**Low**	(-)	
Mitigation and Management Measures	— Restrict vegetation clearance on the site to that which is required for the correct operation of the facility. — As far as possible, limit the number of vehicles which are allowed to access the site. — Ensure that dust suppression techniques are implemented on all gravel access roads. — As far as possible, limit the amount of security and operational lighting present on site. — Light fittings for security at night should reflect the light toward the ground and prevent light spill. — Lighting fixtures should make use of minimum lumen or wattage whilst adhering to safety and security requirements. — Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. — If economically and technically feasible, make use of motion detectors on security lighting. — The buildings should not be illuminated at night and should be painted in natural tones that fit with the surrounding environment. — Non-reflective surfaces should be used where possible.								

The cumulative impact on local services and accommodation will depend on the timing construction phases for the different renewable energy projects in the area. With effective planning the significance of the potential impact was rated as Low Negative. The cumulative impact is outlined below in **Table 9-16.**

Table 9-16: Cumulative impact on local services and accommodation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative impact on Local services and accommodation									
Without Mitigation	3	3	3	2	3	**33**	**Moderate**	(-)	Moderate
With Mitigation	2	3	3	3	2	**22**	**Low**	(-)	
	— Before the construction phase commences the proponent should meet with representatives from the Municipality to establish the existence of a skills database for the area. If such as database exists, it should be made available to the contractors appointed for the construction phase. — No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site. — The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities.								

The cumulative impact on local economy is expected to be Moderate Positive. The cumulative impact is outlined below in **Table 9-17.**

Table 9-17: Cumulative impact on local economy

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Ease of mitigation
Cumulative impact on local economy									
Without Mitigation	2	2	n/a	4	3	**24**	**Low**	(+)	Moderate
With Mitigation	3	2	n/a	4	5	**45**	**Moderate**	(+)	
	— Local government should be encouraged to develop and implement economic incentives to support investment in and the development of green hydrogen and ammonia initiatives. — Maximise opportunities for local content and procurement. — Maximise employment opportunities for local community members. — Implement training and skills development programs for members from the local community.								

10 ENVIRONMENTAL IMPACT STATEMENT

The essence of any S&EIR process is aimed at ensuring informed decision-making, environmental accountability, and to assist in achieving environmentally sound and sustainable development. In terms of NEMA, the commitment to sustainable development is evident in the provision that "development must be socially, environmentally, and economically sustainable and requires the consideration of all relevant factors…" NEMA also imposes a duty of care, which places a positive obligation on any person who has caused, is causing, or is likely to cause damage to the environment to take reasonable steps to prevent such damage. In terms of NEMA's preventative principle, potentially negative impacts on the environment and on people's environmental rights (in terms of the Constitution of the Republic of South Africa, Act No. 108 of 1996) should be anticipated and prevented, and where they cannot be altogether prevented, they must be minimised and remedied in terms of "reasonable measures".

In assessing the environmental feasibility of the proposed Camden I Green Hydrogen & Ammonia Facility, the requirements of all relevant legislation have been considered. The identification and development of appropriate management and mitigation measures that should be implemented in order to minimise potentially significant impacts associated with the project, has been informed by best practice principles, past experience and the relevant legislation (where applicable).

The conclusions of this EIA are the result of comprehensive assessments. These assessments were based on issues identified through the S&EIR process and the parallel process of public participation. The public consultation process has been undertaken according to the requirements of NEMA and every effort has been made to include representatives of all stakeholders within the process.

10.1 ENVIRONMENTAL SENSITIVITIES

The following environmental sensitivities were identified for both Alternative 1 and Alternative 2 (preferred), as a result of the Project location and proposed activities and will require specific applications or measures for mitigation to minimise impact.

Aquatic

— Wetlands and associated buffers (See Section 7.1.6)

Terrestrial

— CBAs (See Section 7.2.2)
— Habitats (See Section 7.2.2 and 7.2.5)
— Listed Ecosystems (See Section 7.2.1)
— Wetlands (See Section 7.2.5)
— Transformed Areas (See Section 5.2.2 and 5.2.5) etc

Avifauna

— Avifauna Sensitivities (consisting of drainage lines and associated wetlands, pans and grasslands) (See Section 7.2.6)

The above sensitivities are discussed in the sub-sections below. The combined environmental sensitivities of the proposed Project footprint are shown **Figure 10-13.**

10.1.1 AQUATIC SENSITIVITES

Alternative 1

MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Freshwater ecosystem priority area quinary catchments

Figure 10-1: Aquatic Biodiversity Theme Sensitivity, DFFE Screening Tool, Alternative 1

Alternative 2- Preferred

MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Freshwater ecosystem priority area quinary catchments

Figure 10-2: Aquatic Biodiversity Theme Sensitivity, DFFE Screening Tool, Alternative 2

The DFFE Screening Tool identified two sensitivity ratings, for alternative 2, within the development footprint, namely, very high and low. Although there is some overlap with the findings on site and the Screening Tool's outcome, the development footprint contains various sensitivities (very high, and Moderate) that were identified following the undertaking of the site visit and spatial input considerations.

Based on the above DFFE screening tool, the specialist agrees with the environmental sensitivities identified on site. The findings have been informed by a site visit undertaken by Dr Brian Colloty in August 2021.

However, according to the aquatic impact assessment which was undertaken by EnviroSci (Pty) Ltd, both the alternatives proposed for Green Hydrogen Facility, (**Figure 10-3**), have avoided the delineated systems inclusive of the calculated buffers and the recommended 100m buffer, therefore no direct impacts are anticipated as all aquatic systems have been avoided. Furthermore, according to the study all impacts are considered acceptable and the project is recommended for authorisation provided all specialist mitigation measures are applied.

The environmental sensitivity input received from the aquatic ecology specialist is taken forward and considered within this EIA report and the impact to these areas assessed. Appropriate layout and development restrictions have been implemented within the development footprint to ensure that the impact to aquatic ecology is deemed acceptable by the aquatic ecologist.

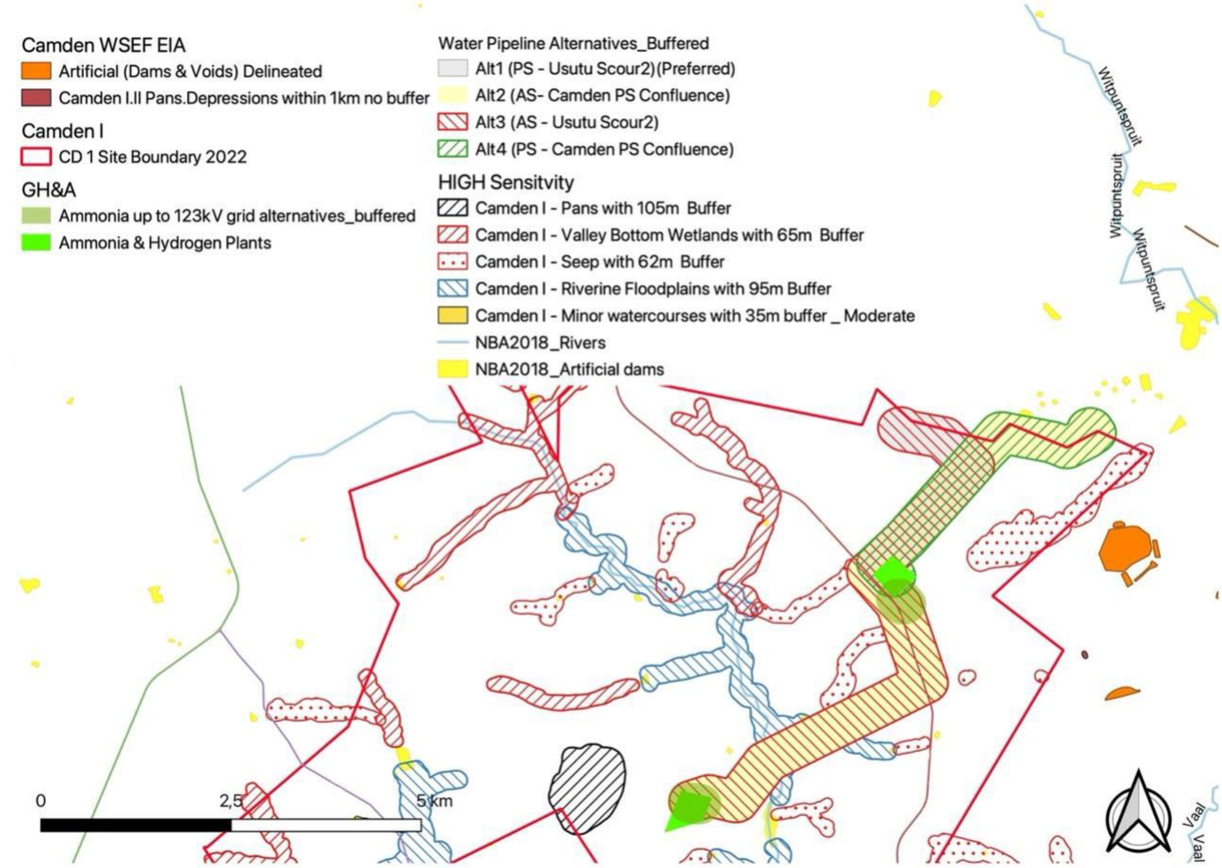


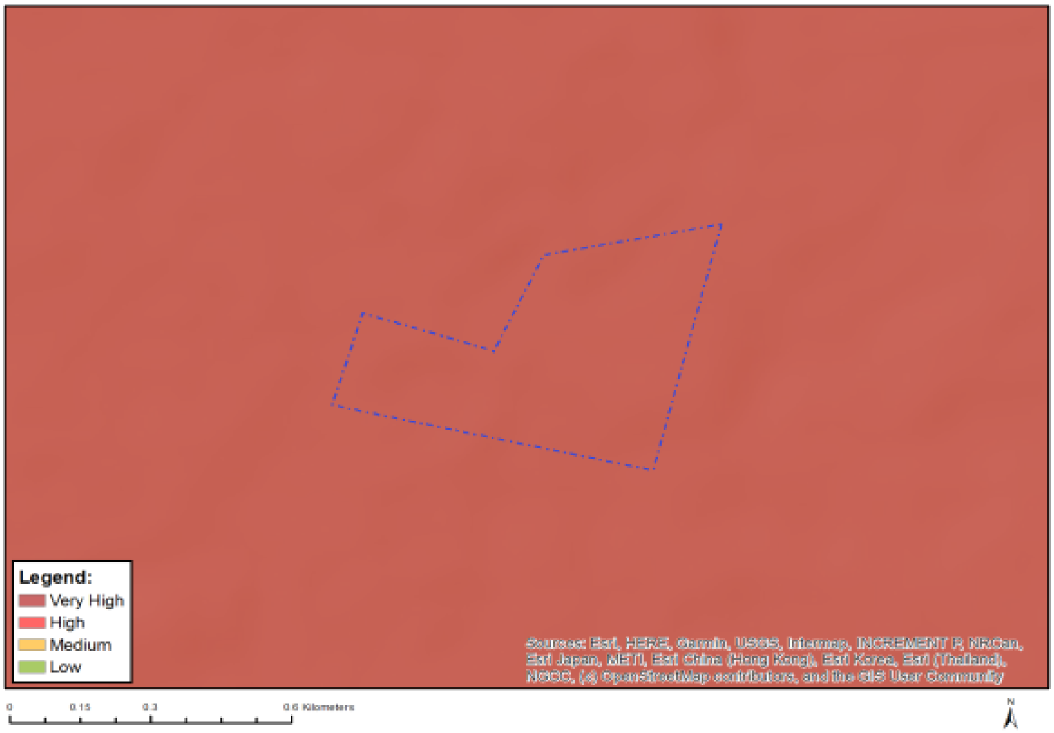
Figure 10-3: Camden I Green Hydrogen site and associated infrastructure, in relation to buffered aquatic systems delineated

10.1.2 TERRESTRIAL SENSITIVITIES

Alternative 1

The biodiversity theme sensitivity as indicated in the screening report was derived to be Very High, mainly due to the area being CBA and ESA **(Figure 10-4**).

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

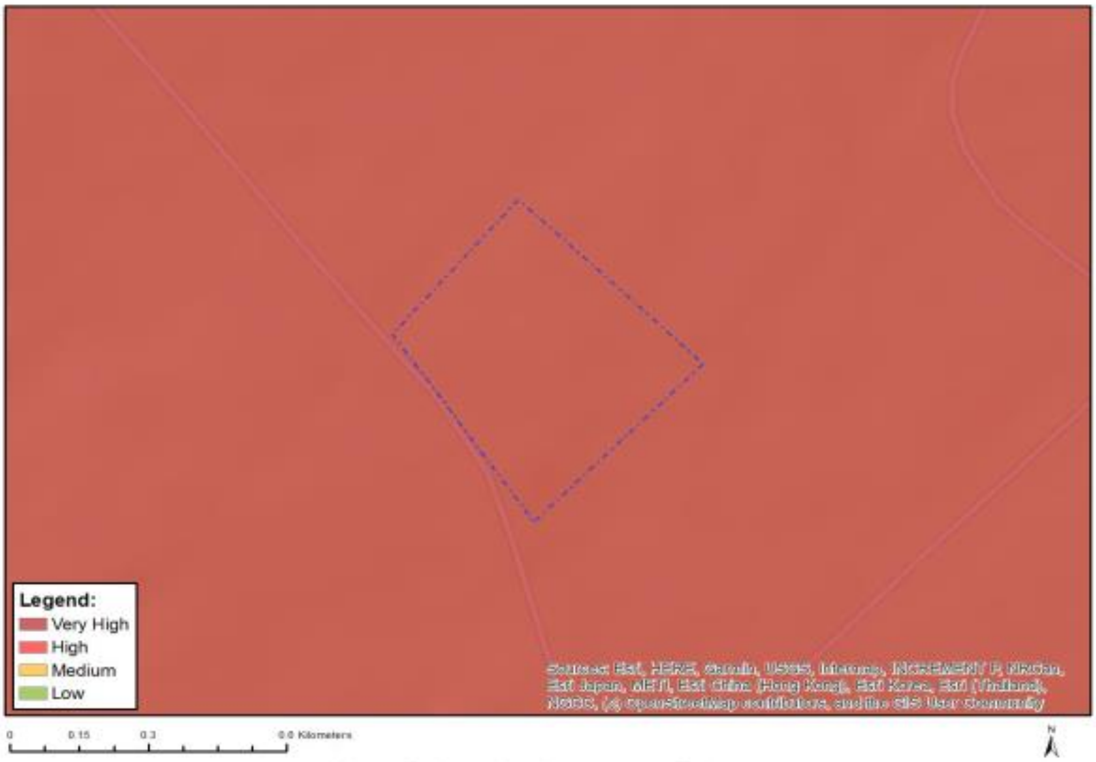
Sensitivity Features:

Sensitivity	Feature(s)
Very High	FEPA Subcatchments
Very High	Langcarel Private Nature Reserve
Very High	Endangered ecosystem
Very High	Strategic Water Source Areas

Figure 10-4: Terrestrial Biodiversity Theme Sensitivity, DEA Screening Report, Alternative 1

Alternative 2

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	FEPA Subcatchments
Very High	Langcarel Private Nature Reserve
Very High	Endangered ecosystem
Very High	Strategic Water Source Areas

Figure 10-5: Terrestrial Biodiversity Theme Sensitivity, DEA Screening Report, Alternative 2

Protected Areas: (National Parks and Nature Reserves)

The Facility Infrastructure is located in the Mpumalanga Province outside urban areas, and partly on Portion 1 & 2 of Farm No. 322 (Welgelegen), which are a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities.

The Mpumalanga Biodiversity Sector Plan (MBSP) (Mpumalanga Parks and Tourism Agency 2014) classifies the natural vegetation of the Province according to the following categories:

— Protected Areas (sub-divided into three categories);
— Critical Biodiversity Areas (sub-divided into “Irreplaceable” and “Optimal”);

— Other natural areas;
— Ecological Support Area (sub-divided into four categories); and
— Modified (sub-divided into Heavily or Moderately modified).

The DFFE online screening tool identifies Terrestrial Biodiversity as a theme of very high sensitivity. This is due to presence on site of areas included within Endangered Ecosystem, Vulnerable Ecosystem, Langcarel Nature reserve, FEPA sub-catchment, Strategic Water Source Area, and/or Protected Areas Expansion Strategy. The theme indicates almost the entire study area as being in the Very High sensitivity category, but there are significant areas that have been cultivated and impacted by heavy grazing that do not support this classification.

The features indicated on the map below **(Figure 10-6**), have been confirmed by the specialist within the study area with these three classes of the MBSP:

Protected Areas: (National Parks and Nature Reserves): The entire site is shown as a protected area. This is, however, in the process of change (see discussion above).

Critical Biodiversity Areas (CBA): Irreplaceable: two small patches.

Critical Biodiversity Areas (CBA): Optimal: a small nearby patch.

According to the National Parks Area Expansion Strategy (NPAES), there are no areas within the study area that have been identified as priority areas for inclusion in future protected areas. The study area is therefore outside the NPAES focus area.

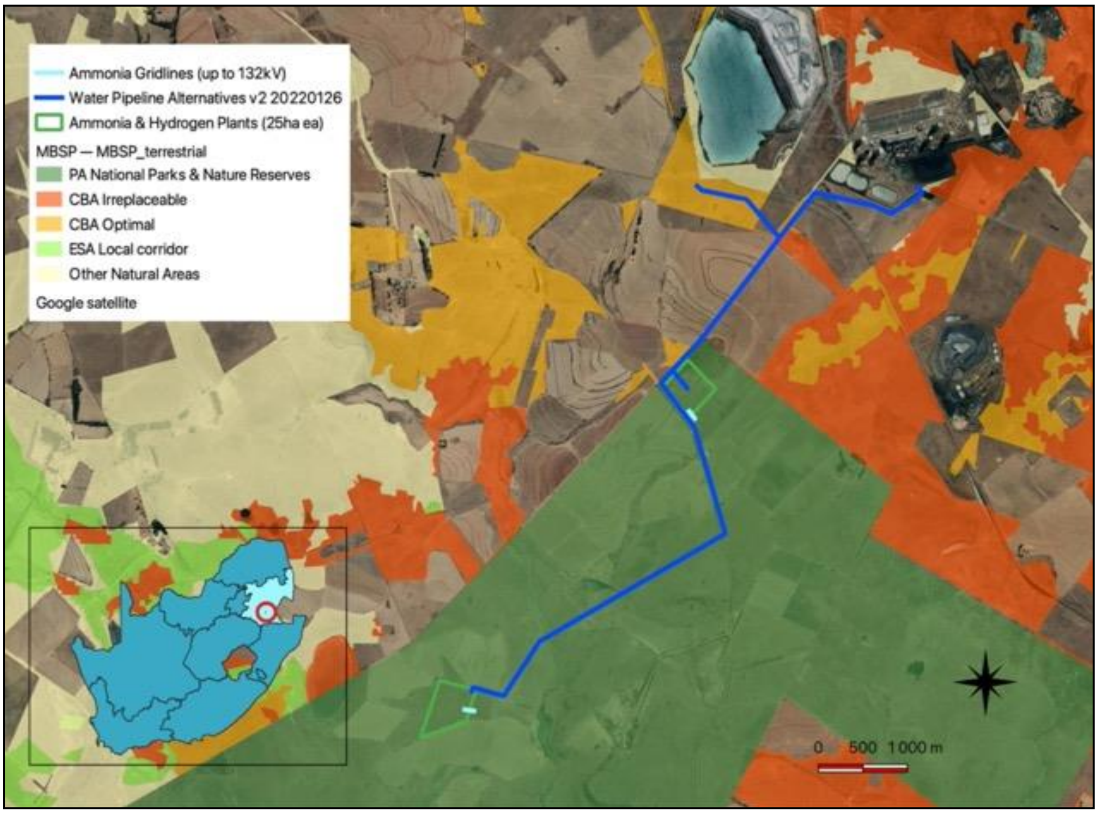
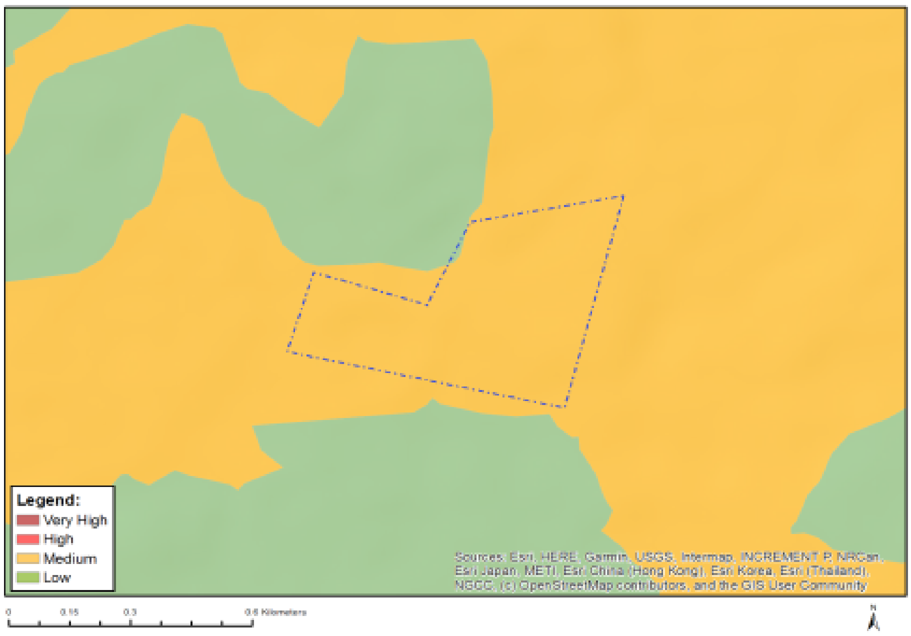


Figure 10-6: Mpumalanga CBA map for the study area

Alternative 1

The DFFE National Screening Tool classifies parts of the study area as medium sensitivity due to the presence of aquatic CBAs ecosystem priority areas (**Figure 10-7**)

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Khadia carolinensis
Medium	Sensitive species 1201
Medium	Aspidoglossum xanthosphaerum
Medium	Sensitive species 41
Medium	Sensitive species 691
Medium	Pachycarpus suaveolens
Medium	Sensitive species 851

Figure 10-7: The DFFE screening tool rating for the Plant Species Theme, Alternative 1

Alternative 2-

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY

Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Khadia carolinensis
Medium	Sensitive species 1201
Medium	Aspidoglossum xanthosphaerum
Medium	Sensitive species 41
Medium	Sensitive species 691
Medium	Pachycarpus suaveolens
Medium	Sensitive species 851

Figure 10-8: The DFFE screening tool rating for the Plant Species Theme, Alternative 2

Alternative 1

The DFFE National Screening Tool classifies parts of the study area as very high sensitivity due to the presence of features with a very high palaeontological sensitivity (**Figure 10-9**).

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

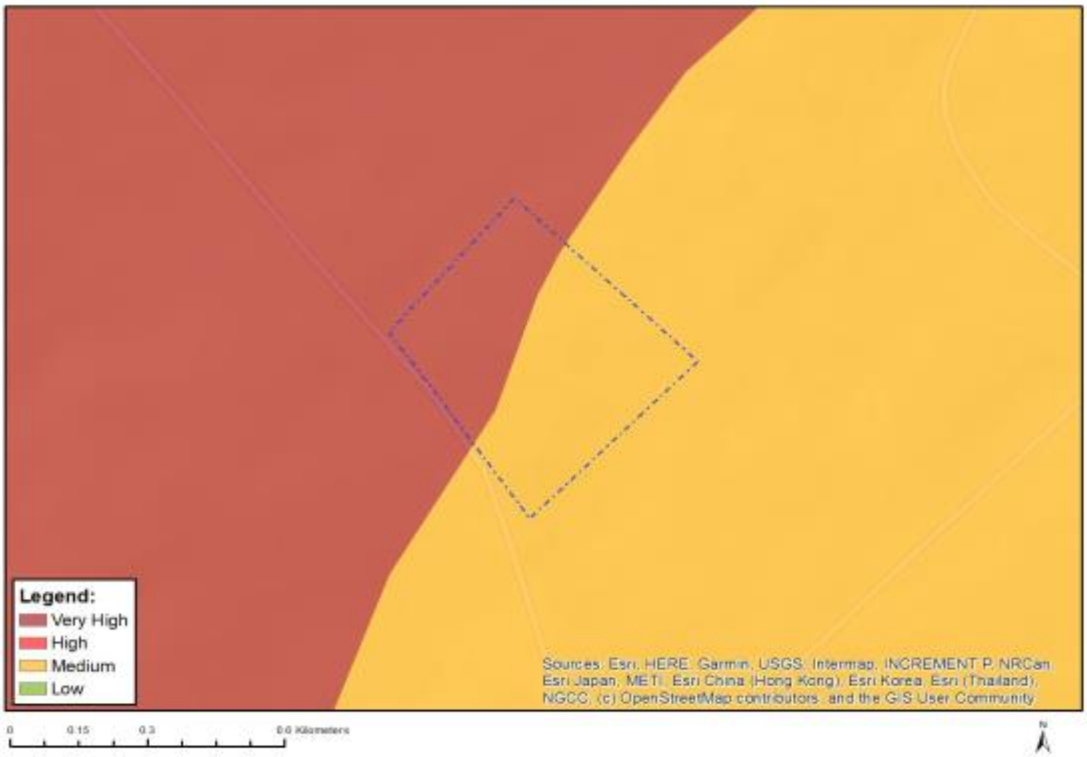
Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

Figure 10-9: The DFFE screening tool rating for the Palaeontological Theme, Alternative 1

Alternative 2-Preferred

The DFFE National Screening Tool classifies parts of the study area as very high & medium sensitivity due to the presence of features with a very high palaeontological sensitivity (**Figure 10-10**).

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

Figure 10-10: The DFFE screening tool rating for the Palaeontology Theme, Alternative 2

The scoping study did not identify any fatal flaws for the proposed Camden GH&A Facility. To comply with the National Heritage Resources Act (Act 25 of 1999) it is recommended that a Phase 1 HIA must be undertaken for the study area.

The HIA has provided the potential impact on heritage resources and has determined the levels of significance of recorded heritage resources. The HIA has also provided management and mitigation measures should any significant sites be impacted upon, ensuring that all the requirements of the SAHRA are met. The study area is of insignificant to moderate to very high paleontological sensitivity and according to the SAHRIS palaeontological sensitivity map must be subjected to a palaeontological assessment in the impact assessment phase.

However, a site visit and walk down was done in April 2022 by the specialist. It was observed that most of the area and routes are either under cultivation currently have been cultivated previously so the land has a soil cover and grasses or crops. The topography is fairly flat and there are no rocky outcrops or shale outcrops there are no fossils visible on the surface. No fossils were seen on the land surface. A further assessment of the paleontological significance of the area (Bamford, 2022) concluded that the impact on palaeontological resources is low and the project should be authorised from a paleontological point of view.

It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the shales of the Vryheid Formation (Ecca Group, Karoo Supergroup) therefore, a Fossil Chance Find Protocol will be added to the EMPr.

10.1.3 AVIFAUNAL SENSITIVITY

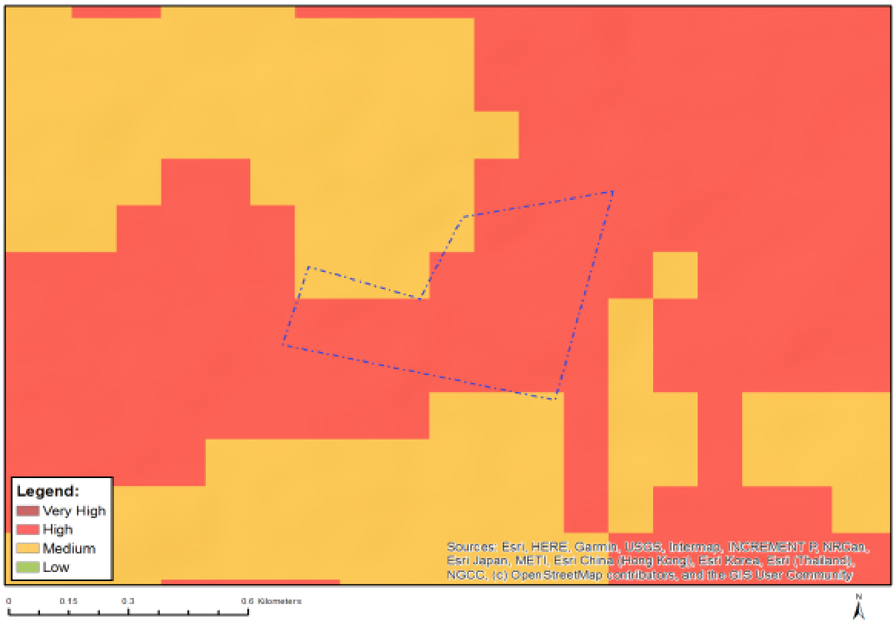
The greater Camden I WEF project area, which includes both Facility alternatives, is classified as Medium to High sensitivity according to the DFFE Animal Species theme, based on the potential presence of several species of conservation concern (SCC) namely Grey Crowned Crane (Globally and Regionally Endangered), Martial Eagle (Globally and Regionally Endangered), Southern Bald Ibis (Globally and Regionally Vulnerable), White-bellied Korhaan (Regionally Vulnerable) and Secretary bird (Globally Endangered and Regionally Vulnerable).

This classification was confirmed during the site surveys at the proposed site, based on the presence of recorded SCC, namely Secretary bird (Globally Endangered, Regionally Vulnerable) White-bellied Bustard (Regionally Vulnerable), Blue Crane (Globally Vulnerable, Regionally Near-threatened), Grey Crowned Crane (Globally and Regionally Endangered), Martial Eagle (Globally and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), Greater Flamingo (Regionally Near-threatened), Lesser Flamingo (Globally and Regionally Near-threatened), Black Harrier (Regionally and Globally Endangered), Southern Bald Ibis (Regionally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), African Grass Owl (Regionally Vulnerable) and Cape Vulture (Globally Vulnerable and Regionally Endangered).

Alternative 1

The DFFE National Screening Tool classifies parts of the study area as highly sensitive from an animal species theme perspective, due to the potential presence of Southern Bald Ibis (Aves-Geronticus calvus) and African Grass Owl (Aves-Tyto capensis). A site sensitivity verification was conducted through the use of both a desktop analysis and the 12-month monitoring programme (associated with the Camden I Wind Energy Facility). The desktop analysis and pre-construction monitoring confirmed and concur with the HIGH sensitivity rating assigned to the study area, based on the habitat available to Southern Bald Ibis and African Grass Owl and the confirmed presence of both species within the project study area (**Figure 10-11**).

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

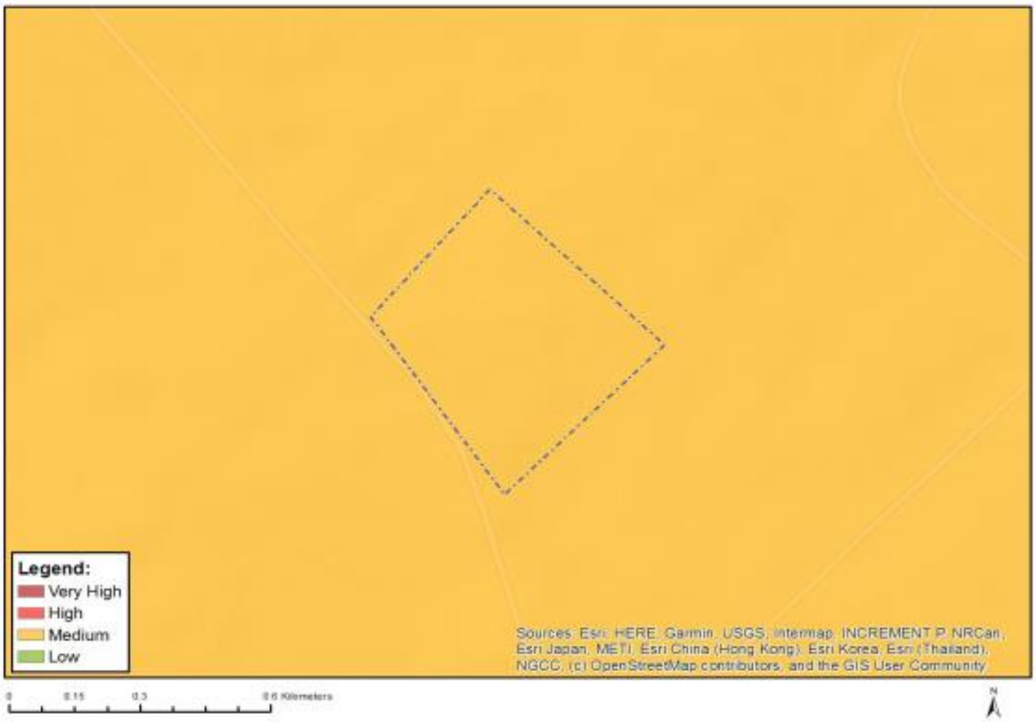
Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Geronticus calvus
Medium	Aves-Tyto capensis
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Ourebia ourebi ourebi

Figure 10-11: The DFFE screening tool rating for the Avifaunal theme, Alternative 1

Alternative 2

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Aves-Geronticus calvus
Medium	Aves-Tyto capensis
Medium	Sensitive species 2
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Ourebia ourebi ourebi

Figure 10-12: The DFFE screening tool rating for the Animal Species Theme, Alternative 2

The DFFE National Screening Tool classifies parts of the alternative 2 study area as medium sensitivity from an animal species theme perspective, due to the potential presence of Southern Bald Ibis (*Aves-Geronticus calvus*) and African Grass Owl (*Aves-Tyto capensis*).

10.2 SENSITIVITY MAPPING

A preliminary consolidated environmental sensitivity map (**Figure 10-13)** has been compiled based on the sensitivities and buffers outlined in the specialist studies.

The environmental sensitivity map indicates consolidated sensitivity significance ranking (i.e. Low, Medium-Low, Medium, Medium-High, High and Very High) as per the above input from the relevant specialist studies.

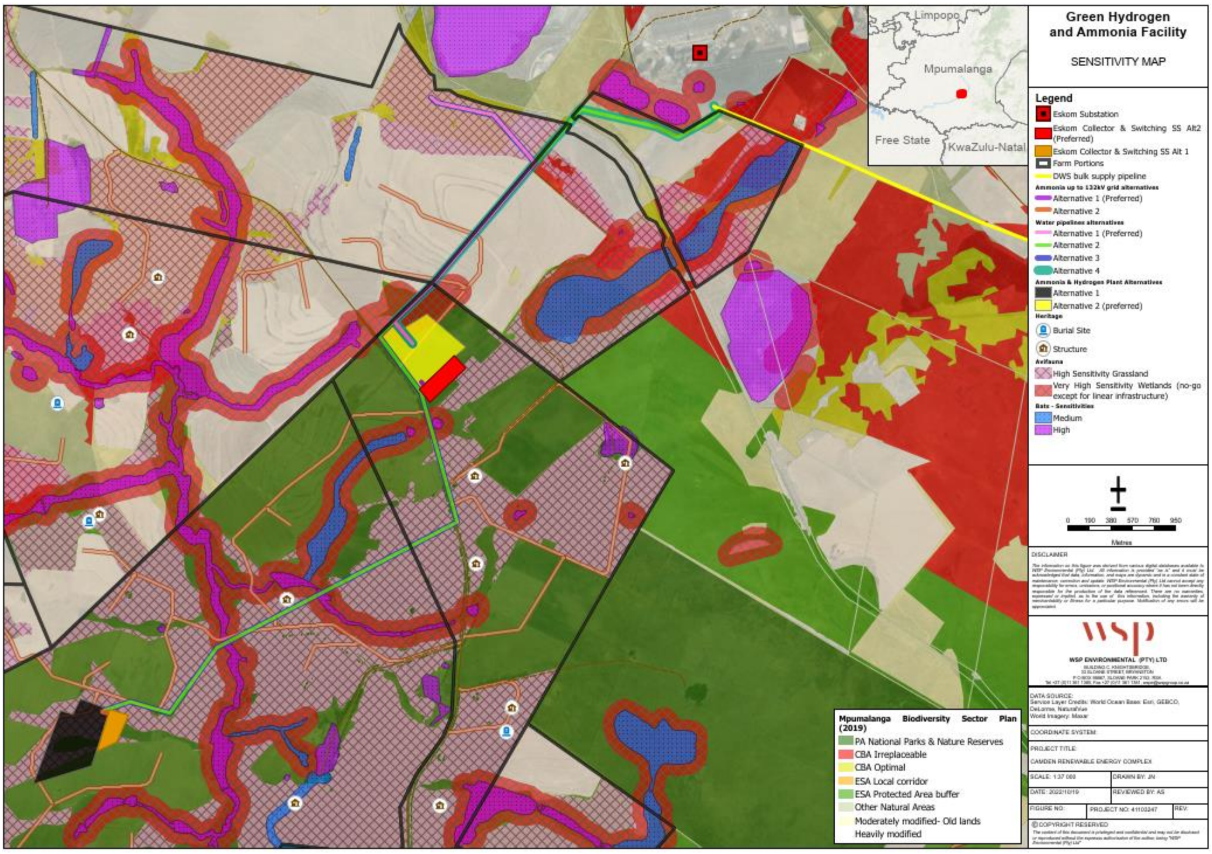


Figure 10-13: Site Layout overlain onto a Preliminary Consolidated Environmental Sensitivity Map

10.3 SPECIALIST CONCLUSIONS

10.3.1 AIR QUALITY ASSESSMENT

The green NH_3 production facility will ideally have a capacity of 100,000 tpa. NH_3 production in excess of 100 tons per annum triggers listed activity *Subcategory 7.1: Production and or use in Manufacturing of Ammonia, Fluorine, Fluorine Compounds, Chlorine and Hydrogen Cyanide of the Listed Activities*, promulgated in line with Section 21 of NEM:AQA , and thus an AEL is required.

In the absence of appropriate methodologies to quantify emission rates using the available activity data, the study qualitatively assessed potential air quality impacts from the proposed site activities. The assessment relied on the intended operational design data provided by Camden Green Energy and well understood principles of bulk liquid storage and compound properties.

Assessment findings are summarised as follows:

CONSTRUCTION PHASE

- Dust (TSP, PM10 and PM2.5) emissions typical of construction activities are expected during the construction of the green NH_3 production facility. Considering the small extent of the proposed site, the site's distance from proximate receptors, and the transient nature of the construction phase, impacts are expected to be low. Appropriate control measures can be applied to further reduce impacts.
- The impact significance of the construction phase is assessed to be low.

OPERATIONAL PHASE

- Hydrogen and nitrogen feedstock for the Haber-Bosch process will be of exceptional purity negating the need for impurity purging. As such, NH_3 emissions from the Haber-Bosch process are not anticipated under normal operating conditions.
- Synthesised anhydrous NH_3 will be stored in temperature-controlled bulk storage tanks at -33.4℃, sufficiently low to prevent product evaporation. Storage tank vents will remain closed to sustain this low liquid temperature and prevent any mechanically induced turbulence inside the tank/s. As such, NH_3 emissions from bulk storage vessels are not anticipated as the liquid cannot vaporise and cannot escape containment.
- Product loading to pressure vessels for dispatch will occur under temperature and pressure-controlled conditions to prevent evaporation during dispatch.
- In a scenario where NH_3 is emitted, emissions will occur at a low-level and are therefore unlikely to reach proximate receptors at concentrations required to induce health or nuisance impacts. Surrounding vegetation is not considered sensitive to nutrient accumulation and impacts on neighbouring grasslands and crop production are also not anticipated.
- The impact significance of the operational phase (under normal operating conditions) is assessed to be very low.

As agreed with the licensing authority, further quantitative assessment should be conducted when operational information and site monitoring data is available to do so and must form part of the facility's PAEL review process.

Therefore, in addition to emissions control measures, it is recommended that:

- Complaints and any actions arising from a complaint must be recorded in a complaints register maintained by site management.
- Passive monitoring of NH_3 along the facility's fence line and at proximate receptors be conducted to provide context in terms of actual impact (if any). A monthly monitoring frequency for a period of 12-months is recommended to provide sufficient data for follow up quantitative assessment of impacts. Monitoring requirements and the frequency thereof can be revised during at the PAEL review process.
- Site management maintain meticulous record keeping of all inputs, throughputs, and production rates, including loading and dispatch quantities to enable a mass balance quantification of facility wide evaporative losses (if any) over time.
- The specialist has concluded that the project may proceed provided the prescribed mitigation measures are applied

10.3.2 NOISE / ACOUSTIC ASSESSMENT

According to the study undertaken, very minimal noise impacts are anticipated based on the remote location and minimal nearby receptors and thus a desktop-based environmental acoustic impact assessment has been carried out as part of the ESIA process to assess impacts.

To assess the existing noise climate in the area surrounding the proposed facility, ambient noise monitoring was conducted at three sensitive receptor locations surrounding the site. An acoustic inventory was developed to identify all potential sources of noise associated with the proposed facility. The acoustic impacts of the proposed facility were then assessed through the use of attenuation-over-distance acoustic calculations.

Baseline monitoring indicated that current day-time noise levels exceed the rural guideline rating level of 45 dB(A) at all three monitoring locations (receptors). Similarly, average night-time noise levels at all receptor locations exceed the rural guideline rating level of 35 dB(A). From the day-time monitoring campaign it is evident that the current noise climate surrounding the proposed site is predominantly natural, with small anthropogenic influences from the Camden Power Station and farm activities. At night, the current noise climate is predominantly natural, with no anthropogenic influences.

During the operational phase of the facility, day-time noise levels at all receptor locations are predicted to increase slightly. Noise levels will increase by between 0.1 and 0.2 dB(A) resulting in "little" community response. Such increases are so negligible that are likely to go unnoticed. It is noted that such increases are also below the 7 dB(A) threshold for annoyance as per the Noise Control Regulations.

Predicted night-time noise levels at all the receptor locations are predicted to increase slightly with the operation of the facility. Noise levels will increase by between 0.4 and 1.5 dB(A) resulting in "little" community response. Such increases are negligible that are likely to go unnoticed. It is noted that such increases are also below the 7 dB(A) threshold for annoyance as per the Noise Control Regulations.

It must be highlighted that these are worst-case assessments of noise impacts, with all equipment located in the same area on the boundary closest to the receptor in question, which will not occur in reality. Noise sources will essentially be spread out across the site. Additionally, many of the sources will be enclosed within buildings, creating further noise transmission loss.

Based on a risk rating methodology, acoustic risks during both day and night-time are ranked as "very low". As such, it is envisaged that the operation of the facility can be authorised without any major impacts or complaints. The facility is adequately positioned away from sensitive receptors and will not negatively impact the noise climate at the receptors. Mitigation options to further minimise noise from the facility are, however, provided in this report should they be required.

10.3.3 AVIFAUNA ASSESSMENT

<u>Displacement of priority species due to disturbance linked to construction activities in the construction phase</u>

Apart from direct habitat destruction, the construction activities could impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Terrestrial species and owls are most likely to be affected by displacement due to disturbance. The priority species which are potentially vulnerable to this impact are Secretary bird, Denham's Bustard, White-bellied Bustard, Blue Crane, Grey Crowned Crane, Blue Korhaan and African Grass Owl. The impact is rated as Low pre-mitigation and will be reduced but remain at a Very Low-level post-mitigation.

<u>Displacement of priority species due to habitat transformation in the construction phase</u>

These activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility through transformation of habitat, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 25-ha proposed facility is likely to be moderate due to the relatively small size of the footprint, but ideally high quality grassland should be avoided if possible. Terrestrial species and owls are most likely to be affected by displacement due to habitat transformation. The priority species which are potentially vulnerable to this impact are Secretary bird, Denham's Bustard, White-bellied Bustard, Blue Crane, Grey Crowned Crane, Blue Korhaan and African Grass Owl. The impact is rated as Low pre-mitigation and will be reduced but remain at a Low-level post-mitigation.

The proposed Facility will have a Low impact on priority avifauna which, in most instances, could be reduced to a Very Low impact through appropriate mitigation, although some instances Low residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed development is therefore supported, provided the mitigation measures listed in this report are strictly implemented. Alternative 2 of the Facility is preferred, as it is located in an agricultural habitat and will not have an impact on high quality grassland.

The proposed up to 132kV OHL will have a Low impact on priority avifauna which, in all instances, could be reduced to a Very Low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The proposed development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

10.3.4 TERRESTRIAL BIODIVERSITY ASSESSMENT

The vegetation type that occurs on site is Eastern Highveld Grassland, is listed as Vulnerable. All areas on site within Eastern Highveld Grassland also fall within another listed ecosystem, Chrissiesmeer Panveld, listed as Vulnerable, and defined independently to the vegetation types. The site is therefore within two listed ecosystems that overlap.

There is a proclaimed conservation area on site, the Langcarel Private Nature Reserve. This area has not been managed as a protected area and has undergone similar levels of degradation as surrounding areas due primarily to overgrazing, but also partially due to alien invasive plants. In addition, no conservation management activities were evident on site during the field assessment. This pattern of over-utilization affects all grasslands on site, resulting in them being in moderate to poor condition. A separate process is underway to have it (or part thereof) de-proclaimed as part of ongoing province-wide reserve verification efforts by the provincial authorities. The habitat has been used for livestock production and is impacted by this landuse. It is therefore the authors' opinion on the basis of the current land use and levels of modification, that the private nature reserve does not align with the objective and purpose of the protected area status.

Natural grassland on site is in moderate to poor condition, primarily due to heavy overgrazing. There are significant areas of low grass cover and bare areas, and plant species composition has been degraded by grazing effects.

For the facility location, Option 2 is favoured over option 1, both because of the impact of the facility itself, as well as the impact of the associated pipeline route options. The best combination is Option 2 with pipeline Alternative 4. This combination will result in no loss of natural habitat. Regardless, all options and alternatives are considered feasible with no associated fatal flaws.

Assessed impact with moderate significance after mitigation is "Loss of indigenous natural vegetation". However, these are only moderate because they are permanent and will definitely happen – the extent of the impact is negligible. On this basis, the project is therefore deemed acceptable from a terrestrial biodiversity perspective and it is recommended the Environmental Authorisation be granted. The author is of the opinion that the impacts associated with the project can be mitigated to acceptable levels provided the recommended mitigation measures identified are implemented.

10.3.5 ANIMAL SPECIES ASSESSMENT

There are a number of threatened animal species that are flagged for the site, as well as others not directly flagged that may occur there. The majority of the flagged animal species are birds, which are assessed in a dedicated avifaunal assessment and not covered in this assessment. The two non-bird species flagged for the site are the Maquassie Musk Shrew and the Oribi. Both could possibly occur on site, but the likelihood is not high. These animals may make use of various habitats available on site, which consists mostly of grasslands and wetlands within shallow drainage valleys.

In terms of the location of the proposed facility, Alternative 2 (preferred) is the favoured option from an animal species perspective. It is situated entirely within a cultivated land, whereas Alternative 1 is mostly within a natural area (21.15 ha of natural habitat). If Alternative 2 (preferred) is selected, it also means that the pipeline Alternatives 1 or 4 are selected over Alternatives 2 or 3, which is preferred here.

The pipeline route alternatives are preferred in the following order, due to the distance within natural habitats and therefore the likelihood of impacting on any animal SCC:

- Alternative 4: most favoured - does not affect any natural habitat.
- Alternative 1: next best - distance of 422 m through grassland.
- Alternative 2: poor option - 2900 m through natural habitat.
- Alternative 3: worst option - 3300 m through natural habitat.

If Alternative 2 (preferred) is selected, along with pipeline Alternative 4, then no natural habitat is affected, which means it is highly unlikely that any animal species of conservation concern will be affected.

The main concern in terms of threatened animal species is direct loss of habitat, but this will be limited for this project, especially if the recommended option is selected for construction. Fragmentation of habitat is assessed but will be very limited due to the placement of infrastructure as well as existing patterns of transformation on site. There may also be direct mortality of individual animals, but this is not very likely due to the placement of most of the infrastructure away from natural habitats. An assessment of these impacts indicates that they will have a significance of low or very low.

10.3.6 PLANT SPECIES ASSESSMENT

There are seven plant species of conservation concern flagged by the screening tool that could possibly occur on site, as well as additional species from historical records from SANBI databases, but none were seen during general field surveys. A targeted walk-through survey of footprint of construction areas is required prior to the commencement of construction, to determine whether or not any occur in the footprint of the development. This survey can take place at the same time as the required walk-through surveys for permitting purposes, or it can be undertaken as a separate targeted survey. It is recommended that this is undertaken in optimum growing season where possible.

Option 2 (preferred) is the favoured option from a plant species perspective. It is situated entirely within a cultivated land, whereas Option 1 is mostly within a natural area (21.15 ha of natural habitat). If Option 2 (preferred) is selected, it also means that the pipeline Alternatives 1 or 4 are selected over Alternatives 2 or 3, which is preferred here. The pipeline route alternatives are preferred in the following order, due to the distance within natural habitats and therefore the likelihood of impacting on any SCC:

— Alternative 4: preferred - does not affect any natural habitat.
— Alternative 1: - distance of 422 m through grassland.
— Alternative 2: - 2900 m through natural habitat.
— Alternative 3: - 3300 m through natural habitat.

If Option 2 (preferred) is selected, along with pipeline Alternative 4, then no natural habitat is affected, which means no plant species of conservation concern will be affected. It is important to note that while there are preferences specified, all alternatives and options for pipeline, powerline and facility locations are considered feasible from a terrestrial plant perspective.

The project is deemed acceptable from a terrestrial plant perspective and it is recommended the Environmental Authorisation be granted. The author is of the opinion that the impacts associated with the project can be mitigated to acceptable levels provided the recommended mitigation measures identified are implemented.

10.3.7 AQUATIC ASSESSMENT

During the aquatic assessment, several sensitive aquatic habitats were observed and are shown in the maps provided. Noteworthy areas, that should be avoided, include the main riverine systems with wetlands, valley bottom wetlands, seeps and the endorheic pans. The only exception being where existing crossings may be used and/or upgraded that intersect valley bottom wetlands and riverine systems and towards the linear infrastructure where it is unavoidable (i.e. water pipeline): or where unavoidable, where specific linear infrastructure is considered.

The current layouts have, to a large degree, avoided these sensitive features and buffer areas, greatly reducing the potential overall impact and risk to Aquatic resources. The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance was not possible, or the nature of the activities involve a potential risk to aquatic resources even at great distance.

Overall, it is expected that the impact on the aquatic environment would be Low (-).

Noteworthy areas, that have been avoided, include the Very High Sensitivity areas as shown in **Figure 10-3**. Existing crossings may be used and/or upgraded that intersect these systems or individual water pipeline crossings permitted (where unavoidable) however, detailed monitoring plan must be developed prior to the construction phase.

Based on the findings of the aquatic study, the specialist finds no reason to withhold to an authorisation of any of the proposed activities for the various projects, assuming that key mitigations measures are implemented.

Lastly no preference is provided with regard any of the alternatives, as it assumed based on the characteristics of the site, that all the aquatic systems could be spanned, while making use of existing tracks, only. This also applies to the various substation / construction and laydown as well as the pipeline alternatives for the GH&A facility positioning as none of these have a direct impact on the aquatic environment are anticipated for each of the projects.

10.3.8 HERITAGE ASSESSMENT

The Project area is a characterised by agricultural activities (mainly grazing and cultivated fields) without any major focal points like pans or hills that would have attracted human occupation in antiquity and is considered to be of low archaeological potential. This was confirmed during the field survey and no archaeological sites of significance were noted and finds were limited to ruins and burial sites in the wider area. None of the recorded sites will be impacted on and both alternatives are acceptable from a heritage point of view.

According to the SAHRA Paleontological sensitivity map the study area is of zero to very high paleontological significance (**Figure 7-31**) and an independent study was conducted for this aspect. Bamford (2022) concluded an assessment of the paleontological significance of the area (Bamford 2022) concluded that the impact on palaeontological resources is low and the project should be authorised from a paleontological point of view. A Fossil Chance Find Protocol should be added to the EMPr.

Potential risks to the proposed project are the occurrence of intangible features and unrecorded cultural resources (of which graves and subsurface cultural material are the highest risk). This can cause delays during construction, as well as additional costs involved in mitigation, as well as possible layout changes.

The impact on heritage resources is very low and the project can commence provided that the recommendations in this report are implemented as part of the EMPr, based on the South African Heritage Resource Authority (SAHRA) 's approval.

The overall impact of the project is considered to be very low and will not adversely affect the cultural resources of the area. Residual impacts can be managed to an acceptable level through implementation of the recommendations made in this report. The socio-economic benefits also outweigh the possible impacts of the development if the correct mitigation measures are implemented for the Project.

10.3.9 DESKTOP GEOTECHNICAL ASSESSMENT

The following findings concluded from a geotechnical desktop study undertaken for the proposed Camden I GH&A facility.

In accordance with the 1:250 000 Geological Maps 2628 East Rand and 2630 Mbabane, published by the Council of Geoscience, the study area is underlain by stratigraphic units of the Ecca Group, Karoo Supergroup which is extensively intruded by post-Karoo dolerite. The site is anticipated to be underlain by deep residual soils.

Due to the dynamic loading of the water reservoir, a ring beam foundation would be ideal to support the structure and distribute the loads into the residual soils or weathered bedrock.

Pad footings, comprising columns and reinforced bases can be considered for founding of the compressed hydrogen tanks and associated buildings relating to the green hydrogen and ammonia facility. The pad footings are required to be keyed into a competent horizon, either weathered bedrock or a pre-treated subgrade comprising good quality material

Ancillary structures proposed across the development area, electrical substations, switch-gear buildings and control rooms, are recommended to be founded on an engineered raft foundation solution and depends upon the size and loads of the proposed structures. As it is assumed that these structures will be lightly loaded, subgrade pre-treatment accompanied by addition of water can be implemented to break the bonds between the soil particles. This will entail over-excavating the material to beyond the optimal founding depth, followed by backfilling of the same material in layers compacted to at least 95% of Modified AASHTO maximum dry density at or near to the optimum moisture content. This will result in densification of the subsurface materials and reducing collapse settlement to within acceptable limits. It is also recommended that an impermeable concrete apron be constructed around the perimeter of these structures following construction and that management of surface water be properly implemented. Alternatively, lightly reinforced strip footings can be considered for the proposed substations and associated buildings.

The potential presence of undermined areas at any given location across the study area has been identified as negligible due to the presence of the underlying dolerite stratigraphy. No fatal flaw to the proposed development has been identified. It must be noted that the extent or presence of any undermined areas cannot accurately be determined at a desk study level and will require further investigation.

Areas with steep slope inclinations are not favoured for the proposed developments due to the earthworks requirements and the potential need for advanced foundations. The topography of the site is relatively gentle and significant earthworks are not anticipated (although some minor earthworks are anticipated where local undulations occur). The soils and topography render the site moderately susceptible to soil erosion.

The levelling of areas to create building platforms will also result in the displacement and exposure of subsoils. These impacts will have a negative visual impact on the environment, which in some cases can be remediated. The risk of soil erosion is also increased during construction activities, by the removal of vegetation and by possible disturbance to the natural drainage environment, subsequently leading to the prevention of infiltration of rainwater and increased surface run-off. Areas of concentrated surface flow can be anticipated at the energy facilities, resulting in gradual erosion of unconsolidated soil during the operational life of the facilities. This can result in the creation of preferential drainage features, unless remediated through proper engineering design (i.e., stormwater drainage).

Based on the preliminary geotechnical assessment, the site is considered suitable for the proposed development provided that the recommendations presented in this report are adhered to, which needs to be verified by more detailed geotechnical investigations during the detailed design stage.

10.3.10 SOCIO-ECONOMIC ASSESSMENT

The findings of the SIA indicate that the proposed Camden Green Hydrogen and Ammonia Facility will create a number of social and socio-economic benefits, including creation of employment and business opportunities during both the construction and operational phase. The development will reduce the carbon footprint associated with production of hydrogen and ammonia and create potential comparative advantages for South Africa in the emerging green hydrogen sector. This will support the transmission of South Africa's fossil fuel-based economy towards renewable energy.

Affected landowners should be notified about the timing of construction related activities in advance of the commencement of the construction phase. The mitigation measures contained in the Acoustic, Hazardous Installation and Visual Impact Assessments should be implemented.

The findings of the SIA also indicate that the potential negative impacts associated with both the construction and operational phase are likely to be Low Negative with mitigation. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. The Camden Green Hydrogen and Ammonia Facility is therefore supported by the findings of the SIA. Alternative 2 located on 322/1 adjacent to Collector Substation Alternative 1 is the preferred option. Both options are still acceptable and feasible.

10.3.11 PALAEONTOLOGY ASSESSMENT

Based on the fossil record but confirmed by the site visit and walk through, there are NO FOSSILS of the Glossopteris flora even though fossils have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the shales of the Vryheid Formation (Ecca Group, Karoo Supergroup) therefore, a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once excavations and drilling for foundations and amenities have commenced, then they should be rescued, and a palaeontologist called to assess and collect a representative sample. There is no preferred site for the facilities, as far as the palaeontology is concerned.

10.3.12 VISUAL ASSESSMENT

A visual study was conducted to assess the magnitude and significance of the potential visual impacts associated with the development of the proposed Camden I Green Hydrogen and Ammonia Facility near Ermelo in Mpumalanga Province. The VIA has demonstrated that the study area has a somewhat mixed visual character, transitioning from the heavily transformed urban / peri-urban landscape associated with Camden Power Station, Camden residential area and Mooiplaats Colliery in the north-east to a more rural / pastoral character across the remainder of the study area. Hence, although the proposed Facility would alter the visual character and contrast with this rural / pastoral character, the location of the proposed Facility in relatively close proximity to Camden Power Station and the associated power lines, mining activity and rail infrastructure will significantly reduce the level of contrast.

A broad-scale assessment of visual sensitivity, based on the physical characteristics of the study area, economic activities and land use that predominates, determined that the area would have a low visual sensitivity. However, an important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs.

One formal protected area (Langcarel Private Nature Reserve) was identified within the study area, although the area is entirely managed for commercial agriculture with no conservation activities present, and therefore any visual appeal has been reduced. In addition, no public access to the site was evident.

A total of ten (10) potentially sensitive receptors were identified in the combined study area for the two site alternatives, none of which was found to be sensitive. All of the identified receptors are believed to be farmsteads that are regarded as potentially sensitive visual receptors as the proposed development will likely alter natural or semi-natural vistas experienced from these locations. Four of the receptor locations are outside the viewshed for both site alternatives, and the remaining receptors would experience either moderate, low or no visual impacts as a result of Facility development on Site Option 1 or Site Option 2. Considering that all but two of these receptors are located within the Camden 1 WEF project area, it has been confirmed by the developer that the relevant landowners are involved in the overall Camden Renewable Energy Complex project. As such, they are not expected to perceive the proposed development in a negative light, and this would reduce the level of visual impact experienced at these locations.

A preliminary assessment of overall impacts revealed that impacts associated with all the proposed Camden I Green Hydrogen and Ammonia Facility (post mitigation) are of low significance during both construction and decommissioning phases. During operation however, visual impacts (post mitigation) from the Camden I WEF would be of moderate significance with relatively few mitigation measures available to reduce the visual impact.

Considering the presence of existing and proposed mining activity and electrical generation and distribution infrastructure, the introduction of this type of facility in the area will result in further change in the visual character of the area and alteration of the inherent sense of place, extending an increasingly industrial character into the broader area, and resulting in significant cumulative impacts. It is however anticipated that these impacts could be mitigated to acceptable levels with the implementation of the recommended mitigation measures. In light of this, cumulative impacts have been rated as moderate.

A comparative assessment of site alternatives for the Facility was undertaken in order to determine which of the alternatives would be preferred from a visual perspective. No fatal flaws were identified for either of the proposed site alternatives and both alternatives were found to be favourable.

10.3.13 TRAFFIC IMPACT ASSESSMENT

The traffic impact assessment for the construction and operational phases for the proposed GH&A facility was undertaken, and the following conclusions and recommendations were made.

There is no need for public transport services or non-motorised transport infrastructure to serve the site for the construction and operational phase, except for the transport of staff.

Due to the site accesses to the facility off low to medium trafficked National roads, and low trafficked district roads, the traffic impact during the workday AM and PM peak hours are expected to be low.

The expected traffic increase on the local access roads during the construction phase could result in deterioration of the unsurfaced roads, as they are not designed for abnormal vehicles.

The transport route/s between the origin of the GH&A plant components to the facility may be National, Provincial or Local roads; and each authority will be required to provide the necessary permits for the transportation of any oversized or abnormally heavy components.

It is recommended that an abnormal vehicle route management plan be undertaken when the port/s of entry of the tower components (masts, blades, rotor nacelles, generators, etc.) are known. These plans should include all aspects such as horizontal and vertical requirements along the routes, bridges along the route, speed limits, etc. These plans and the application for the abnormal permits is normally the responsibility of the logistics company that will transport the components to site.

The trip generation during the Operational phase of the GH&A plant due to staff transport cannot be determined at this stage as the number of permanent and support staff that will work on-site is not known. However, as during the construction phase, the routes to the facility and access is off low to medium trafficked National roads, and low trafficked district roads, therefore the traffic impact during the workday AM and PM peak hours are expected to be low.

The transportation of the manufactured liquid ammonia from the plant may be via road, rail or a combination of the two, by means of Standard pressurised road tanker or ISOtainers (for road transport), or via pressured rail containers (ISOtank).

Rail transportation of the ammonia will reduce the traffic loading on the greater road network. The closest rail facility to the ammonia plant is located outside of Ermelo. This rail facility is primarily used to load coal for transport to the Richards Bay coal terminal. There may be an opportunity to load ammonia at this facility, however this has not been assessed. It is assumed that the ammonia will then have to be transported via road from site to the Ermelo railway facility. The option to build a rail loading facility on the railway line outside Camden, closer to the ammonia plant, is not regarded as feasible due to the cost. Therefore, the impact on the district roads and sections of the N2 and/or N11 to transport the ammonia to the Ermelo rail facility will be high, depending on the type of road tankers that will be utilised.

ISOtainers are road-based tankers that can transport 12 tons of ammonia per 20ft pressurised tank, 2 tanks per vehicle. For a production capacity of 100 000 tons per annum, approximately 8 334 two-way trips are required per annum. If the ammonia is transported during workdays only, 251 days a year, a total of 34 trips (Total IN & out) will be required per day. This low trip generation is expected to have a low impact on the road network and surround, however the unsurfaced district road from the plant to the N11 and N2 will require regular maintenance and should preferably be upgraded to surfaced standards (only where the appropriate permissions may be obtained from the relevant authorities to do so).

Standard pressurised road tankers can transport 1.1 tons of ammonia per 40ft pressurised tank, 1 tank per vehicle. For a production capacity of 100 000 tons per annum, approximately 181 818 two-way trips are required per annum. If the ammonia is transported during workdays only, 251 days a year, a total of 725 trips (Total IN & out) will be required per day. This is a substantial volume of traffic that should not be accommodated on the unsurfaced district roads and will in all probability trigger the requirement to upgrade either or both of the accesses onto the N11 and N2 to a grade-separated standard. Note: the capacity analysis of the access intersections off the N2 and N11 was not undertaken as it falls outside the scope of work.

It is recommended that only ISOtainers via road is utilised to transport the ammonia from the site.

The safety of the intersections off the National roads may be compromised due to the increase in especially heavy vehicle volumes. It is recommended that additional temporary and permanent road signage is installed at the intersections of the D260/N11, the D1107/N11 and the D1264/N2 to improve the safety of the intersections.

It is not possible to determine the volume of traffic that will be generated during the decommissioning phase. It can however be expected that the volumes will be lower than during the construction phase, and the resultant transport impact on the local access roads will be lower than during the Construction phase. Any damage to the road caused by the decommissioning phase traffic should be repaired at the cost of the developer.

The overall significance of each impact during the Construction Phase of the facility detailed in **Section 8.11 Traffic,** is Low without mitigation, and Very Low with mitigation. The impacts are limited to the peak construction period only, site only/local or regional, and fully reversible.

The proposed mitigating measures are easy to implement and will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and generation of dust on unsurfaced roads.

The maintenance and repair of the local access roads due to damage by construction vehicles should be the responsibility of respective project companies of the Camden I and Camden II facilities.

It is concluded that the proposed Camden I GH&A Facility will have a low transport impact on the adjacent road network, if the recommended upgrades and mitigation measures are implemented, and it is recommended that the TIA should be accepted as part of the EIA application.

10.3.14 BAT ASSESSMENT

The Bat Environmental Impact Assessment Report considered information gathered from site visits between August 2020 and October 2021, literature, and satellite imagery. The bat species most likely to be impacted on by the proposed GH&A facility are Laephotis (formally Neoromicia) capensis. This species is of special importance based on their likelihood of being impacted by the proposed GH&A facility, due to their habit of roosting readily in building roofs and stands of tall trees. These more abundant species are of a large value to the local ecosystems as they provide a greater contribution to most ecological services than the rarer species, due to their higher numbers.

Currently there is no evidence of the GH&A facility posing a direct threat of fatality impact on bats during operation. However, roosting and foraging habitats may be significantly impacted during the construction phase. This is primarily due the fact that such facilities require large areas of land to be cleared, and in some cases, earthworks are required for levelling purposes. This can result in habitat that is suitable for micro roosts, such as clumps of trees and certain vegetation being destroyed, which can also be fatal to bats residing in such roosts. Natural vegetation can support higher insect food quantities and diversity than cleared land, therefore foraging habitat can also be displaced, especially by solar facilities.

The presence of security lights on and around these facilities creates significant light pollution that can impact bat feeding habits and species compositions negatively, by artificially discouraging photophobic (light averse) species and favouring species that readily forage around insect-attracting lights. Additionally, if the buildings and associated infrastructure for these facilities are placed close to wind turbines, the light pollution at these buildings can attract photophilic bat species, thereby significantly increasing their chances of being killed by moving blades of turbines within close proximity.

A sensitivity map (**Figure 7-20**) was drawn up indicating potential roosting and foraging areas. The High Bat Sensitivity areas are expected to have elevated levels of bat activity and support greater bat diversity. High Bat Sensitivity areas are 'no–go' areas for specific infrastructure specified in **Figure 7-18.** Avoidance is the most affective mitigation measure for reducing the impact on bats and should be implemented as the first layer of mitigation. The proposed layout adheres to the sensitivity map provided.

Thus far, from a bat impact perspective, no reasons have been identified for the proposed Camden I GHA facility not to proceed to the Environmental Authorisation phase. It is the opinion of the specialist that the proposed project may proceed provided the prescribed mitigation measures are applied.

10.3.15 RISK ASSESSMENT

GREEN HYDROGEN AND AMMONIA FACILITY

The Health Safety and Environmental Risk assessment has found that, in the event of accidents such as large releases of hydrogen, nitrogen, oxygen or ammonia, the proposed facilities have the potential to impact significantly on both employees and members of the public outside the site. Based on the current design information, worst case hydrogen events may have significant impacts up to 350m from the site and ammonia up to 1.4km from the site.

However, the risk assessment has found that provided suitable preventative and mitigative measures are in place and everything reasonably practicable has been done to reduce the risks both with the design and operation of the facilities, none of the identified potential risks need be intolerably high, i.e., from a SHE perspective no fatal flaws were found with the proposed Camden I Green Hydrogen and Ammonia Facility.

Each of the hydrogen, air separation and ammonia plants have the potential to cause major accidents and the entire establishment should be classified as a Major Hazard Installation (MHI).

The hydrogen system, and ammonia under exceptional circumstances, have the potential to lead to fires and explosion which may lead to domino failures of other equipment in close proximity.

<u>The following recommendations have been made:</u>

The entire Green Hydrogen and Ammonia Establishment is an MHI and the necessary risk assessment, notifications, emergency response plans etc. as per the MHI Regulations, should be in place prior to commencement of construction.

Initiate the Major Hazard Installation Quantitative Risk Assessment as soon as possible in the development process to ensure that risks to the public persons outside the site are as low as reasonably practicable.

Note that the MHI regulations are under review and if the new regulations are promulgated before this Green Hydrogen and Ammonia facility is approved under the old regulations, compliance with the new regulation will be required which will entail, amongst other requirements, the obtaining of a license to operate.

At any large major hazard installation, such as this facility, a full formal Process Safety Management system should be implemented and maintained. Such a system should begin to be implemented prior to commencement of the basic engineering design, i.e. certain elements will require specific tasks of the design team.

One element of PSM is that the design should be subject to a full Hazard and Operability Study (HAZOP) prior to commencement of procurement. A HAZOP is a detailed technical systematic study that looks at the intricacies of the design, the control system, the emergency system etc. and how these may fail under abnormal operating conditions. Additional safeguards may be suggested by the team doing the study.

The hydrogen systems, and ammonia under exceptional circumstances, have the potential to lead to fires and explosions which may lead to domino failures of other equipment in close proximity, e.g. within 250m. From an overall Camden I GH&A project risk reduction point of view, suitable separation, or other mitigation, should be considered in the design of the site layout, including proximity to other critical infrastructure such as the Battery Energy Storage Systems (BESS) and electrical substations connecting the wind turbines or solar facilities to the National Electricity Grid.

Critical to the mitigation of any potential major accidents is a detailed, well-practiced Emergency Response plan. Such a plan, compliant with SANS 1514, should be in place and tested prior to commissioning.

From a SHE risk assessment point of view, where there is a choice of location that is further from public roads, water courses or isolated farmhouses, this would be preferred. The alternative 1 location for the Green Hydrogen and Ammonia facility is approximately 175m from a stream that tributes to the Vaal River system and 1.4km from the closest farmhouse. From a SHE risk assessment point of view; this means that alternative 2, which is further away from streams or farmhouses, is a slightly preferred alternative.

The impact assessment in **Section 8.16** of this report contains technical and system suggestions for managing and reducing risks. Ensure the items listed in these tables under preventative and mitigative measures are included in the design, operation and maintenance of the facilities.

BESS

GENERAL

This risk assessment has found that with suitable preventative and mitigative measures in place, none of the identified potential risks are excessively high, i.e., from a SHE perspective no fatal flaws were found with the proposed VRFB or Lithium Solid-state BESS installations at the ENERTRAG Camden I Green Energy Facility.

At a large facility, without installation of the state-of-the art battery technology that includes protective features, there can be significant risks to employees and first responders. The latest battery designs include many preventative and mitigative measures to reduce these risks to tolerable levels. Refer to tables in **Section 8.16** under preventative and mitigative measures.

State-of-the-art technology should be used, i.e. not old technology as it presents higher risks.

The design should be subject to a full Hazard and Operability Study (HAZOP) prior to commencement of procurement. A HAZOP is a detailed technical systematic study that looks at the intricacies of the design, the control system, the emergency system etc. and how these may fail under abnormal operating conditions. Additional safeguards may be suggested by the team doing the study.

VANADIUM REDOX FLOW BATTERY INSTALLATIONS

The most significant hazard with VRF battery units is the possibility of spills of corrosive and environmentally toxic electrolyte. Many preventative and mitigative features will be included in the design and operation, e.g., full secondary containment, level control on tanks, leak detection on equipment etc. (Refer to tables in **Section 8.16** under preventative and mitigative measures).

VRF batteries do not present significant fire and electrical arcing hazards provided they are correctly designed, operated, maintained and managed. Suitable Battery Management System (BMS), safety procedures, operating instructions, maintenance procedures, trips, alarms and interlocks should be in place. (Refer to tables in **Section 8.16** under preventative and mitigative measures).

LITHIUM SOLID STATE CONTAINERIZED BATTERIES

With lithium solid-state batteries, the most significant hazard with battery units is the possibility of thermal runaway and the generation of toxic and flammable gases. There have been numerous such incidents around the world with batteries at all scales and modern technology providers include many preventative and mitigative features in their designs. This type of event also generates heat which may possibly propagate the thermal runaway event to neighbouring batteries if suitable state of the art technology is not employed. The flammable gases generated may ignite leading to a fire which accelerates the runaway process and may spread the fire to other parts of the BESS or other equipment installed near the BESS.

If the flammable gases accumulate within the container before they ignite, they may eventually ignite with explosive force. This type of event is unusual but has happened with an older technology container installed at McMicken in the USA in 2019.

Due to a variety of causes, thermal runaway could happen at any point during transport to the facility, during construction or operation / maintenance at the facility or during decommissioning and safe making for disposal.

Due to the containerized approach as well as the usual good practice of separation between containers, which should be applied on this project, and therefore the likely restriction of events to one container at a time, the main risks are close to the containers i.e. to transport drivers, employees at the facilities and first responders to incidents.

In terms of a worst conceivable case container fires, the significant impact zone is likely to be limited to within 10m of the container and mild impacts to 20m. Based on the current proposed layouts, impacts at the closest isolated farmhouses are not expected.

In terms of a worst conceivable case explosion, the significant impact zone is likely to be limited to with 10m of the container and minor impacts such as debris within 50m. Based on the current proposed layouts, impacts at the closest isolated farmhouses are not expected.

In terms of a worst reasonably conceivable toxic smoke scenario, provided the units are placed suitably far apart to prevent propagation from one unit to another and large external fires are prevented, the amount of material burning should be limited to one container at any one time. In this case, beyond the immediate vicinity of the fire, the concentrations of harmful gases within the smoke should be low. Both the alternative BESS installation's locations are over 500m from any occupied farmhouse, although Option 1 has more houses in the down wind direction which may be a slight disadvantage. Therefore, the risks posed by BESS to the closest isolated farmhouses are negligible.

TECHNOLOGY AND LOCATION OF BESS FACILITIES

From a safety and health point of view, the above risk assessment shows that risks posed by VRFB systems may be slightly lower than those of SSL facilities, particularly with respect to fire and explosion risks. From an environmental spill and pollution point of view the VRFB systems present higher short-term risks than the SSL systems. However, the above conclusions may be due to the fact that the VRFB technology is not as mature as SSL technology and therefore there is not as much operating experience and accident information available for the VRFB.

From a SHE risks assessment point of view, where there is a choice of location that is further from public roads, water courses or isolated farmhouses, this would be preferred. VRFB hazards are mostly related to possible loss of containment of electrolyte and SSL batteries to fires producing toxic smoke and fire fighting which may result in contaminated of firewater runoff. One would not want these liquids to enter water courses nor the smoke to pass close to houses / public traffic. The Option 1 alternative location for the BESS borders on a stream that tributes to the Vaal River system. This proximity to an important water course is a disadvantage of this location 1, but with suitable mitigation measures in place, the risks are acceptably low and this option remain a viable option.

The following recommendations have been made:

There are numerous different battery technologies but using one consistent battery technology system for both the BESS installations associated with the Camden I GH&A facility would allow for easy of training, maintenance, emergency response and could significantly reduce risks.

State-of-the-art battery technology should be used with all the necessary protective features e.g. draining of cells during shutdown and standby-mode, full BMS with deviation monitoring and trips, leak detection systems.

Neither battery technology type presents any safety or health fatal flaws.

The tables in **Section 8.16** of this report contains technical and systems suggestions for managing and reducing risks. Ensure the items listed in these tables under preventative and mitigative measures are included in the design.

The overall design should be subject to a full Hazop prior to finalization of the design.

For the VRFB systems an end of life (and for possible periodic purging requirements) solution for the large quantities of hazardous electrolyte should be investigated, e.g. can it be returned to the supplier for re-conditioning.

Prior to bringing any solid-state battery containers into the country:

An Emergency Response Plan should be in place that would be applicable for the full route from the ship to the site. This plan would include details of the most appropriate emergency response to fires both while the units are in transit and once they are installed and operating. An End-of-Life plan should be in place for the handling, repurposing or disposal of dysfunctional, severely damaged batteries, module and containers. The site layout and spacing between lithium solid-state containers should be such that it mitigates the risk of a fire or explosion event spreading from one container to another.

Under certain weather conditions, the noxious smoke from a fire in a lithium battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress etc. Close to the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. Location of the facilities needs to ensure a suitable separation distance from public facilities/residences etc. Both the alternative BESS installation's locations are over 500m from any occupied farmhouse, although location 1 is closer to farmhouses which may be a slight disadvantage. Nevertheless, the risks posed by BESS to the closest isolated farmhouses are negligible and both locations remain viable.

Where there is a choice of alternative locations for the BESS, those that are further from water courses would be preferred. VRFB hazards are mostly related to possible loss of containment of electrolyte and solid-state systems may experience fires that may result in loss of containment of liquids or the use of large amounts of fire water which could be contaminated. One would not want these run-offs to enter water courses directly. The buffer distance between water bodies and the facilities containing chemicals should be set in consultation with a water specialist and is therefore not specified in the SHE RA. However, it is noted that the Option 1 alternative location for the BESS borders on a stream that tributes to the Vaal River system. This proximity to an important water course is a disadvantage of this location 1, but with suitable mitigation measures in place, the risks are acceptably low and this option remains a viable option.

From the above it is clear that from a SHE point of view there is a slight preference for BESS location Option 2, although both options remain viable.

Finally, it is suggested once the technology has been chosen and more details of the actual design are available, that necessary updated risk assessments should be in place.

10.4 IMPACT SUMMARY

A summary of the identified impacts and corresponding significance ratings for the proposed GH&A facility is provided in **Table 10-1** for the construction operational and decommissioning phase below. The impacts summarised are applicable to both proposed site alternatives.

CONSTRUCTION, OPERATION AND DECOMISSIONING IMPACT SUMMARY

Table 10-1: Impact Summary

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
Air Quality	Generation of Dust and PM	Construction	**Low**	(-)	**Low**	(-)
	Ambient air quality due to NH_3 emissions	Operation	**Low**	(-)	**N/A**[11]	
Noise	Noise Emissions	Construction	**Low**	(-)	**Very Low**	(-)
	Noise Emissions from facility operation	Operation	**Low**	(-)	**Low**	(-)
Soil, land capability and Agricultural	Loss of agricultural potential	Construction	**Moderate**	(-)	**N/A**	(-)
Freshwater/Aquatic	Loss of Very High Sensitivity Systems	Construction	**Moderate**	(-)	**Low**	(-)
	Damage or loss of riparian and or riverine systems	Construction	**Moderate**	(-)	**Low**	(-)
	Water quality	Construction	**Moderate**	(-)	**Low**	(-)
	Habitat fragmentation	Construction	**Moderate**	(-)	**Low**	(-)
	Increased run off leading to erosion and sedimentation	Operation	**Low**	(-)	**Very Low**	(-)
Terrestrial Biodiversity	Loss of indigenous natural vegetation	Construction	**Moderate**	(-)	**Moderate**	(-)
	Establishment and spread of declared weeds and alien invader plants	Construction	**Low**	(-)	**Very Low**	(-)

[11] Note: A post-mitigation scenario is not applicable for the control of NH_3 emissions during the operational phase. All emission controls are considered standard operating procedure and thus the pre-mitigation scenario is representative of normal operations as the proposed facility is designed to function

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Continued disturbance to natural habitats due to general operational activities and maintenance	Operation	**Low**	(-)	**Low**	(-)
	Establishment and spread of declared weeds and alien invader plants	Operation	**Moderate**	(-)	**Very low**	(-)
	Continued runoff and erosion	Operation	**Low**	(-)	**Low**	(-)
	Loss and/or disturbance of indigenous natural vegetation during removal of infrastructure	Decommissioning	**Low**	(-)	**Low**	(-)
	Establishment and spread of declared weeds and alien invader plants	Decommissioning	**Moderate**	(-)	**Low**	(-)
Animal Species	Loss of faunal habitat	Construction	**Moderate**	(-)	**Low**	(-)
	Direct mortality of fauna	Construction	**Low**	(-)	**Very low**	(-)
	Direct mortality of fauna	Operation	**Low**	(-)	**Very low**	(-)
Plant Species	Loss of individuals of Species of Conservation Concern due to clearing for construction	Construction	**Moderate**	(-)	**Very low**	(-)
Avifauna	Displacement due to disturbance associated with the construction	Construction	**Low**	(-)	**Very Low**	(-)
	Displacement due to habitat transformation associated with the construction	Construction	**Low**	(-)	**Low**	(-)
	Mortality of priority species due to collisions with the up to 132kVkV overhead power line	Operation	**Low**	(-)	**Very Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Electrocution of priority species on the up to 132kV overhead powerline	Operation	**Low**	(-)	**Very Low**	(-)
	Displacement of priority species due to disturbance associated with decommissioning of the facility	Decommissioning	**Low**	(-)	**Low**	(-)
Visual	Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed grid connection infrastructure	Construction	**Moderate**	(-)	**Low**	(-)
	Potential visual impact on sensitive visual receptors located within a close proximity of the facility infrastructure during the operational phase	Operation	**Moderate**	(-)	**Moderate**	(-)
Traffic	Noise, dust & exhaust pollution due to vehicle trips on-site	Construction	**Low**	(-)	**Very Low**	(-)
	Noise, dust & exhaust pollution due to additional trips on the national and district roads	Construction	**Low**	(-)	**Very low**	(-)
	Road transport of ISOtainers Noise, dust & exhaust pollution due to vehicle trips on-site-	Operation	**Moderate**	(-)	**Low**	(-)
	Road transport of ISOtainers Noise, dust & exhaust pollution due to additional trips on the national and district roads	Operation	**Moderate**	(-)	**Low**	(-)
	Road transport of standard pressurised tankers- Noise, dust & exhaust pollution due to vehicle trips on-site-	Operation	**Moderate**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Road transport of standard pressurised tankers- Noise, dust & exhaust pollution due to additional trips on the national and district roads	Operation	**Moderate**	(-)	**Low**	(-)
	Safety & capacity of local district and National Road intersections	Operation	**High**	(-)	**Low**	(-)
Heritage	Destruction or damage to recorded ruins	Construction	**Very Low**	(-)	**Very Low**	(-)
Palaeontology	Impacts on fossil heritage	Construction	**Low**	(-)	**Very Low**	(+)
Socio-economic	Improvement of Employment, Business Development and Skills Development	Construction	**Low**	(+)	**Moderate**	(+)
	Presence of Construction Workers and Impact on Family Structures and Social Networks	Construction	**Moderate**	(-)	**Low**	(-)
	Influx of job seekers into local community	Construction	**Low**	(-)	**Very low**	
	Risk to safety, livestock, and farm infrastructure	Construction	**Moderate**	(-)	**Low**	(-)
	Generation of dust and noise, and safety of employees and community members	Construction	**Moderate**	(-)	**Low**	(-)
	Risk of veld fires	Construction	**Moderate**	(-)	**Low**	(-)
	Loss of farmlands	Construction	**Moderate**	(-)	**Low**	(-)
	Development of infrastructure produce green hydrogen and ammonia for SA	Operation	**Moderate**	(-)	**High**	(+)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Creation of employment, skills development and business opportunities	Operation	**Moderate**	(+)	**High**	(+)
	Generate income for affected landowners	Operation	**Low**	(+)	**Moderate**	(+)
	Visual impact and impact on sense of place	Operation	**Moderate**	(-)	**Moderate**	(-)
	Noise generation during operation of facility	Operation	**Low**	(-)	**Low**	(-)
	Incidents releasing harmful substances affecting health and safety of adjacent landowners	Operation	**Moderate**	(-)	**Low**	(-)
Bats	Loss of foraging habitat by clearing of vegetation.	Construction	**Moderate**	(-)	**Low**	(-)
	Roost destruction during earthworks.	Construction	**Moderate**	(-)	**Very Low**	(-)
	Increased bat mortalities due to light attraction and habitat creation.	Operation	**Moderate**	(-)	**Low**	(-)

CUMULATIVE IMPACT SUMMARY

A summary of the identified cumulative impacts is outlined in **Table 10-2** below for both before and after mitigation measures have been considered for the current project as well as the combination of projects in the area.

Table 10-2: Cumulative impacts summary

ASPECT	IMPACT DESCRIPTION	CURRENT PROJECT		COMBINATION OF PROJECTS	
		SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
Noise	Cumulative acoustic impact	**Moderate**	**(-)**	**Low**	**(-)**
Surface water	Cumulative surface water impact	**Moderate**	**(-)**	**Low**	**(-)**
Avifauna	Cumulative Avifaunal impacts from GH&A facility	**Low**	(-)	**Low**	**(-)**
	Cumulative Avifaunal impacts from 132kV powerline	**Moderate**	(-)	**Low**	**(-)**
Animal species	Loss of faunal habitat during construction	**Moderate**	(-)	**Moderate**	**(-)**
	Increased mortality during construction	**Low**	(-)	**Moderate**	**(-)**
	Cumulative Loss of faunal habitat during operation	**Low**	(-)	**Moderate**	**(-)**
Plant species	Loss of individuals of Species of Conservation Concern	**Very low**	(-)	**Moderate**	**(-)**
Biodiversity	Clearing of natural habitat for construction	**Moderate**	(-)	**High**	**(-)**
	Disruption of ecological processes at landscape level	**Low**	(-)	**Moderate**	**(-)**
	Establishment and spread of declared weeds and alien invader plants	**Very low**	(-)	**Moderate**	**(-)**
Heritage and Palaeontology	Damage or loss of heritage or palaeontological finds	**Moderate**	(-)	**Low**	**(-)**
Visual and landscape	Cumulative visual impact	**High**	(-)	**Moderate**	**(-)**
Traffic	Increased traffic due to surrounding developments	**Low**	(-)	**Very low**	**(-)**
Social	Cumulative change in the Sense of place and the landscape	**Low**	**(-)**	**Low**	**(-)**

ASPECT	IMPACT DESCRIPTION	CURRENT PROJECT		COMBINATION OF PROJECTS	
		SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Cumulative impact on Local services and accommodation	**Moderate**	(-)	**Low**	(-)
	Cumulative impact on local economy	**Low**	(+)	**Moderate**	(+)

10.5 ALTERNATIVES ASSESSMENT

Project alternatives in terms of activity, technology, location and layout were considered as part of this EIAR process. Two alternative sites have been assessed, as well as four alternative pipeline routes.

The site alternative 2 (**Figure 10-14**) along with the associated pipeline alternative 1 (**Figure 10-15**) is the preferred option for the proposed Camden GH&A facility as outlined in **Section 6.5.5.** However, it is important to note that while there are preferences specified, all site alternatives and options for pipelines locations are considered feasible from an environmental impact perspective.

Site alternative 2 is preferred with the following coordinates:

— A2-A - 26°38'32.33"S; 30° 4'1.48"E
— A2-B - 26°38'41.63"S; 30° 4'14.16"E
— A2-C - 26°38'54.03"S; 30° 3'59.34"E
— A2-D - 26°38'39.31"S; 30° 3'46.55"E
— A2-E - 26°38'34.55"S; 30° 3'51.22"E
— A2-F - 26°38'36.98"S; 30° 3'53.46"E”

Pipeline alternative 1 is preferred with the following coordinates:

— WP10 - 26°38'40.97"S; 30° 3'58.68"E
— WP11- 26°38'34.67"S; 30° 3'51.33"E
— WP7 - 26°37'48.45"S; 30° 4'34.26"E
— WP8 - 26°37'35.50"S; 30° 4'20.72"E
— WP9 - 26°37'30.69"S; 30° 4'2.75"E

Up to 132kV Grid Connection line preferred alternative with the following coordinates:

— PS_A (Start) - 26°38'51.84"S; 30° 4'0.18"E
— PS_B (Finish) - 26°38'54.29"S; 30° 4'2.35"E

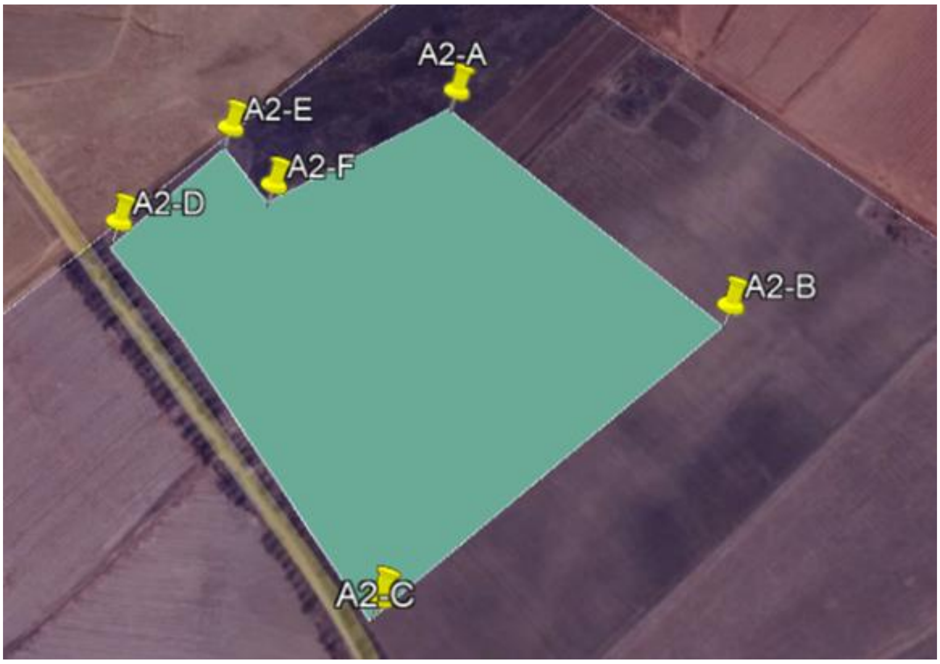


Figure 10-14: Site alternative 2

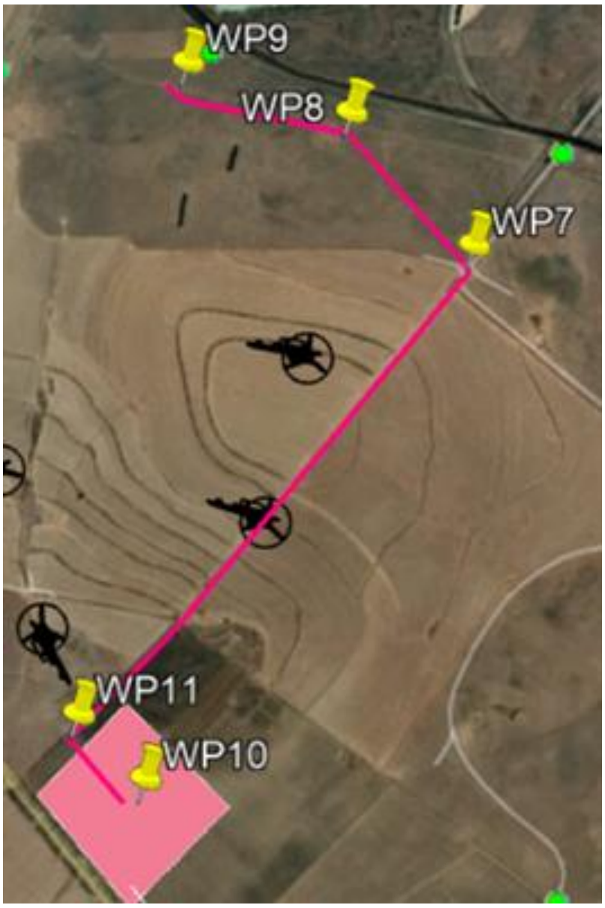


Figure 10-15: Pipeline alternative 1

Figure 10-16: Preferred up to 132kV powerline option

With regards to the proposed BESS facility, both alternative technologies (Solid state Lithium-ion and Vanadium Redox Flow batteries) were assessed (**See Section 8.16**) and no fatal flaws were identified, it is recommended that both alternatives be authorised. However, the Solid-State lithium-ion technology is preferred.

In the "no project" alternative, the Camden I GH&A Facility project will not be developed. In this scenario, there could be a missed opportunity to address the need for the green production of hydrogen and ammonia for commercial use in an effort to mitigate against concerns of climate change and exploitation of non-renewable resources. The no-go alternative would not assist in responding to the global call to reduce GHG emissions in the industrial sector. Conversely, negative environmental impacts of the project (as outlined in **Section 8**) associated with the development of the Camden I GH&A Facility would be avoided.

10.6 IMPACT STATEMENT

The overall objective of the EIA is to provide sufficient information to enable informed decision-making by the authorities. This was undertaken through consideration of the proposed project components, identification of the aspects and sources of potential impacts and subsequent provision of mitigation measures.

It is the opinion of WSP that the information contained in this document (read in conjunction the final scoping report) is sufficient for the MDARDLEA to make an informed decision for the environmental authorisation being applied for in respect of this project.

Mitigation measures have been developed where applicable for the above aspects and are presented within the EMPr (**Appendix I**). It is imperative that all impact mitigation recommendations contained in the EMPr, of which the environmental impact assessment took cognisance, are legally enforced.

Considering the findings of the respective studies, no fatal flaws were identified for the proposed Project. Should the avoidance and mitigation measures prescribed be implemented, the significance of the considered impacts for all negative aspects pertaining to the environmental aspects is expected to be low. It is thus the opinion of the EAP that the Project can proceed, and that all the prescribed mitigation measures and recommendations are considered by the issuing authority.

EA AUTHORISATION PERIOD

Appendix 1(3)(1)(q) of the NEMA EIA Regulations 2014, as amended requires "where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised" must be included in the EIA Report.

The EA is required to be valid for a period of 10 years from the date of issuance of the EA. This is considered a reasonable period to allow the Applicant time to conduct relevant internal processes which can only begin after issuance of the EA.

FINALISATION OF THE EMPR AND LAYOUT

It is important to note that the EMPr (Appendix I) and project layout included in this EIR are not final and although included in this EIR, these are not submitted for approval at this stage. Subsequent to the decision-making phase, if environmental authorisation is granted for the project, the EMPr will have to be amended to include measures as dictated by the final layout map and micro-siting, including the requirements of the EA. The amended EMPr and final layout subjected to micro-siting will be submitted to the DFFE for review and approval following detailed design.

ASPECTS TO BE INCLUDED AS CONDITIONS IN THE EA

The following key aspects are recommended to be included as conditions of authorisation:

- The layouts submitted in the EIR are not final. The final layouts are to be submitted to the DFFE for approval prior to construction.
- The EMPr submitted in the EIR is not final. The final EMPr is to be submitted to the DFFE for approval prior to construction.
- Construction may only commence once the Protected Area status has been changed for the directly affected properties (i.e. Portion 1 & 2 of Welgelegen Farm No. 322);
- All mitigation measures detailed in this EIR and the relevant specialist reports must be implemented.
- Recommendations for the layout as provided by the relevant specialists must be implemented as far as possible.
- The final EMPr must form part of all contractual documents with contractors during construction and operational phases of the project. Furthermore, a dedicated Environmental Control Officer (ECO) must be appointed to ensure compliance to all EA conditions and EMPr commitments throughout the construction phase.
- Applications for all relevant and required permits must be submitted prior to construction.
- Where required, water use authorisation under NWA is to be obtained from the Department of Water and Sanitation prior to construction.

11 CONCLUSION

A number of environmental impacts have been identified as requiring some more in-depth investigation and the identification of detailed mitigation measures. Therefore, this detailed EIAR provides an assessment of these potential impacts and recommend appropriate mitigation measures.

The anticipated environmental impacts associated with the proposed development have been evaluated according to their significance, which is determined as a result of their extent, magnitude, probability and duration. All impacts were assessed with and without management measures in place. This final EIR has been structured to comply with the requirements of the Appendix 3 of GNR 982. The report provides a description of the proposed project and details the aspects associated with the construction, operation and decommissioning. The report also includes the methodology followed to undertake the S&EIR process. A detailed description on the existing environment (bio-physical as well as socio-economic) is provided based on findings from the specialist surveys. Stakeholder engagement was undertaken from the onset of the project in a transparent and comprehensive manner. Outcomes of all comments received from the public review periods were recorded and responded to in the S&EIR. Based on the environmental description, specialist surveys as well as the stakeholder engagement a detailed EIA rating has been undertaken and where relevant the necessary management measures have been recommended.

In summary, the S&EIR process assessed both biophysical and socio-economic environments and identified appropriate management and mitigation measures. The biophysical impact assessment revealed that there are no environmental fatal flaws associated with the proposed project should mitigation and management measures be implemented. In addition, it should be noted that the overall socio-economic impacts associated with the project are positive.

WSP is of the opinion that should the identified mitigation and management measures be implemented the overall impact of the proposed Project is Low to Medium and can therefore by authorised.

The draft EIR was made available for public review from **7 September 2022 to 10 October 2022.**

All issues and comments submitted to WSP during the scoping and EIA phase have been incorporated in the CRR (**Appendix D**). The Final EIR will be submitted to the MDARDLEA, as the competent authority, for review and decision -making.

If you have any further enquiries, please feel free to contact:

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