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# **REPORT:**

## **AMENDED SCOPING PLUS IMPACT ASSESSMENT - CLEANERGY GREEN HYDROGEN DEMONSTRATION PLANT, WALVIS BAY, NAMIBIA**

**PROJECT NUMBER:** ECC-145-523-REP-02-D

**REPORT VERSION:** REV 01

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Hydrogen Demonstration Plant, Walvis Bay, Namibia

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Client Name: Ms Liesbeth Verhaert

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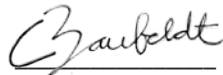
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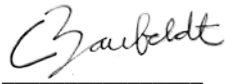
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## ABBREVIATIONS

| Abbreviations   | Description                                               |
|-----------------|-----------------------------------------------------------|
| %               | percentage                                                |
| barg            | Bar gauge pressure                                        |
| Cleanergy       | Cleanergy Solutions Namibia (Pty) Ltd                     |
| CMB.TECH        | CMB.TECH Namibia (Pty) Ltd                                |
| DEAF            | Department of Environmental Affairs and Forestry          |
| ECC             | Environmental Compliance Consultancy (Pty) Ltd            |
| e.g.            | example                                                   |
| EIA             | Environmental impact assessment                           |
| EMA             | Environmental Management Act, No. 7 of 2007               |
| EMP             | Environmental management plan                             |
| ERC             | Erongo Regional Council                                   |
| ESIA            | environmental and social impact assessment                |
| ESMP            | environmental and social management plan                  |
| etc             | <i>et cetera</i>                                          |
| GHDP            | Green Hydrogen Demonstration Plant                        |
| H <sub>2</sub>  | hydrogen                                                  |
| ha              | hectares                                                  |
| I&AP            | Interested and affected parties                           |
| IFC             | International Finance Corporation                         |
| km              | kilometre                                                 |
| KOH             | potassium hydroxide                                       |
| LFP             | lithium iron phosphate                                    |
| Ltd             | limited                                                   |
| NH <sub>3</sub> | ammonia                                                   |
| NamPort         | Namibian Ports Authority                                  |
| NamWater        | Namibia Water Corporation                                 |
| NDP             | National Development Plan                                 |
| NHC             | National Heritage Council                                 |
| No.             | number                                                    |
| m <sup>3</sup>  | cubic metre                                               |
| mt              | Million tonnes                                            |
| MAFWLR          | Ministry of Agriculture, Fisheries, Water and Land Reform |
| MEFT            | Ministry of Environment, Forestry and Tourism             |
| MIME            | Ministry of Industries, Mines and Energy                  |
| MoDVA           | Ministry of Defense and Veteran Affairs                   |
| mtpd            | Metric Tonnes Per Day                                     |
| MW              | megawatt                                                  |
| MWh             | megawatt hour                                             |
| MWp             | megawatt peak                                             |

| Abbreviations | Description                      |
|---------------|----------------------------------|
| Pty           | proprietary                      |
| PV            | photovoltaic                     |
| WBIA          | Walvis Bay International Airport |
| WBM           | Walvis Bay Municipality          |

# 1 INTRODUCTION

## 1.1 BACKGROUND INFORMATION

Environmental Compliance Consultancy (Pty) Ltd (ECC) has been engaged by Cleanergy Solutions Namibia (Pty) Ltd (hereinafter referred to as the Proponent or Cleanergy Solutions) to prepare the environmental clearance certificate amendment application, update the environmental and social impact assessment (ESIA) and revise the environmental and social management plan (ESMP) (Appendix A ) for the current Cleanergy Green Hydrogen Demonstration Plant (hereinafter referred to as the Project or GHDP). The Project is located on Farm 58, Walvis Bay, in the re-zoned industrial area near Dune 7. The Project covers a footprint of approximately 24 hectares (ha) and can be accessed via the Walvis Bay – Swakopmund highway (D1984) (Figure 1).



**Figure 1 - Locality map of the GHDP**

## 1.2 AMENDMENT TO THE EXISTING REPORT

As part of the ongoing development of the GHDP at Portion 8 of Farm 58, this amendment application and report outline key enhancements as shown below to scale up operations and are further described in section 4.2, which did not form part of the original environmental clearance certificate application and ESIA.

- Extension of the solar park from 5 MWp to 100 MWp

- Battery extension from 5.9 MWh to 230 MWh
- 5 MW electrolyser (alkaline);
- The construction of an ammonia plant (4 mtpd);
- New utilities: Flare, Nitrogen Generation Unit, Water Treatment plant, and cooling water system.

### 1.3 PURPOSE OF AMENDMENT REPORT

This amendment report is required to assess the potential impacts associated with the additional construction activities and infrastructure development of the Hydrogen and Ammonia Production Plant on the surrounding biophysical and social environment. This assessment process was completed in compliance with the requirements of the Environmental Management Act, No. 7 of 2007 (EMA) and its associated 2012 Regulations. The current environmental clearance certificate was issued by the Ministry of Environment, Forestry and Tourism (MEFT) on 14 March 2023 and remains valid until 14 March 2026 (Appendix B ).

### 1.4 THE PROPONENT OF THE PROPOSED PROJECT

Cleanergy Solutions holds a long-term lease agreement with Walvis Bay Municipality for the construction and operation of the proposed activities as part of the scope of the Project, within the identified and agreed area.

Cleanergy Solutions Ltd was formed in 2021, is duly registered in Namibia and is now wholly owned by CMB.TECH Namibia (Pty) Ltd. The company has already constructed the Hydrogen Demonstration Plant (which will be the focus of this amendment) on Farm 58, located outside Walvis Bay. The Proponents' details are provided in Table 1.

**Table 1 – Proponent’s details**

| Company representative             | Contact details                                                                                                                                              |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
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## 1.5 ENVIRONMENTAL ASSESSMENT PRACTITIONER

Environmental Compliance Consultancy (Pty) Ltd (ECC) (Reg. No. 2022/0593) has prepared this amendment report and the updated ESMP on behalf of the Proponent and in line with the relevant national regulations and international best practice.

This report has been authored by employees of ECC, who have no material interest in the outcome of this report, nor do any of the ECC team have any interest that could be reasonably regarded as being capable of affecting their independence in the preparation of this report. ECC is independent from the Proponent and has no vested or financial interest in the Project, except for fair remuneration for professional fees rendered which are based upon agreed commercial rates. Payment of these fees is in no way contingent on the results of this report or the assessment, or a record of decision issued by Government. No member or employee of ECC is, or is intending to be, a director, officer, or any other direct employee of Cleanergy Solutions. No member or employee of ECC has, or has had, any shareholding in Cleanergy Solutions. All compliance and regulatory requirements regarding this report should be forwarded by email or posted to the following address:

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## 1.6 ENVIRONMENTAL REQUIREMENTS

The Environmental Management Act, No. 7 of 2007, and its 2012 Regulations, stipulate that an environmental clearance certificate is required before undertaking any of the listed activities. The existing environmental clearance (ECC-2300257) (Appendix B ) has been approved under the listed activities as shown in Table 2.

**Table 2 - Activities triggered by the approved GHDP Project (2022)**  
**(Source: Environmental Management Act, No. 7 of 2007 and its 2012 Regulations)**

| Listed activity                                               | As defined by the regulations of the Act                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Relevance to the Project                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Energy generation, transmission and storage                   | (1.a) The construction of facilities for the generation of electricity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>- Construction and operation of a five (5)-megawatt peak (MWp) demonstration solar photovoltaic (PV) power plant, including a battery storage facility powering a five (5) megawatt (MW) electrolyser allowing to produce green hydrogen.</li> </ul>                                                   |
| Waste management, treatment, handling and disposal activities | (2.1) The construction of facilities for waste sites, treatment of waste and disposal of waste.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>- The construction of a wastewater collection system comprising of a conventional gravity system and conservancy tanks.</li> </ul>                                                                                                                                                                     |
| Hazardous substance treatment, handling and storage           | <p>(9.1) The manufacturing, storage, handling, or processing of a hazardous substance defined in the Hazardous Substances Ordinance, 1974.</p> <p>(9.4) The storage and handling of dangerous goods, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres (m<sup>3</sup>) at any one location.</p> <p>(9.5) Construction of filling stations or any other facility for the underground or aboveground storage of dangerous goods, including petrol, diesel, liquid, petroleum, gas or paraffin.</p> | <ul style="list-style-type: none"> <li>- Storage and handling of various hazardous chemicals. Hydrogen will be produced which is a combustible fuel.</li> <li>- Facilities for the storage and handling of dangerous goods, including the storage of hydrogen.</li> <li>- Construction and operation of a hydrogen filling station</li> </ul> |
| Infrastructure                                                | 10.1. The construction of –                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | The Project required the construction of:                                                                                                                                                                                                                                                                                                     |

| Listed activity | As defined by the regulations of the Act                                                  | Relevance to the Project                                                                                                                                                             |
|-----------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | a) oil, water, gas and petrochemical and other bulk supply pipelines.<br>b) public roads. | <ul style="list-style-type: none"> <li>- Access road(s) to site; and</li> <li>- Water supply pipeline from closest Namibia Water Corporation (NamWater) connection point.</li> </ul> |

The amendment to the existing environmental clearance certificate will trigger the following additional listed activities (Table 3).

**Table 3 - Activities potentially triggered by the amended activities (2026)**

| Listed activity                                         | As defined by the regulations of the Act                                                                                                                        | Relevance to the Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Energy generation, transmission and storage activities. | (1.a) The construction of facilities for the generation of electricity.<br>(1.b) The construction of facilities for the transmission and supply of electricity. | <ul style="list-style-type: none"> <li>- An additional 95 MWp solar capacity is to be added, covering an area of thirty-nine (39) ha.</li> <li>- An additional 224 megawatt hour (MWh) lithium iron phosphate (LFP) battery system (liquid-cooled) to power at night time the ammonia production and terminal operations, ensuring continuous output.</li> <li>- Addition of a new five (5) MW alkaline electrolyser.</li> <li>- The construction of an ammonia plant (4 mtpd);</li> <li>- New utilities: Flare, Nitrogen Generation Unit, Water Treatment plant, and cooling water system.</li> </ul> |

| Listed activity                                               | As defined by the regulations of the Act                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Relevance to the Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Waste management, treatment, handling and disposal activities | (2.1) The construction of facilities for waste sites, treatment of waste and disposal of waste.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>- The existing solid waste management system will be used for the extension.</li> <li>- A septic tank is installed on site for the treatment of domestic wastewater. Sewage is removed on a regular basis by a licensed service provider.</li> </ul>                                                                                                                                                                                                        |
| Hazardous substance treatment, handling and storage           | <p>(9.1) The manufacturing, storage, handling, or processing of a hazardous substance defined in the Hazardous Substances Ordinance, 1974.</p> <p>(9.2) Any process of activity which requires a permit, licence or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste.</p> <p>(9.4) The storage and handling of dangerous goods, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 m<sup>3</sup> at any one location.</p> | <ul style="list-style-type: none"> <li>- The ammonia plant will consist of a hydrogen component of 40 m<sup>3</sup>.</li> <li>- The alkaline electrolyser loop is filled with potassium hydroxide (KOH)</li> <li>- Additional Hydrogen will be produced</li> <li>- Hydrogen storage will not be expanded A low pressure hydrogen buffer will be installed. 40m<sup>3</sup> at 16 barg.</li> <li>- Production (4 mtpd) and storage (50 mt) of ammonia.</li> <li>- LPG as fuel for flare.</li> </ul> |

## **2 APPROACH TO THE ASSESSMENT**

### **2.1 PURPOSE AND SCOPE OF THE AMENDMENT ASSESSMENT**

This amendment report aims to scope the available data and any gaps that need to be filled; determine the spatial and temporal scope; identify the assessment methodology; and determine and assess which impacts are likely to be significant (the main focus of the assessment) from the additional activities proposed for the GHDP Project.

The scope of the assessment was determined through assessing the proposed additional Project elements against the receiving environment, which was defined through desktop reviews, specialists site visits, available site-specific literature and the initial environmental and social impact assessment including the EMP, conducted 2021-2022 (Appendix C ).

### **2.2 THE ASSESSMENT PROCESS**

ECC's environmental and social impact assessment (ESIA) methodology applied to this amendment report has been developed using the International Finance Corporation (IFC) standards and models, in particular Performance Standard 1, 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2017) (International Finance Corporation, 2012); Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008); international and national best practice; and over twenty-five (25) years of combined EIA experience. This is also detailed in chapter 6 of this report.

The findings of the assessment chapter (chapter 7) provide the basis for determining the significance of potential impacts. Final mitigation measures and recommendations are based on the cumulative experience of the consulting team and the client, taking into consideration the potential environmental and social impacts. The process followed through this assessment is illustrated in Figure 2 and detailed further in the following sections. This chapter hereby provides a structured framework for assessing the potential impacts that are likely to be triggered by proposed infrastructure developments on-site. The outcome of the assessment guides the Department of Environmental Affairs and Forestry (DEAF) on whether to grant approval, consent, or reject (with conditions) the proposed additional Project elements.

| 1. Project screening                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2. Establishing the assessment scope                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3. Baseline studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p>The first stages in the ESIA process are to undertake a screening exercise to determine whether the Project triggers listed activities under the Environmental Management Act, 2007, and its regulations. The screening phase of the Project is a preliminary analysis, to determine ways in which the Project might interact with the biophysical, social, and economic environments.</p> <p>The outcome of the screening phase established that the Project triggered listed activities, as detailed in chapter 1, Table 3 due to material changes that require an amendment to the current environmental clearance certificate for the Cleanergy Green Hydrogen Demonstration Plant</p>  | <p>The main aim of this stage is to determine which impacts are likely to be significant; to scope the available data and any gaps that need to be filled; to determine the spatial and temporal scope; and to identify the assessment methodology.</p> <p>The scope of this assessment was determined through undertaking a preliminary assessment of proposed additional project developments against the receiving environment. The following environmental and social topics were scoped into the assessment, as there was the potential for significant impacts to occur. Impacts that are identified as potentially significant during the screening and scoping phase are taken forward for further assessment in the ESIA process. These are:</p> <p><b>SOCIOECONOMIC ENVIRONMENT</b></p> <ul style="list-style-type: none"> <li>• Employment</li> <li>• Local businesses</li> <li>• Occupational health and safety</li> <li>• Noise and air quality, including dust emissions</li> <li>• Traffic</li> </ul> <p><b>BIOPHYSICAL ENVIRONMENT</b></p> <ul style="list-style-type: none"> <li>• Surface and ground water</li> <li>• Biodiversity</li> <li>• Climate change</li> </ul>  | <p>A robust baseline is required, to provide a reference point against which any future changes associated with a Project can be assessed, and to allow suitable mitigation and monitoring to be identified.</p> <p>The region and general area have been studied for various projects and assessments. This literature was available to be referenced. The Project site-specific area has been studied as part of the ESIA process, and the following has been conducted as part of this assessment:</p> <ul style="list-style-type: none"> <li>• Field surveys</li> <li>• Desktop studies</li> <li>• Consultation with stakeholders</li> <li>• Specialist field visits, and ongoing studies</li> </ul> <p>The environmental and social baselines are provided in Chapter 5 of this report.</p>  |

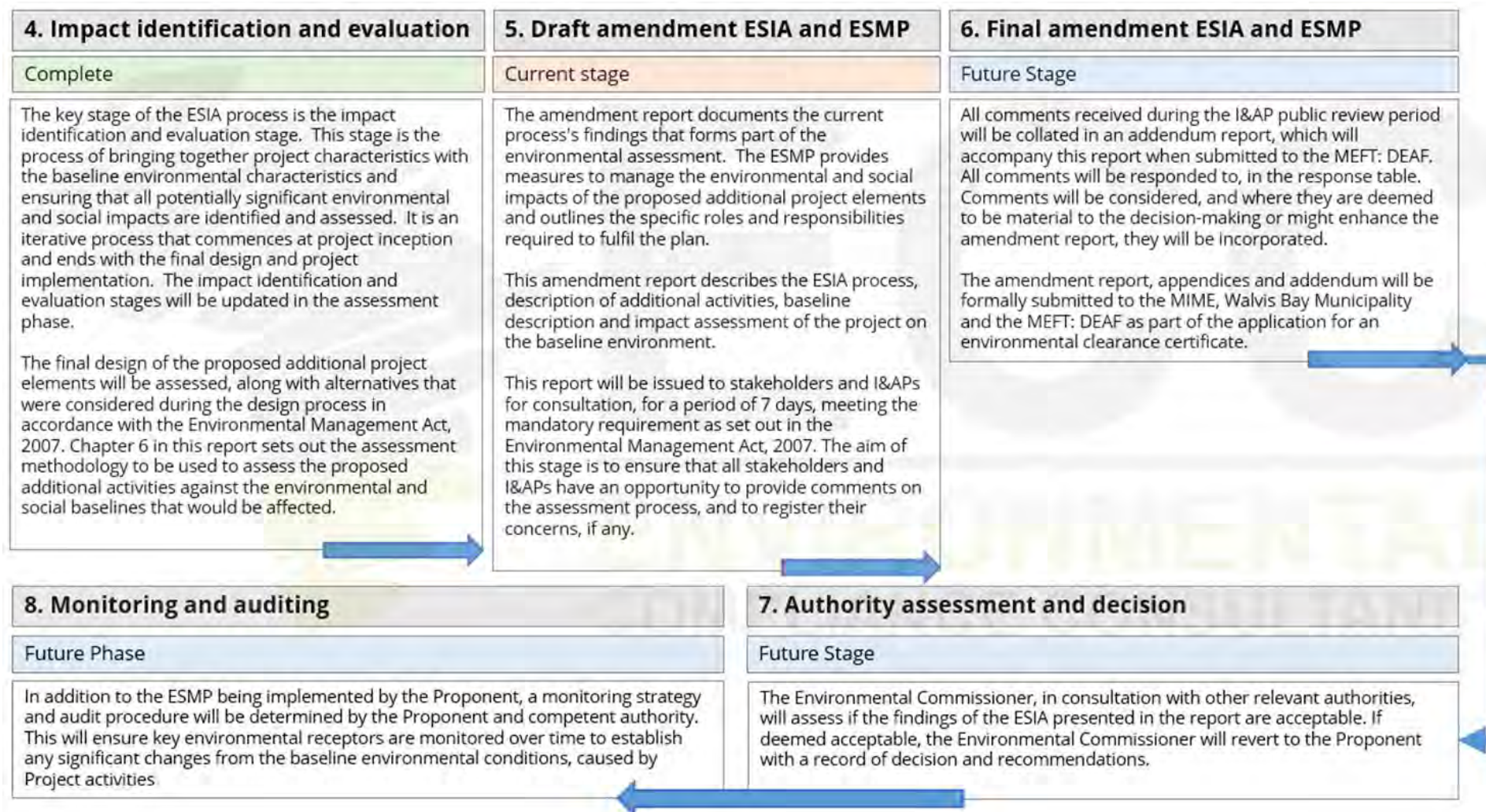


**Figure 2 - ECC ESIA method**

## 2.3 STUDY AREA

The study area for the amendment assessment was defined according to the geographic scope of the receiving environment and potential impacts that could arise as a result of the proposed additional infrastructure developments on-site (

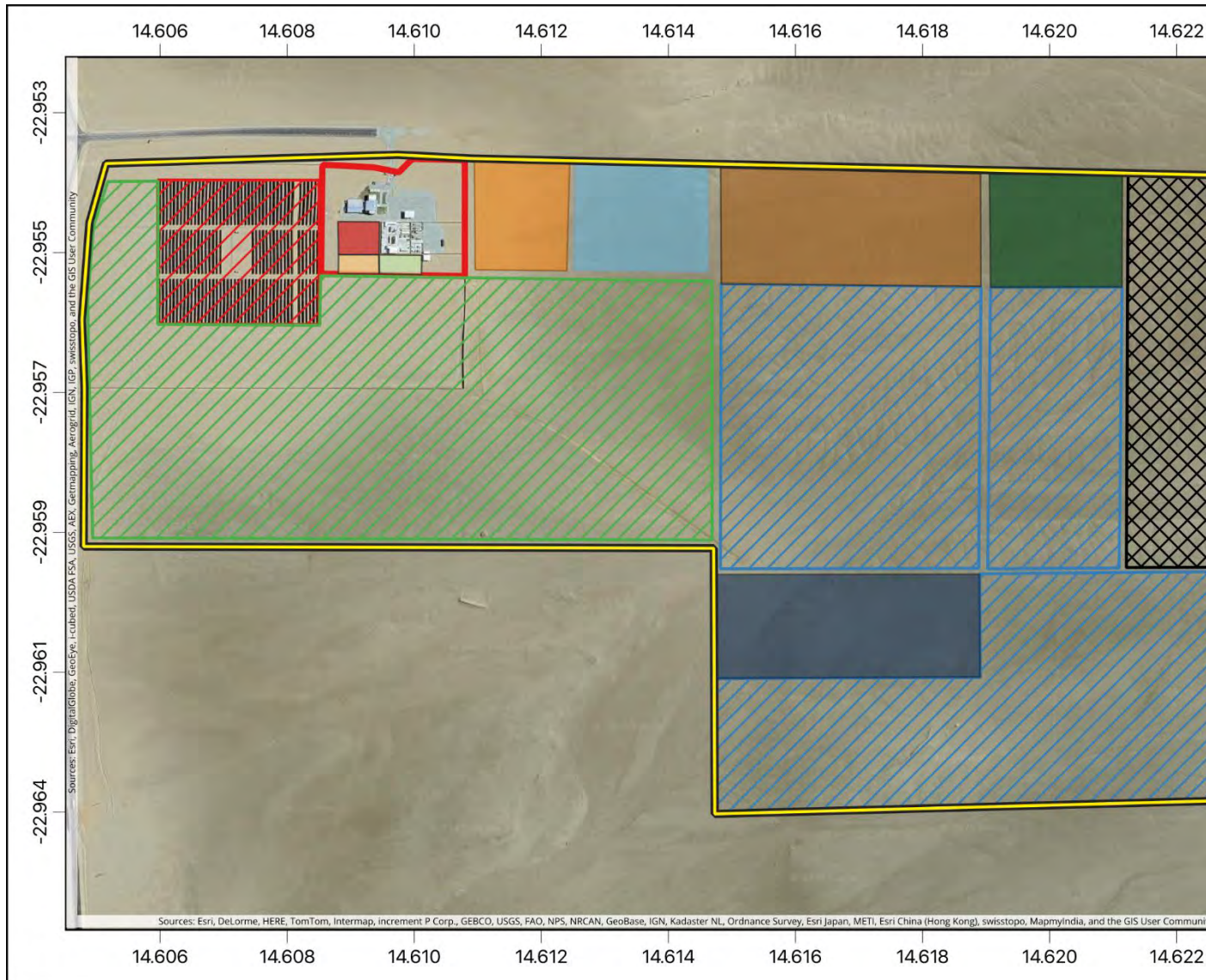


Figure 6 in chapter 4). The receiving environment is a summary term for the biophysical and socio environment that is described in the baseline chapter (chapter 5). The study area focuses on Portion 8 of Farm 58, as well as nearby receptors such as Dune 7 Adventures (~1 km south west of the site), the Walvis Bay International Airport (~2.5 km southeast of the site) and the Rooikop Army Base (~4 km southeast of the site).

## 2.4 PUBLIC CONSULTATION

Public participation and consultation are requirements stipulated in Section 21 of the Environmental Management Act, No. 7 of 2007 (EMA) and its 2012 Regulations, for projects requiring a new environmental clearance certificate. However, where an application relates to the renewal and/or amendment of an existing environmental clearance certificate, the

Regulations do not necessarily require a full public participation process, unless deemed necessary by the competent authority.

The objectives of the public participation and consultation process are to:

- Provide information on the Project, and introduce the overall Project concept and plan to the key stakeholders and interested and affected parties (I&APs);
- Determine the relevant government, regional and local regulating authorities;
- Listen to and understand community issues, record concerns, and questions;
- Explain the process of the ESIA and timeframes involved; and
- Establish a platform for ongoing consultation.

The Proponent is applying for this renewal and amendment in accordance with section 39 of the EMA. As per the requirements for a renewal and an amendment, the Environmental Commissioner may only amend a condition of an environmental clearance certificate under this section if he or she is satisfied that the amendment will not have a significant effect on the environment and the interests of any other person are not adversely affected. All identified stakeholders I&APs were notified of this amendment application through a stakeholder letter distributed via email on 12 August 2025 (Appendix D ). The I&APs were also invited to submit written comments, questions or concerns regarding the proposed additional on-site infrastructure developments. In accordance with Section 44 of the EMA, this final amendment report was communicated and made available to all stakeholders and I&APs for a public review period of 14 days from 11 May 2026 to 25 May 2026 prior to finalisation and submission to MIME, Walvis Bay Municipality and MEFT for a record of decision (RoD).

#### 2.4.1 IDENTIFICATIONS OF KEY STAKEHOLDERS AND INTERESTED AND AFFECTED PARTIES

A stakeholder mapping exercise was undertaken to identify individual stakeholders or groups of stakeholders. A summarised list of stakeholders that will be engaged during the public consultation process for this amendment are listed below:

- Neighboring businesses (Dune 7 Adventures);
- Affected and surrounding;
- Dorob National Park;
- Namib Naukluft Park;
- The general public with an interest in the Project;
- Rooikop Army Base;
- Ministry of Environment, Forestry, and Tourism (MEFT);
- Ministry of Industries, Mines and Energy (MIME);
- Ministry of Agriculture, Fisheries, Water and Land Reform (MAFWLR);
- Ministry of Defense and Veteran Affairs (MoDVA);
- Walvis Bay International Airport (WBIA);
- Erongo Regional Council (ERC);
- Walvis Bay Town Council; and

- Walvis Bay Municipality (WBM).

### **3 REVIEW OF THE LEGAL ENVIRONMENT**

This chapter outlines the regulatory framework applicable to the proposed amendment. An environmental clearance certificate is required for any activity listed in the Government Notice No. 29 of 2012 of the EMA. The Proponent currently holds a valid environmental clearance certificate for the GHDP (Appendix B ). The proposed Project is bounded by environmental protected areas (i.e. Dorob National Park). Therefore, a comprehensive impact assessment is undertaken to assess the significance of potential impacts that may be triggered by the amendment application.

A thorough review of the relevant legal legislation has been conducted for the proposed amendment. Table 4 details the current licences and permits held by the Proponent, Table 5 lists the relevant legal requirements specific to the Project, Table 6 details the national policies and plans relevant to the Project and Table 7 details the permits and licences relevant to the Project.

### 3.1 CURRENT AND VALID LICENCE AND PERMITS

**Table 4 - The current and valid permits held by the Proponent**

| Permit/licence/certificate/consent                                         | Authority | Issue date    | Expiry date   | Validity        | Status                   |
|----------------------------------------------------------------------------|-----------|---------------|---------------|-----------------|--------------------------|
| Environmental clearance certificate for the GHDP                           | MEFT      | 14 March 2023 | 14 March 2026 | Three (3) years | Issued and valid         |
| Heritage consent for activities at the Project site (Portion 8 of Farm 58) | NHC       | 13 March 2023 | 13 March 2024 | One (1) year    | Expired, pending renewal |

### 3.2 NATIONAL REGULATORY FRAMEWORK

**Table 5 - Details of the regulatory framework as it applies to the amendment**

| National regulatory framework                                                                                                                                      | Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Applicability to the amendment                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Environmental Management Act, 2007 (Act No. 7 of 2007) and associated regulations, including the Environmental Impact Assessment Regulation, 2007 (No. 30 of 2011) | <p>The Environmental Management Act (EMA) (7 of 2007) has been compiled and is regulated by the Ministry of Environment, Forestry and Tourism (MEFT). This Act was gazetted on 27 December 2007 (Government Gazette No. 3966) and the Environmental Impact Assessment Regulations: Environmental Management Act, 2007 (Government Gazette No. 4878) were promulgated on 6 February 2012.</p> <p>Section 39 of the Environmental Management Act, 2007 states that the Environmental Commissioner may amend a condition of an environmental clearance certificate;</p> | This amendment report is undertaken in accordance with the requirements under the Act, its regulations and IFC standards. |

| National regulatory framework              | Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Applicability to the amendment                                                                                                                                                                                                                                     |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            | <ul style="list-style-type: none"> <li>- If the certificate holder consents to or requests an amendment or</li> <li>- At the initiative of the Environmental Commissioner, by giving written notice to the holder of the certificate</li> </ul> <p>The Environmental Commissioner may require the holder of the environmental clearance certificate to make an application in the prescribed form and manner to the Environmental Commissioner for the proposed amendment.</p> <p>Requires that projects with significant environmental impact be subject to an environmental assessment process (Section 27).</p> <p>In terms of this legal framework certain identified activities may not commence without an environmental clearance certificate - a certificate that is issued by MEFT. This environmental clearance can only be granted after consideration of an ESIA.</p> |                                                                                                                                                                                                                                                                    |
| The Regional Councils Act (No. 22 of 1992) | This Act sets out the conditions under which Regional Councils must be elected and administer each delineated region. From a land use and project planning point of view, their duties include, as described in section 28 “to undertake the planning of the development of the region                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The Project site falls within the jurisdiction and development planning framework of the Erongo Regional Council. Accordingly, the Council, along with other relevant governing authorities in the region (Walvis Bay Municipality), has been duly notified of the |

| National regulatory framework                                                                                            | Summary                                                                                                                                                                                                                                                                                                                                                                                                      | Applicability to the amendment                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                          | <p>for which it has been established with a view to physical, social, and economic characteristics, urbanisation patterns, natural resources, economic development potential, infrastructure, land utilisation pattern and sensitivity of the natural environment.</p> <p>The main objective of this Act is to initiate, supervise, manage and evaluate development.</p>                                     | <p>amendment application and will be granted a seven (7)-day period to review the final documentation.</p>                                                                                                                                                                                                                                                                |
| Water Resources Management Act (Act No. 11 of 2013) and associated Water Resource Management Regulations, No. 269 (2023) | <p>Regulation 66 (1) states that a person who intends to apply for a licence under section 72 of the Act must apply to the Executive Director on a form approved by the Minister. The form is obtainable from the offices or official website of the Ministry. (Sections 66(1)) and Section 67 of the Regulations requires effluent discharge to comply with the water quality standards of Annexure 11.</p> | <p>The Proponent shall ensure that untreated water effluents are contained and removed by a licensed service provider.</p>                                                                                                                                                                                                                                                |
| Hazardous Substances Ordinance, No. 14 of 1974                                                                           | <p>This Ordinance provides for the control of toxic substances and can be applied in conjunction with the Atmospheric Pollution Prevention Ordinance, No. 11 of 1976.</p> <p>This applies to the manufacture, sale, use, disposal, and dumping of hazardous substances, as well as their import and export.</p>                                                                                              | <p>There will be facilities for the storage and handling of dangerous goods:</p> <ul style="list-style-type: none"> <li>- The alkaline electrolyser loop is filled with potassium hydroxide (KOH);</li> <li>- There is an existing hydrogen storage;</li> <li>- Production (4 mtpd) and storage (50 mt) of ammonia; and</li> <li>- LPG tank as fuel for flare.</li> </ul> |

| National regulatory framework          | Summary                                                                                                                                                                                                                                                                                                                                                       | Applicability to the amendment                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| National Heritage Act, No. 27 of 2004. | <p>The Act provides for the protection and conservation of places and objects of heritage significance and the registration of such places and objects. It also makes provision for archaeological impact assessments.</p> <p>If applicable, the relevant permits must be obtained before disturbing or destroying a heritage site as set out in the Act.</p> | The 2022 heritage impact assessment conducted by Dr. Alma Nankela, found that the current development poses no threats to the heritage resources. Therefore, it was recommended that a consent relevant to the provisions of the National Heritage Act, (27 of 2004) is issued to the Proponent. The Proponent is advised to renew the consent issued by NHC on 13 March 2023 and adopt a chance find procedure throughout the Project lifespan. |
| Labour Act, No. 11 of 2007             | The Labour Act, No. 11 of 2007 (Regulations relating to the Occupational Health & Safety provisions of Employees at Work promulgated in terms of Section 101 of the Labour Act, No. 6 of 1992 - GN156, GG 1617 of 1 August 1997)                                                                                                                              | The Proponent should ensure the safety and welfare of employees throughout the Project development framework.                                                                                                                                                                                                                                                                                                                                    |

### 3.3 NATIONAL POLICIES AND PLANS

**Table 6 - Namibian national policies and plans applicable to the amendment**

| Policy or plan | Summary                                                                                                                                                                             | Applicability to the amendment                                                                                                                                                                                                                                                                                                                                  |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vision 2030    | Vision 2030 sets out the nation's development programmes and strategies to achieve its national objectives. It sets out eight (8) themes to realise the country's long-term vision. | The overall Project promotes sustainable industrialisation, energy independence and environmental stewardship. These projects drive economic diversification, attract foreign investment, and create skilled employment opportunities while utilising the country's abundant solar and wind resources to reduce greenhouse gas emissions (carbon footprint). In |

| Policy or plan                         | Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Applicability to the amendment                                                                                                                                                                                                                                  |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                        | Vision 2030 states that the overall goal of the vision is to improve the quality of life of the Namibian people to a level in line with the developed world.                                                                                                                                                                                                                                                                                                                                                                               | addition, they enhance Namibia's energy security, position the country as a regional leader in clean energy production, and contribute to global climate change mitigation efforts in line with Vision 2030's goals for sustainable development and prosperity. |
| Sixth National Development Plan (NDP6) | <p>The NDP6 is the sixth plan in the series of seven five-year national development plans that outline the objectives and aspirations of Namibia's long-term vision as expressed in Vision 2030.</p> <p>There are four pillars on which NDP6 is built, these are:</p> <ul style="list-style-type: none"> <li>– Economic growth, transformation and resilience;</li> <li>– Human development and community resilience;</li> <li>– Environmental sustainability; and</li> <li>– Effective governance and public service delivery.</li> </ul> | The Proposed amendment Project will support the achievement of the set targets through inclusive economic growth, strengthening institutions to improve livelihoods and the use of renewable energy.                                                            |
| Namibia's Green Plan, 1992             | Namibian has developed a 12-point plan for integrated sustainable environmental management to ensure a safe and healthy environment and to maintain a viable economy. Clause 2 (f) makes specific mention to guidelines related to sustainable development.                                                                                                                                                                                                                                                                                | The Proponent is committed to implementing best industrial practices to ensure the sustainable use of the country's renewable resources, the protection of a safe and healthy environment and the promotion of a prosperous economy.                            |
| Draft Gas Bill, 2001                   | The draft Gas Bill aims to promote the establishment of a gas transportation and distribution network in Namibia for the purpose of domestic supply and for export; to establish a framework of licensing of the gas industry and a national gas regulator to monitor the performance of licence                                                                                                                                                                                                                                           | The Gas Bill has not been enacted, however, the Proponent is cognisant of the requirements and will comply with the conditions related to the transportation, storage, distribution and trading of ammonia/hydrogen.                                            |

| Policy or plan                                            | Summary                                                                                                                                                                                                                                                                                                                                                                                                                                              | Applicability to the amendment                                                                                                                                                               |
|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                           | conditions and promote reliability of services; to ensure safety, efficiency and environmental responsibility in the transportation and distribution of natural gas; to facilitate investment in pipeline infrastructure by private, public, municipal and mixed owned enterprises. The draft bill also aims to promote a competitive market in gas in the long term, and to stimulate cross-border trade in gas between Namibia and its neighbours. |                                                                                                                                                                                              |
| Pollution Control and Waste Management Bill (draft), 1999 | This draft bill aims to promote sustainable development by regulating the discharge of pollutants into the air, land and sea. Additionally, the draft bill aims to ensure that Namibia has an integrated waste management approach and complies with international legislation.                                                                                                                                                                      | The Proponent will ensure that all pollutants are appropriately contained and managed in accordance with best practices and regulatory requirements.                                         |
| The Green Paper for the Coastal Policy of Namibia         | The Green Paper provides an outline of the key findings of a long-term study on the conservation and management of the Namibian coast. It sets out the coastal policy and the vision for the coast, as well as principals, goals and objectives for coastal governance. It also presents the options for institutional and legal arrangements towards implementing the emerging Namibia Coastal Policy options for coastal governance in Namibia.    | The Proponent will comply with the policy by promoting development activities that are environmentally, socially, and economically sustainable, while protecting fragile coastal ecosystems. |

### 3.4 NATIONAL PERMITS AND LICENCES

**Table 7 - Permits and licences relevant to the Project**

| Permit or licence                                 | Act / Regulation                            | Related activities requiring permits / licence                                                                                                           | Relevant Authority                                                                                            |
|---------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Environmental clearance certificate               | Environmental Management Act, No. 7 of 2007 | Required for all listed activities shown in Table 2 in chapter 1.                                                                                        | Ministry of Environment, Forestry and Tourism (MEFT): Department of Environmental Affairs and Forestry (DEAF) |
| Renewal application for National Heritage Consent | National Heritage Act, (27 of 2004)         | Submit progress report on whether any archaeological/cultural objects have been unearthed during current operations and renewal application for consent. | National Heritage Council (NHC)                                                                               |

## 4 PROJECT DESCRIPTION AND PROPOSED PROJECT AMENDMENTS

### 4.1 CURRENT ACTIVITIES

The current environmental clearance certificate was issued for the following Project activities:

- Solar photovoltaic (PV) plant with an output of five (5) megawatt peak (MWP) with tracker configuration covering an area of fifteen (15) hectares (ha);
- A five (5) MW polymer electrolyte membrane (PEM) electrolyser (electrolyser systems with a capacity of producing 90 kg of hydrogen per hour);
- One (1) hydrogen generation alkaline electrolyser system with a capacity of 100-300 KW/2-6 kg/h;
- Compressor(s) with a combined capacity of 135 kg/h (1500 Nm<sup>3</sup>/h) at 40 bar inlet pressure to densify the hydrogen gas for storage;
- Hydrogen buffer and storage tanks:
  - o Low pressure hydrogen buffer tank at forty (40) bar with a volume of forty (40) m<sup>3</sup>.
  - o Medium pressure hydrogen storage tank at 300 bar.
  - o High pressure hydrogen buffer storage tank at 500 bar for distributing hydrogen for refuelling heavy duty vehicles and filling Multiple Element Gas Container (MEGC) trailers.
- Hydrogen fuelling station;
- Information centre/building (hydrogen academy);
- Access road; and
- Water pipeline connection from the existing Namibia Water Corporation (NamWater) pipeline network.

Further information related to the current project can be viewed in the original EIA report (Appendix C ). This report will now only focus on the amendment activities and their associated impacts.

### 4.2 PROPOSED AMENDMENT ACTIVITIES

Four (4) key enhancements (Figure 5) are proposed to scale up operations; these are as follows:

- Alkaline electrolysis unit (Figure 3)
  - o The alkaline electrolyser unit that will be installed is a system that uses electricity to split water (H<sub>2</sub>O) into its constituent elements (H<sub>2</sub> and O<sub>2</sub>).
  - o The equipment to be added includes a new alkaline electrolyser (5 MW), which will produce hydrogen during daylight hours using a 30% potassium hydroxide (KOH) solution, with an integrated lye tank (KOH) for electrolyte management.
- Ammonia plant (Figure 4)

- The ammonia plant, which will operate on a 24/7 schedule, will convert hydrogen (from electrolysis) and nitrogen (extracted from air) into four (4) metric tons per day (MTPD) of green ammonia, stored at 10 bar pressure in a ~50-ton capacity tank. A flare system will safely handle occasional gas purges (~1x/month).
- Renewable energy expansion
  - An additional 95 MWp capacity will be added to the solar park (using existing panel technology) as well as a 224 MWh lithium iron phosphate (LFP) battery system (liquid-cooled).
  - This enhancement will power nighttime ammonia production and terminal operations which will ensure continuous output.
- Auxiliary systems
  - Demineralised water production, cooling water units, nitrogen generation unit and effluent management systems will all be added to support the alkaline electrolysis and ammonia production system.

Figure 5 provides the layout of the interaction between the four (4) key components within the overall process.

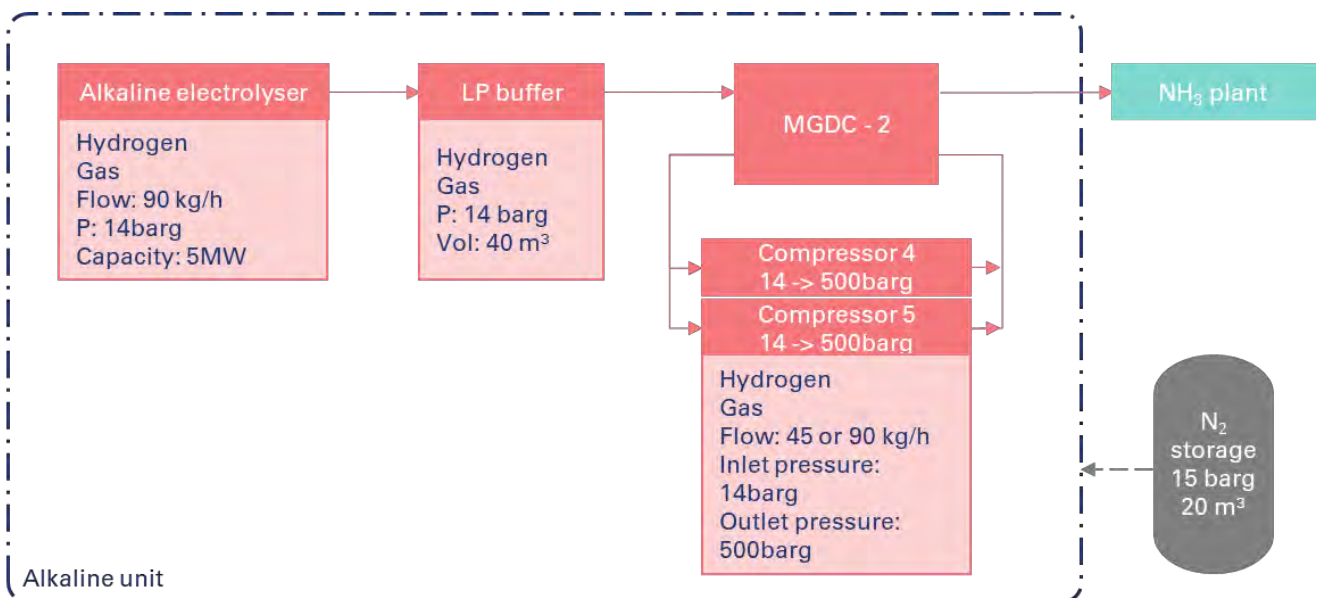


**Figure 3 - Illustration of the Alkaline unit to be added (Source: CMB.TECH, 2025)**

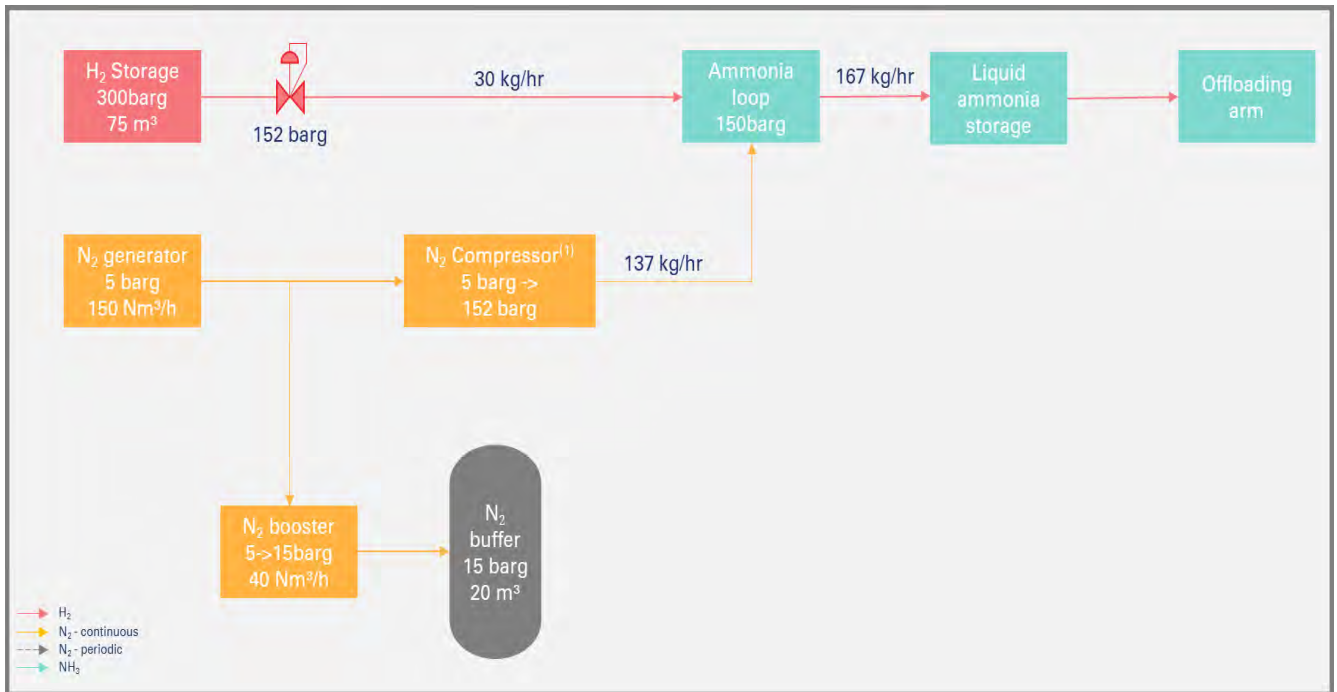


**Figure 4 – High-level block diagram of the ammonia plant to be added (Source: CMB.TECH, 2025)**

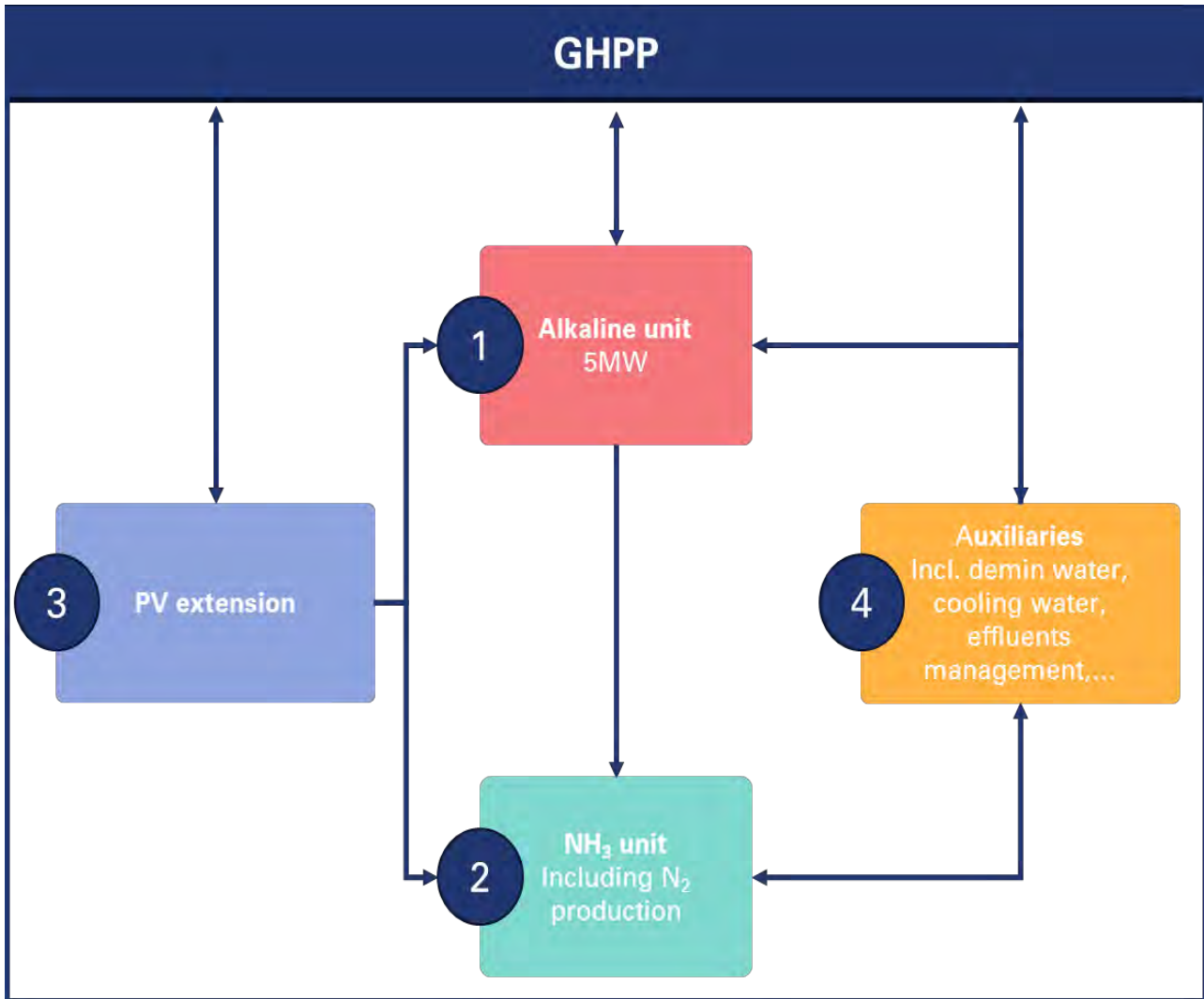


**Figure 5 - Interactions between the four key enhancements (Source: CMB.TECH, 2025)**

The site layout over Portion 8 of Farm 58 and the specific area which will be impacted by the amendments are illustrated in

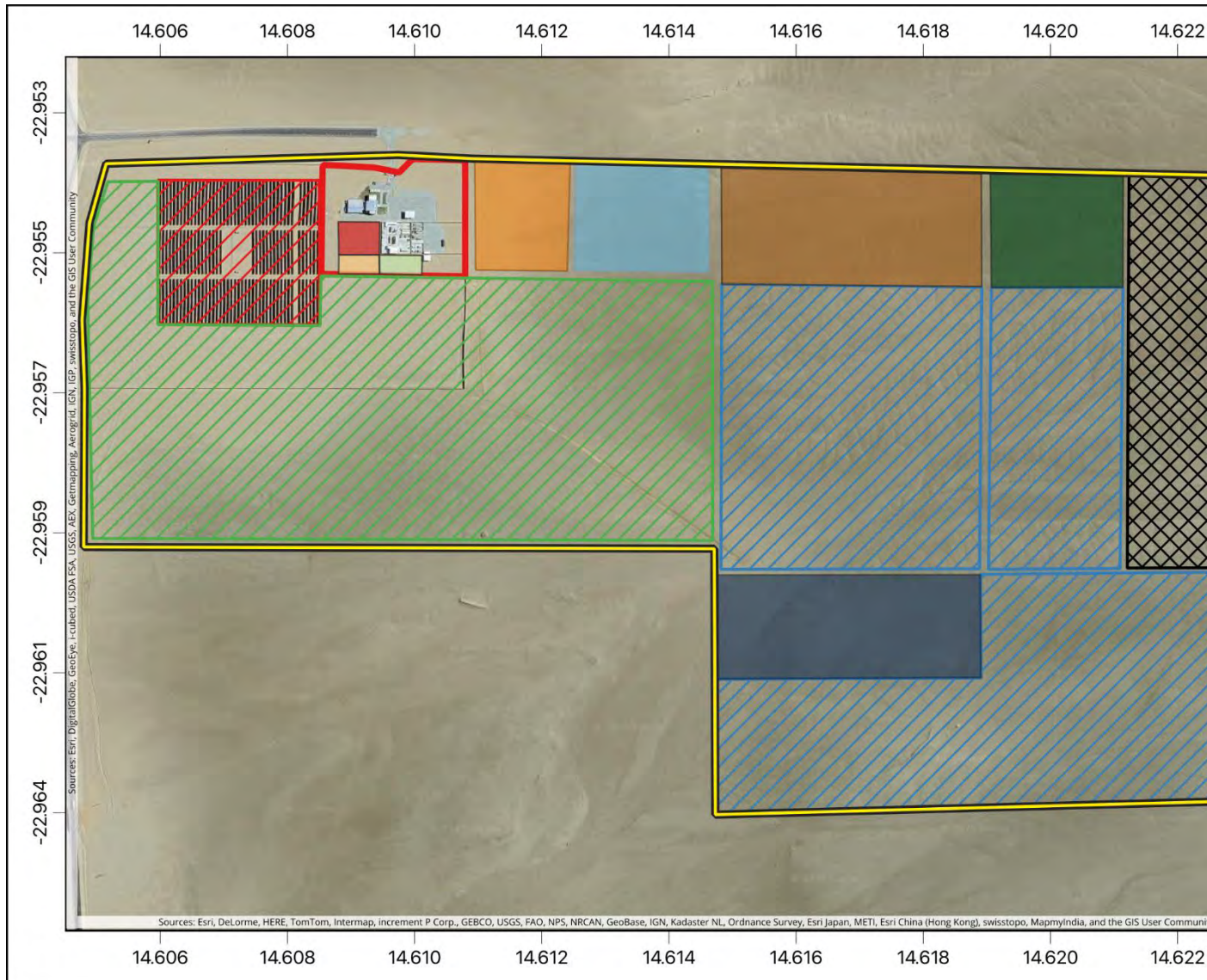


Figure 6.

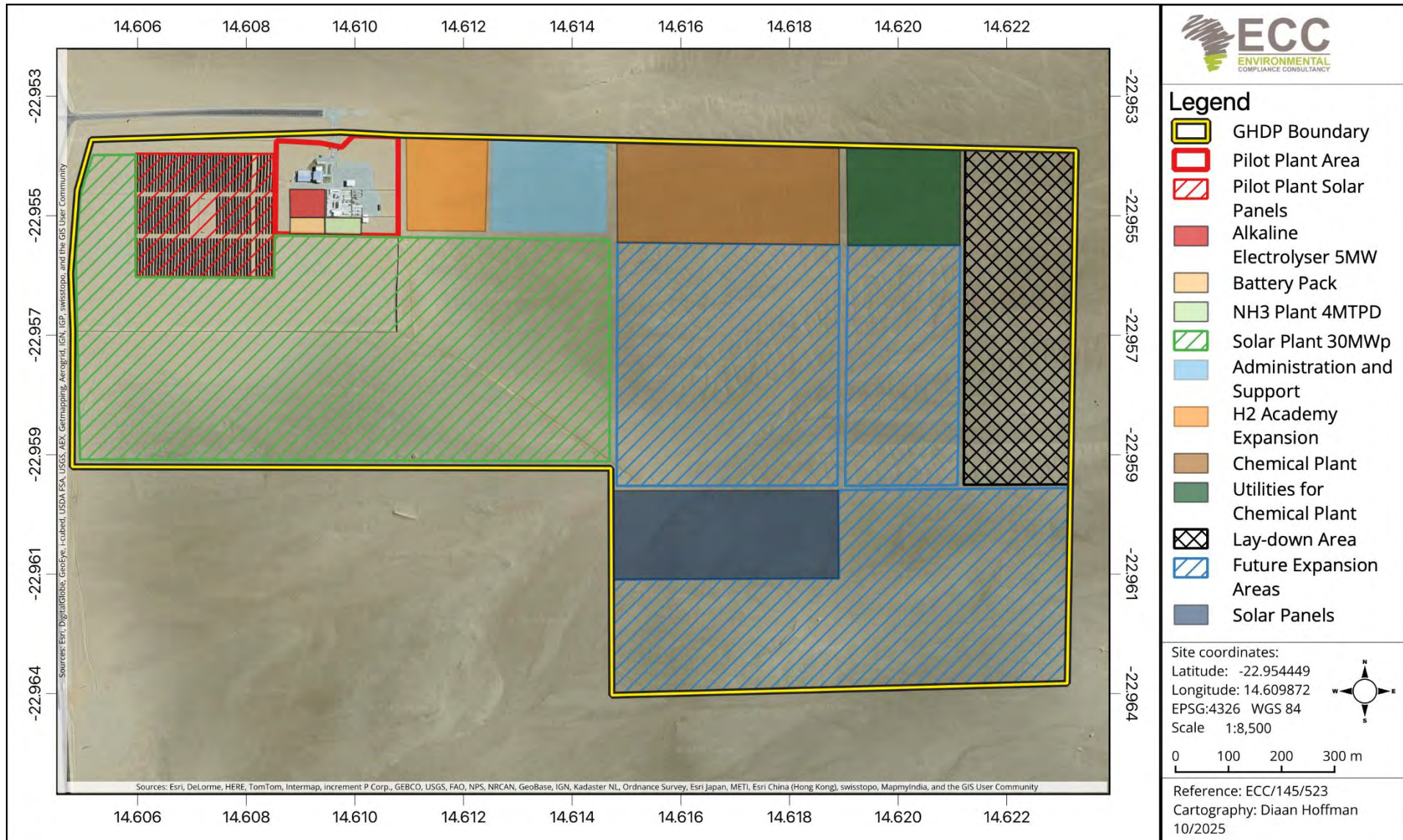


**Figure 6 - Site development plan which includes the proposed enhancements (Source: CMB.TECH, 2025)**

## 5 ENVIRONMENTAL AND SOCIAL BASELINE

### 5.1 BASELINE DATA COLLECTION

This chapter outlines the desktop study findings for the Project, based on a review of literature, spatial data and publicly available reports regarding the biophysical and socio-economic environment of the Project area. Additionally, the specialist studies shown in Table 8 were commissioned and completed to update the baseline conditions of the Project environment.

**Table 8 - Specialist studies that were completed for the amendment project**

| Study area                | Purpose                                                                                                                                                                                                                                                                                                                                                                    | Specialist name                                                                                                                        |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Biodiversity              | <ul style="list-style-type: none"> <li>– To evaluate the biophysical aspects specifically vertebrate fauna and flora relevant to the Project; and</li> <li>– The assessment will further determine the significance of any amendments in terms of potential developmental and environmental impacts on the vertebrate fauna and flora within the proposed site.</li> </ul> | <ul style="list-style-type: none"> <li>– Dr. Peter Cunningham (Environment &amp; Wildlife Consulting, Namibia) (Appendix E)</li> </ul> |
| Surface and groundwater   | <ul style="list-style-type: none"> <li>– Assess the direct, indirect and cumulative impacts of the development on surface hydrology and geohydrology due to the proposed amendment; and</li> <li>– Anticipated impacts associated with the above assessment findings and develop mitigations and management recommendations.</li> </ul>                                    | <ul style="list-style-type: none"> <li>– Mr. Luke Towers (ECC) (Section 5.4.4 and 5.4.5)</li> </ul>                                    |
| Socio-economic            | <ul style="list-style-type: none"> <li>– To assess the impact of the proposed Project amendment on the current socio-economic state of the locals and impacts on a regional and national scale.</li> </ul>                                                                                                                                                                 | <ul style="list-style-type: none"> <li>– Ms. Brigit Loots (Section 5.3)</li> </ul>                                                     |
| Visual and sense of place | <ul style="list-style-type: none"> <li>– Assessment will include an evaluation of the visual impacts and their potential effects on local tourism enterprises, surrounding businesses and residential areas.</li> </ul>                                                                                                                                                    | <ul style="list-style-type: none"> <li>– Ms. Kelly Ochs (ECC) (Section 5.2.3)</li> </ul>                                               |

## 5.2 SOCIO-ECONOMIC BASELINE ENVIRONMENT: SOCIAL

### 5.2.1 AIR QUALITY

Air quality in Walvis Bay is generally considered stable based on the Air Quality Index (AQI) and the primary pollutant, PM<sub>2.5</sub>, and PM<sub>10</sub> which complies with the World Health Organisation's (WHO) annual guideline of 37.5 µg/m<sup>3</sup> and 75 µg/m<sup>3</sup>, respectively (Airshed Planning Professionals, 2024). Although the proposed Project area is bordered by existing infrastructure, such as roads and the airport, which may contribute to minor reductions in air quality, there are limited other developments nearby.

During construction of the proposed amendments to the Cleanergy GHDP Project, some dust generation may occur. However, given the current conditions in the area, any resulting impacts are anticipated to be minimal. The amendment (scoping plus impact assessment) phase will further examine the practical implications of these potential emissions, but due to the expected low significance, a dedicated air quality specialist study was not considered necessary. Air quality related impacts are further assessed in chapter 7 of this report.

### 5.2.2 NOISE

Existing noise sources in the area mainly derives from nearby roads and the Walvis Bay International Airport (WBIA). The Cleanergy GHDP currently operates without creating notable noise disturbances, and the planned modifications are not anticipated to noticeably alter the present noise conditions. Chapter 7 outlines how potential construction-related noise will be evaluated. Given that any effects are expected to be minimal, a dedicated noise specialist assessment was not considered necessary.

### 5.2.3 VISUAL

A visual impact assessment was carried out by InSite Landscape Architect (Bredell, 2022) for the initial environmental clearance certificate application. The broader setting around the Project area has already been altered by various human-made features, including transport infrastructure such as roads and bridges. Despite these modifications, the Dorob National Park and the iconic Dune 7 landscape stand out as a striking natural contrast to the surrounding development.

Dune 7 is recognised for its exceptional natural value and "irreplaceability" at local, regional, national, and international scales. As Namibia's tallest dune, reaching more than 383 metres and the seventh dune encountered after crossing the Tsauchab River, it has become a landmark of global tourism importance. Situated within the Dorob National Park, a protected area that spans roughly 1 600 km along the central coast, Dune 7 contributes significantly to the area's scenic and touristic appeal. The proposed Project site lies approximately 500 m east of the park boundary.

The visual sensitivity of the area is generally high due to the open and exposed nature of the landscape. The terrain to the east and south is predominantly flat with slight undulations, creating wide, unobstructed views. The natural dune formations to the west provide some visual buffering. Visual related impacts related to the amendment activities are further assessed in chapter 7 of this report.

#### 5.2.4 TRAFFIC

The GHDP near Walvis Bay, adjacent to the upgraded MR44 as shown in Figure 7, is expected to have minimal long-term traffic impacts due to low operational staff numbers and occasional hydrogen deliveries. Existing MR44 traffic consists of regional commuter and freight movements, and the dual carriageway provides sufficient capacity to accommodate additional operational trip. The current gravel salt road is being upgraded to a bitumen standard sealed road. Construction, however, may temporarily increase heavy vehicle and workforce traffic, creating short-term congestion and potential safety risks at the plant access and nearby local roads. Traffic related impacts related to the amendment activities are further assessed in chapter 7 of this report.

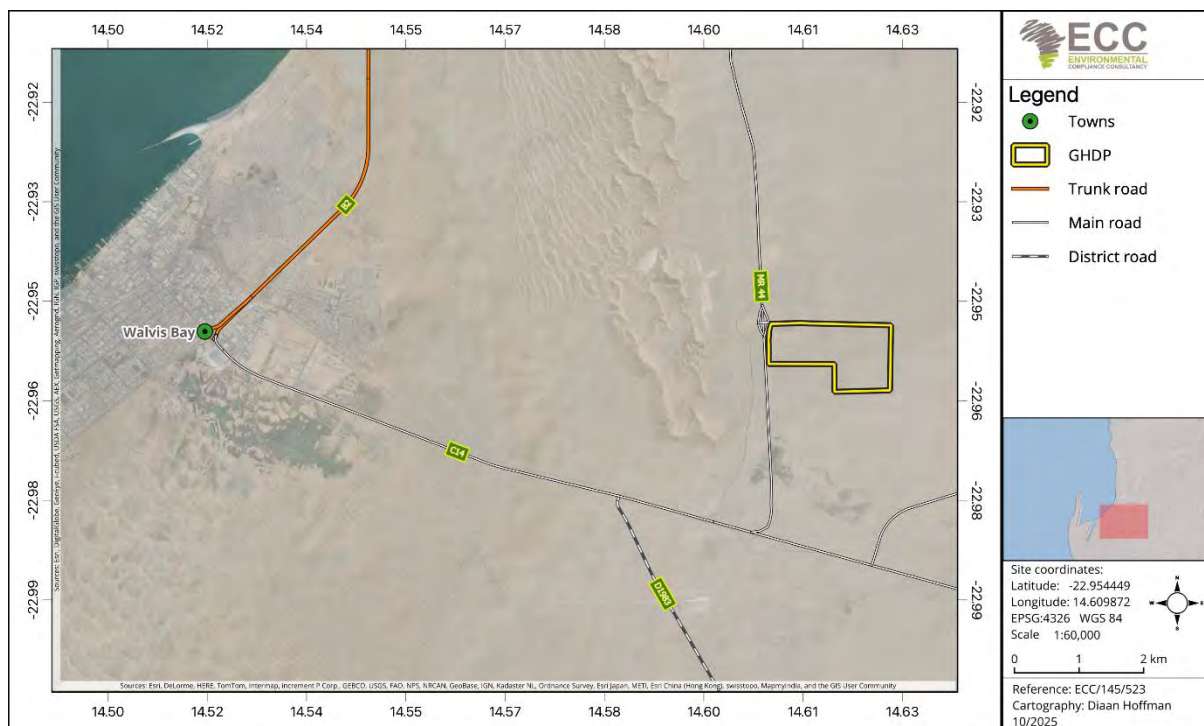


**Figure 7 - Site accessibility map**

#### 5.2.5 POPULATION AND GROWTH RATE

Namibia is one of the world's most sparsely inhabited countries, with a population of 3 022 401 recorded in the 2023 Population and Housing Census. In 1991, Namibia's population was approximately 1.4 million, with the Erongo region accounting for 55 470 people. Between 2011 and 2023, Namibia's population grew by around 3% annually, with urban areas

expanding by 65.5% compared to a 26.3% increase in rural populations (Windhoek Express, 2025). A significant population increase in 1994 followed the reintegration of Walvis Bay from South Africa. Growth between 2001 and 2011 was driven largely by industrialisation in coastal towns and expansion in mining activities. By 2011, the national population stood at 2 113 077 (Namibia Statistics Agency, 2011). The most recent census found the Erongo region to have a population of 240 206. Currently Erongo Region is the fifth most populated region in the country with a population density of 3.8 persons per km<sup>2</sup> (Namibia Statistic Agency, 2023).

According to Namibia's 2023 Population and Housing Census, Walvis Bay had a population of 102 704, up from 62 096 in 2011 and 22 999 in 1991. This reflects sustained rapid growth, with the town's population increasing more than fourfold since independence and expanding at an average annual rate of about 4% over the past three decades. Walvis Bay remains the largest urban centre in the Erongo region and a key driver of Namibia's coastal development.

#### *5.2.5.1 Age structure*

Namibia has a young population, with 66% of people below the age of 35 and 37% of the total population less than 15 years of age.

Erongo region has a distinctly urban profile, with nearly two-thirds of its population in the working-age groups (15 – 59 years). Children and young people (0 – 14) make up just under 30%, while the elderly account for only 5.8%, both lower than national and rural averages. This reflects Erongo region's role as an economic hub, attracting young adults for employment in mining, fishing, the port and tourism. The region's demographic structure places less pressure on child and elderly services compared to rural areas but creates a strong demand for jobs, housing and urban infrastructure to support its growing and predominantly working-age population.

#### *5.2.5.2 Sex composition*

In Namibia's overall population, women make up 51.2% and men 48.8%, giving a national sex ratio of 95 men for every 100 women.

Labour-driven demographic patterns have had a pronounced impact on the Erongo region's overall sex composition. According to the 2023 Population and Housing Census, the Erongo Region recorded a total population of 240 206 people, comprising 122 322 men (50.9 %) and 117 884 women (49.1 %), resulting in a sex ratio of approximately 104 men per 100 women. This represents a shift from the 2011 Census, which recorded about 93.6 men per 100 women.

The reversal of the sex balance over time, and the divergence from the national sex ratio reflect demographic and economic dynamics: the predominance of male labour migration into Walvis Bay, Swakopmund and other urban centres linked to mining, fishing and port industries; contrasted with the longer female life expectancy that typically favours a higher share of women in older age cohorts.

#### 5.2.5.3 Household characteristics

Average household size in Namibia, which has been on the decline since 1991, is 3.8 persons per household. The average household size in the Erongo region is at 3.1 persons per household (Namibia Statistic Agency, 2023). This is the lowest figure among Namibia's regions, shared by both Erongo and //Kharas.

Many households in the region are headed by men, accounting for 65.6%, with similar trends observed in Walvis Bay. In the Erongo region, most households (80%) relied on salaries or wages as their primary source of income. This was followed by income from business activities (5.5%), pensions (5.2%), and remittances or grants (5.0%). Subsistence farming was the main source of income for only 0.4% of households

#### 5.2.6 COMMUNITY HEALTH

Namibia's health services are twofold: private (serving approximately 18% of the population with medical aid) and public (serving the remaining 82%) (Christians, 2020). Public health falls under the Ministry of Health and Social Services (MoHSS), which operates a four-tiered health system, consisting of primary healthcare (PHC) sites, district hospitals, intermediate hospitals and a referral hospital (Christians, 2020). Overcrowding is common at hospitals due to higher quality of care compared to rural clinics. (Namibia Ministry of Health and Social Services, 2017).

##### 5.2.6.1 HIV/AIDS

Namibia has a generalised human immunodeficiency virus (HIV) epidemic, with an HIV prevalence of 8.3% in 2022. Among adults aged 25 and over, HIV prevalence is 19.3% in women and 12.3% in men (PEPFAR, 2023)

In 2015 it was reported that in the Erongo Region the HIV prevalence in women between ages of 15 and 49 was 14.6% and men between the same ages 10.4% (Namibia Ministry of Health and Social Services, 2015). The 2016 Ministry of Health Centennial Surveillance Survey confirmed Walvis Bay had a HIV/AIDS prevalence rate estimated at 17.6% and Swakopmund of 18.6% (the national prevalence rate stands at 17.2%). Both Swakopmund and Walvis Bay are above the national average; however, Walvis Bay has shown a noted decrease from previous surveys (29% in 2009) and Swakopmund has shown a significant increase from the 2015 survey (it was at 10.5%).

Walvis Bay is considered an HIV hotspot due to high migration, economic activity and concentrations of key populations, including commercial sex workers (CSWs), men who have intimate relations/sex with men (MSM) and truck drivers. Adult HIV prevalence in Walvis Bay was 17.6% in 2016, down from 28% in the early 2000s, likely reflecting the impact of targeted prevention interventions among key populations and adolescent girls and young women (AGYW). These targeted interventions were mostly funded by USAID which has now (in 2025) been drastically cut or discontinued.

#### 5.2.6.2 *Tuberculosis*

Tuberculosis (TB) is the fifth highest cause of death in Namibia. Those infected with HIV are about 25 times more likely to develop active TB. The Erongo region has a history of high numbers of TB cases, with about 5% of deaths in the Erongo Region caused by TB (NSA, 2020). Walvis Bay has historically experienced a high burden of tuberculosis (TB) cases in Namibia. This was also the first town during the COVID-19 pandemic where cluster infections were occurring. This may be due to the international harbour, various trucking companies and overcrowding in townships, whereby airborne diseases travel faster.

#### 5.2.6.3 *Reproductive health*

Reproductive health is directly tied to population dynamics, gender equality, health outcomes and social well-being. It frequently intersects with issues like gender-based violence (GBV), poverty, youth development and social cohesion.

The national adolescent pregnancy rate is at 19%. This means that one in five adolescent girls aged 15 to 19 years have been pregnant (UNFPA, 2020). Erongo has been reported to have one of the lowest teenage pregnancy rates among the regions; the lowest are Khomas (7.76%), Erongo (8.78%) and Oshana (9.6%). Unintended pregnancies among adolescent girls are an indication of the levels of risk to which they are exposed with regards to sexually transmitted diseases, including HIV. Adolescent girls are among the most vulnerable populations for HIV infection in Namibia. Some 30% of total new infections are among young women (15 - 24 years old) (UNAIDS, 2022). Teenage pregnancy is also an indicator of compromised safety for girls, reflecting their heightened exposure to gender-based violence, including sexual coercion and exploitation.

Sexual and reproductive health services in the Erongo region are compromised, as is the case in all the regions (especially in light of recent USAID health cuts). Walvis Bay does however have a district hospital, three state clinics and a multipurpose centre where women can access health services.

### 5.2.7 SOCIAL COHESION

#### 5.2.7.1 *Gender based violence*

Sexual and gender-based violence (SGBV) remains a persistent challenge in Namibia, with an increasing incidence of intimate partner violence, sexual violence and femicide. One in four young women in Namibia are survivors of intimate partner violence (Ministry of Health and Social Services and ICF International, 2014), while 86% of sexual and domestic violence survivors are women and 93% of perpetrators are men (Legal Assistance Centre, 2012). According to National Health Survey conducted by the Ministry of Health and Social Services in 2013, of all women aged 15 – 49 who reported having experienced any form of physical or sexual violence, only 14.9% of survivors sought help from the police. Fifteen (15) per cent sought no help at all. Of young men (age 15 - 19) who participated in the survey, 29.5% are

of the opinion that a husband is justified in beating his wife. A corresponding 28.3% of young women (age 15 - 19) agree. These statistics reveal not only the high levels of GBV found in Namibia but also the widespread acceptance and tolerance for it. There is widespread acceptance of corporal punishment and high levels of men-on-men violence in Namibia; both further indicative of a society where violence is seen as normal behaviour.

Many local non-government organisations (NGOs) and civil society organisations (CSOs), including Women's Action for Development in 2014, Women's Solidarity in 2019 and the #ShutItAllDown movement and coalition in 2020, have called upon the Namibian President to declare a state of emergency over high rates of violence against women.

The 2019 Namibia Violence against Children and Youth Survey (VACS) assessed the experiences of females and males ages 13 - 24 through a nationally representative sample of households. National figures found that among 18 - 24-year-olds, more than one in four females (28.7%) and three in ten males (30.4%) have experienced a form of violence - sexual, physical or emotional - in the past 12 months (VACS, 2019). Among 13 - 17-year-olds, more than one out of three females (34.2%) and males (35.5%) had experienced violence in the past 12 months. Furthermore, the survey found that, when considering sexual violence in childhood among 18 - 24-year-olds, about one in ten females (11.8%) and one in 13 males (7.3%) experienced sexual violence before age 18. Further, nearly one in four females (23.8%) and males (22.6%) experienced physical violence in childhood by a parent, caregiver or other adult relative.

According to local news sources, the Erongo region recorded 493 GBV cases, making it the second highest among Namibia's 14 regions in the 23/24 financial year (The Namibian, 2024). These figures highlight the urgent need for targeted interventions in Erongo to address GBV effectively. In response to the rising GBV cases, the Erongo Regional Government established the Erongo Regional Gender Permanent Task Force in September 2024. This initiative aims to coordinate efforts across various sectors to combat GBV, enhance support for survivors, and ensure accountability for perpetrators (Observer, 2024).

There are progressive laws and policies in place to protect Namibian women against GBV and intimate partner violence. The GBV Unit in Walvis Bay under the Ministry of Gender Equality and Social Welfare is active in protecting and supporting community members navigate the protection services available. Social workers stationed in Walvis and Swakopmund from both the Ministry of Gender Equality and from the Ministry of Health, can help women, men, families and children. In addition, LIFELINE CHILDLINE runs a national GBV Helpline that provides counselling and referral services for anyone who needs it. It is contactable at 116 or 106 toll free.

#### *5.2.7.2 Alcohol and drug abuse*

Alcohol and drug abuse is considered a major challenge in coastal towns but especially in Walvis Bay. This is due to easy access to drugs being illegally transported via the harbour.

The Coastal Drug Awareness Campaign (CODAC) is a local grassroots non-profit initiative that carries out awareness campaigns in Walvis Bay and other coastal towns. Studies have shown that migrant workers living far away from families and communities and on unusual shift schedules, with little to do in small industrial towns are vulnerable to alcohol and drug abuse (Maree, 2008). Walvis Bay has many migrant workers, both internal migrants from other parts of Namibia and foreign workers. This internal migration is driven by employment opportunities in the port, transport and fishing industries.

#### 5.2.8 CULTURAL HERITAGE

An archaeological and heritage specialist study was conducted for the initial Project environmental clearance certificate application in 2022 by Research Culture Heritage Services cc. A physical field examination revealed no significant nor sensitive heritage resources relevant in terms of the National Heritage Act, (No. 27 of 2004). The footprint of the of the amendment application will not change. Therefore, the findings of the previous study remain relevant to the amendment application. The chance finds plan is incorporated into the ESMP should discoveries of heritage remains be found during the project activities.

### 5.3 SOCIO-ECONOMIC BASELINE ENVIRONMENT: ECONOMIC

Farm 58 is located within the Walvis Bay Urban Constituency within the Erongo region. The Erongo region is situated on the central western area of Namibia and covers an area of 63 586 km<sup>2</sup>, which comprises 7.7% of Namibia's total area of about 823 680 km<sup>2</sup>. Walvis Bay is the second largest city in Namibia and contains the country's only deep-sea harbour with well-equipped infrastructure and port facilities. Due to its geographical location between the Namib Desert and the Atlantic Ocean, Walvis Bay is a strategic gateway for exports and imports between landlocked countries in Africa and the rest of the world (ICLEI - Local Governments for Sustainability, 2025).

#### 5.3.1 EMPLOYMENT

Namibia has a persistently high and increasing unemployment rate despite its upper-middle-income classification. The general unemployment rate according to the 2018 Namibia Labour Force Survey stood at 33.4% which increased to 36.9% in 2023. According to the 2023 Labour Force Report, Namibia's working-age population stood at 1 876 122, of which approximately 320 442 (17.1%) individuals were recorded as unemployed (Namibia Statistics Agency, 2024).

Notably, the Erongo region recorded the fourth lowest unemployment rates after //Kharas, Omaheke and Otjozondjupa regions, respectively (Namibia Statistic Agency, 2023). This is largely attributable to the region's economic opportunities, including prominent mining operations, the Walvis Bay Port and the fishing and tourism sectors. The region had an unemployment rate of 32%, which, while lower than the national average of 33.4%, still reflects significant labour market challenges. The unemployment rate for men in Erongo is 29.7% and 34.8% for women (Namibia Statistic Agency, 2023). This gender disparity is largely

attributed to the region's male-dominated sectors such as, port operations, fishing and mining which offer limited employment opportunities for women.

#### *5.3.1.1 Youth unemployment*

Youth unemployment nationally is higher than the national average (i.e. than overall unemployment). The 2023 Labour Force Report highlights that youth unemployment remains critically high, with estimates at 44.4%. Another recent source of data on youth unemployment comes from the Afrobarometer survey (April 2024, round 10). Survey findings support studies reporting an increase in youth unemployment over recent years, 58% of young people aged 26 - 35 years who participated in the study are unemployed and looking for employment. It is widely accepted that factors that contribute to unemployment rates are limited access to quality education, limited job creation in the formal sector and high dependency on the public sector.

The National Planning Commissions' Targeted Review Report on Youth Unemployment (2021), lists the problematic nature of Namibian education (access, equity, quality and efficiency) as one of the major factors contributing to high unemployment rates in Namibia. The re-admission and age-limit policy for junior secondary education in Namibia contributes to skills shortages. Many young people drop out of school at this level, joining the ranks of the unemployed with minimal qualifications. By their late 20s or early 30s, many remain unable to access vocational training institutions and are therefore excluded from opportunities for formal employment. According to the National Planning Commissions' Targeted Review Report (2021) on Youth unemployment, 35% of respondents have no formal education.

#### **5.3.2 POVERTY, FOOD SECURITY AND NUTRITION**

According to July 2024 Afrobarometer report, nearly two-thirds (64%) of Namibians experienced "moderate lived poverty" (39%) or "high lived poverty" (25%) during the previous year, indicating frequent deprivation of necessities.

According to the 2021 Namibia Multidimensional Poverty Index (MPI) report (NSA, 2021), 34.4% of children under five experience growth impairment (stunting), 16.6% suffer from food insecurity and a significant proportion are considered malnourished. The report also indicates that the Erongo is one of the regions with the lowest multidimensional poverty incidence, estimated at approximately 16%.

#### **5.3.3 EDUCATION**

Although some of the available education data for Erongo region is dated, it still provides useful insights into literacy, enrolment and school progression in the region.

Adult literacy is very high, with 96.7% of those aged 15+ literate. Rates are even higher in Walvis Bay Urban (98.9%). Among youth aged 15 – 24, literacy in Walvis Bay reached 99.3% (NSA, 2014a).

Early Childhood Development (ECD) enrolment is low at 24.2% for the region (27.8% in Walvis Bay Urban and 25.6% in Rural), with little gender difference and more children attending Educare than pre-primary (NSA, 2014a).

About 5.2% of Erongo regions residents aged six and above never attended school, compared to 2.7% in Walvis Bay Urban and 4.1% in Walvis Bay Rural. Nearly half of adults left formal education after completing primary. Overall school enrolment stood at 56.8% (58% Urban, 52% in Rural), with primary enrolment at 92% in both constituencies (NSA, 2014a).

School survival rates show strong retention at lower levels but significant drop-off at higher grades: 88.2% from primary to secondary (2018), 78.3% from Grade 9 to 10, and only 44.2% from Grade 11 to 12 (MEAC, 2020).

#### 5.3.4 NATIONAL AND LOCAL ECONOMY

The main economic activity in the area includes the Namibian port located in Walvis Bay, which happens to be Namibia's main industrial harbour. Along with the port, the fishing industry is also a large contributor to the local economy. Mining plays a critical role in the Erongo Region's economy, contributing significantly to employment, local business development, and national revenue. The area hosts some of Namibia's largest uranium mines, namely Rössing, Husab, and Langer Heinrich. Tourism in the Walvis Bay-Swakopmund area plays a vital role in the local economy. Lastly, another important factor that adds to the local economy is the presence of the Walvis Bay airport.

Green hydrogen is the production of hydrogen through electrolysis using renewable energies. Green hydrogen is useful in numerous industries including agriculture, automotive and the renewable energy industries. It is an important factor in transitioning to cleaner and more efficient energy systems globally. It is well-suited to the Walvis Bay area specifically as it is nearby to the port for shipping, seawater is available for the electrolysis process and there is a large amount of space and resources available to produce renewable energies.

### 5.4 BIODIVERSITY BASELINE ENVIRONMENT

#### 5.4.1 LAND USE

The GHDP is located on Farm 58, portion 8 which is a section of government-owned land positioned on the northern boundary of Walvis Bay, near Dune 7 and to the northwest of Walvis Bay International Airport as shown in Figure 8. The portion of land is leased by the Proponent for a period of 25 years. Farm 58 has been rezoned for industrial development and is considered a strategically favourable location due to its proximity to the Port of Walvis Bay, Namibia's primary deep-water harbour and a key logistics gateway for regional and international trade (NamPort, 2025). Planned future developments at Farm 58 encompass industry initiatives, sustainable green projects, and renewable energy installations.

The Project site is located adjacent to Dorob National Park, established in 2010, which encompasses the central Namib Desert and is approximately 7 800 km<sup>2</sup>. It is bounded to the north by the Ugab River and the Skeleton Coast Park. Natural features in the park includes the Atlantic coastline, gravel plains, sandy beaches with dune hummocks and a variety of lichens (MEFT, 2025).



**Figure 8 - Project locality and stakeholder map**

#### 5.4.2 CLIMATE

The Erongo region lies within the arid west coast zone of southern Africa and experiences a harsh climate characterised by low precipitation, extreme temperature fluctuations and unique environmental conditions that shape its biodiversity. Dust storms occur sporadically, particularly during the austral autumn and winter, driven by easterly winds that carry fine particles westwards across Namibia toward the Atlantic Ocean (Liebenberg-Enslin *et al.*, 2017). These events are associated with descending air, which reduces air pressure due to the expansion of vertical air columns, and triggers warm, dry berg-wind conditions through adiabatic heating. While these easterly winds can be intense, hot, and uncomfortable, they are generally short in duration (Liebenberg-Enslin *et al.*, 2017). The climate and weather data used in the write up of this baseline were sourced from the Meteoblue (2024), Atlas of Namibia: its land, water and life (2022), along with desktop QGIS data for the Project study area.

##### 5.4.2.1 Temperature

The Project area is characterised by cool temperatures with average annual temperatures ranging between 16 - 18°C. This shows that the mild temperatures experienced in this region

are due cold air and winds from the Atlantic Ocean onshore (Atlas of Namibia team, 2022) (Figure 9). Warm average temperatures between the months of February to May with average maximum temperatures of 28°C during these months. While winter months are cooler with the lowest temperatures recorded in between June and October at a mean daily minimum of 11°C.

#### 5.4.2.2 Rainfall

Considering that the Project is located in the Namib Desert, the area receives very little annual rainfall ranging between 0 mm – 10 mm annually. The rainy season where most rainfall occurs is between the months of December and April can receive up to ~12 mm of rain as shown in Figure 9.

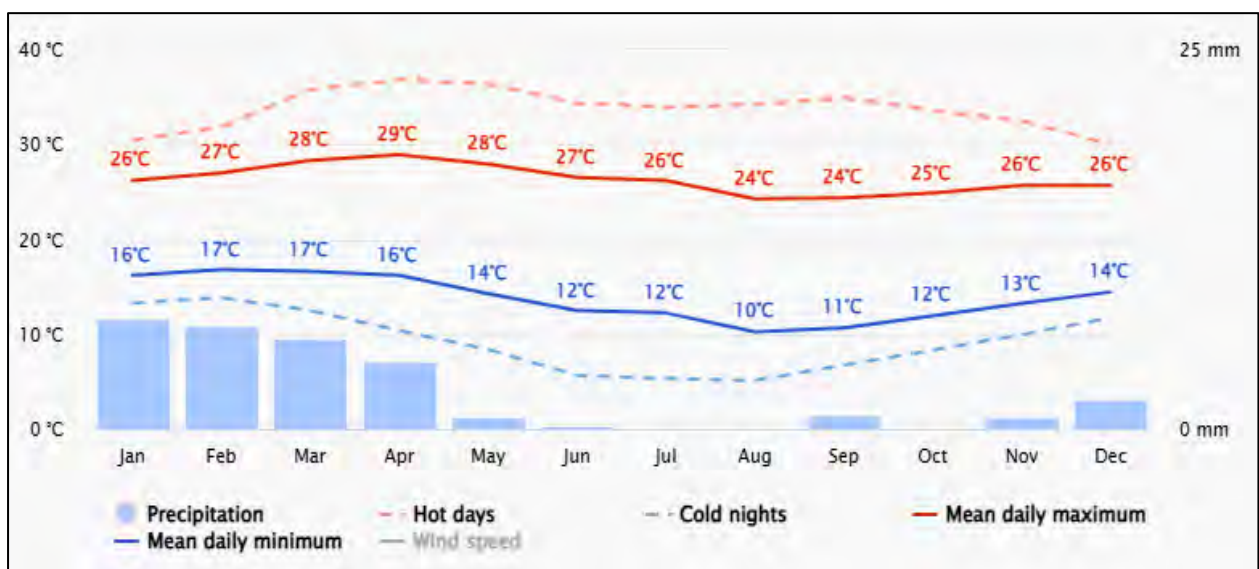


**Figure 9 - Average temperature and precipitation for the Farm 58 (near Walvis Bay Airport) vicinity (Meteoblue, 2025)**

#### 5.4.2.3 Wind

At the Project site wind speeds range between 2 km/h to 40 km/h. The prevailing winds originating from the southwest (SW) and south-southwest (SSW) directions with the majority wind speed being between 10 - 20 km/h as shown in Figure 10.

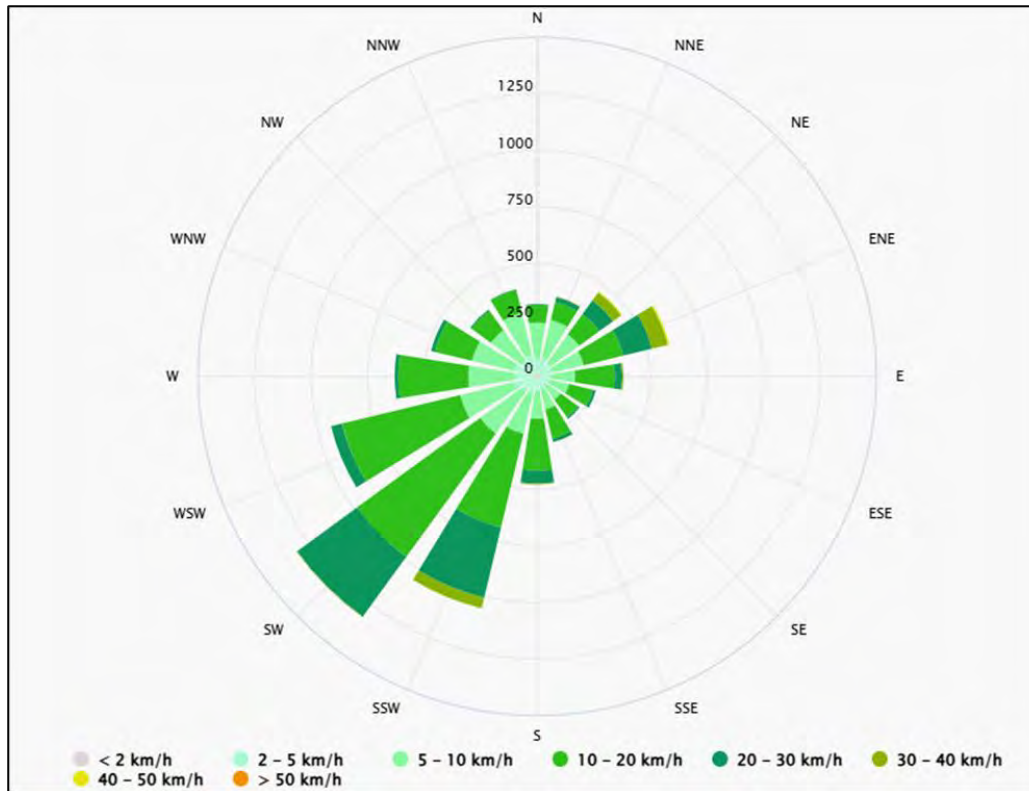


**Figure 10 - Annual wind speed and direction within the Project area**

#### 5.4.2.4 Solar radiation and humidity

Solar radiation and the average amount of daily annual sunshine in this area is relatively low at 2 374 kWh/m<sup>2</sup>/year and on average less than 5 hours daily. The low solar radiation is due to the frequent cloud and fog cover experienced along the coast. The average number of days that this area receives fog are more than 125 days (Mendelsohn, Jarvis, Roberts, & Robertson, 2002).

The relative humidity in this area averages from 60 - 70% in the least humid month (June) and can reach more than 90% in the most humid month (February), as shown in Figure 11.

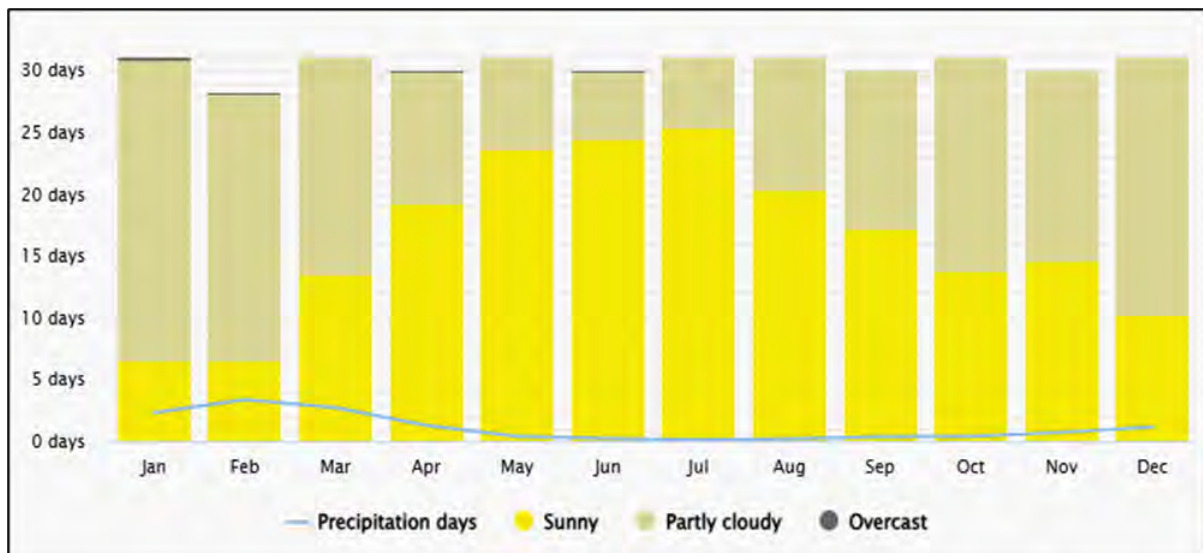


**Figure 11 - Annual wind speed and direction withing the Project area**

#### 5.4.3 TOPOGRAPHY AND SOIL

The GHDP occurs on relatively flat, low relief terrain that slopes gently (average slope ~2%) from east to the Atlantic coastline in the west. The mobile dune belt directly west of the GHDP forms a prominent topographic feature in the region. The GHDP is in a minor localised depression or low point; hence evidence of east to west surface run-off across the site. The site elevation gradually changes from ~65 metres above mean sea level (mamsl) on the eastern most border to ~34 mamsl in the west.

The dominant soil type in this area is a calcic petric gypsisol (yermic) soil (Figure 12). These are soils with a solid layer at a shallow depth that remains hard even when wet with an accumulation of calcium sulphate (gypsum) restricted to the very dry areas of the Namib. The accumulation of gypsum crusts in these soils can be attributed to sulphur releases during upwelling events in the ocean in the past. These substrates support the most diverse lichen fields in the world (Antje Burke, 2003). These soils are found in the driest parts of the world in areas where evaporation exceeds precipitation. They are typically low in fertility with only the hardiest plants able to survive in them. The parent material of these soils includes mostly unconsolidated alluvial or aeolian deposits. Gypsisols form in these areas due to the rising sea water which brings organic sulphates to the surface and the south westerly winds blow them onshore. Along with the gypsisol soil there are secondary calcium carbonate (calcic) rich layers and petric layers which refer to a cemented horizon likely due to calcite or gypsum cementation (Atlas of Namibia team, 2022).

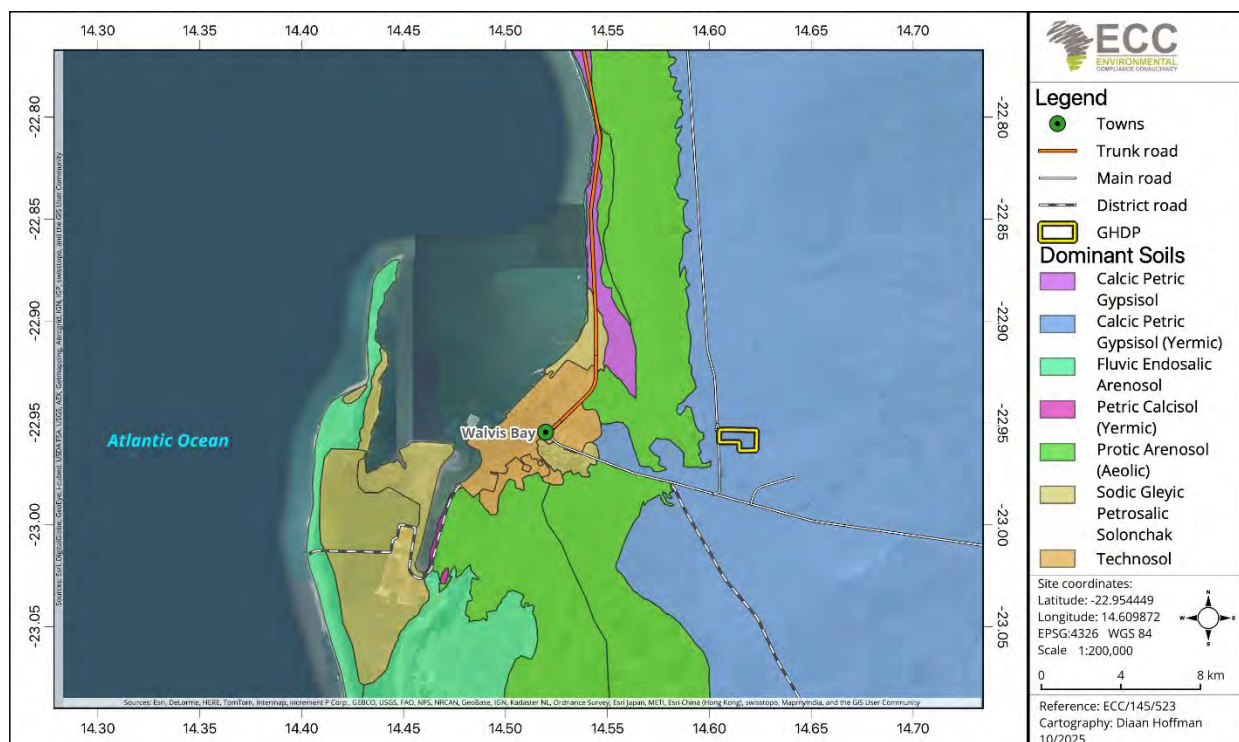


**Figure 12 - The dominant soil of the Project area**

#### 5.4.4 HYDROLOGY

The area is bordered by the Kuiseb River to the south (Walvis Bay area) and the Swakop River to the north (Swakopmund area) with catchment areas of 15,500 km<sup>2</sup> and 30,100 km<sup>2</sup>, respectively (Figure 14) (Cunningham, 2022). These larger rivers, the Swakop and the Kuiseb, do not affect the local hydrology (Sarma, 2022).

The GHDP is in a minor localised depression or low point; hence evidence of east to west surface run-off across the site. The site does not occur in a defined river catchment and occurs in a region bound by the Swakop and Kuiseb Rivers to the north and south respectively. The project area is generally drained by unnamed water courses associated to tributaries of the ephemeral Tumas River. The westward flowing Swakop river is ephemeral and seldom experiences flow in the southern reaches of the catchment. Some 20 km south of the site, the Kuiseb River delta occurs where the ephemeral Kuiseb River meets the Atlantic Ocean. Neither of these hydrological systems have direct influence over the hydrological conditions experienced at the GHDP.

Run-off from rainfall in the project area (south of the Swakop river catchment, including the area drained by the Tumas River) is expected to be limited and short lived; pooling in localised depressions and low points where evaporation and infiltration occur, especially when terminating into the dunes.

#### 5.4.5 GEOLOGY AND HYDROGEOLOGY

According to the 1:250 000 Walvis Bay 2214 geological map (Figure 13) the GHDP is directly underlain by Quaternary aeolian sands (Qs) and gravels typical of the Namib desert. In the study area, the sands variably overly metasediments of the Khan and Etusis Formations, Nosib Group of the Damara Supergroup and syntectonic Salem granites. The lower Etusis formations comprises quartzites and meta-arkose, local gneiss, mica schist and marble. The Khan Formation comprises calc-silicates, mica schist and amphibolite. The Salem granites (syntectonic) is a pink to grey foliated and variably porphyritic monzogranite and grandiorite. Directly west of the site, the dune sands of the Namib Group, Sossus Formation for the mobile dune belt synonymous with the Namib sand sea.

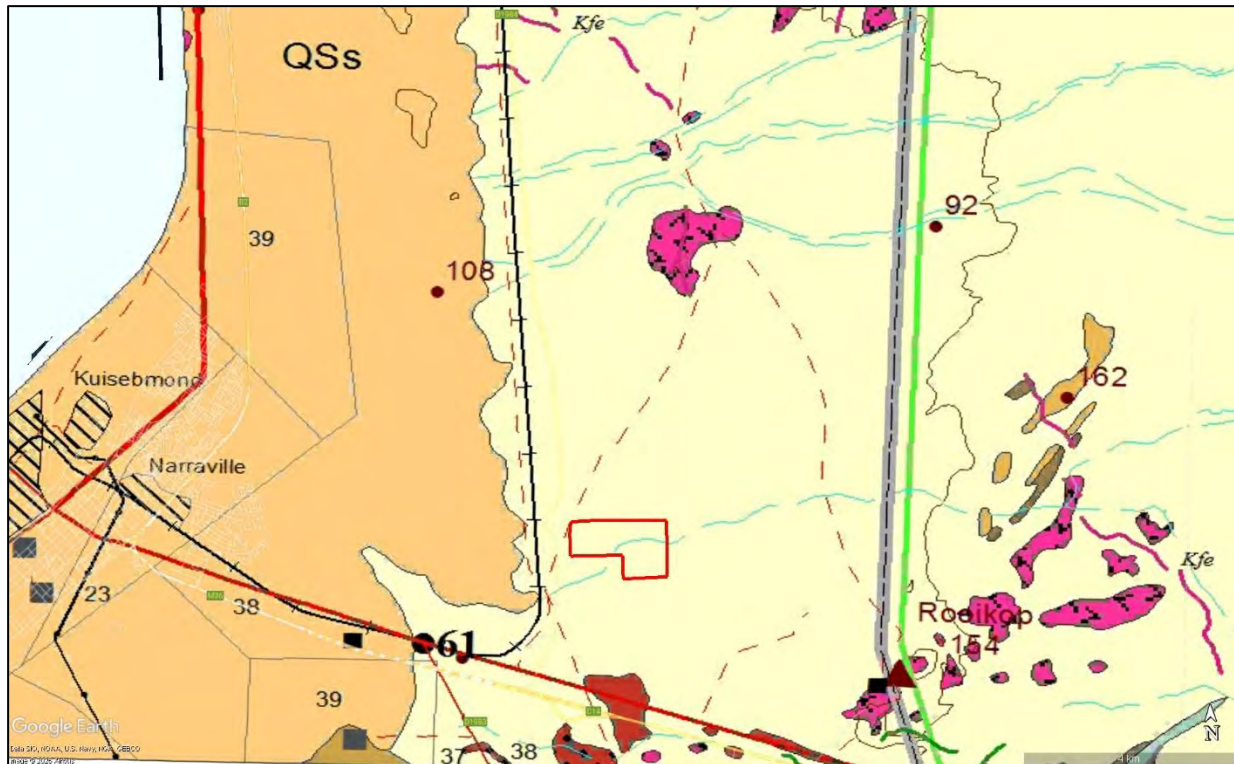


**Figure 13 - 1:250 000 Walvis Bay geological map**

The 1:1 000 000 Namibian hydrogeological map (Figure 15) classifies the area as a region with little or no groundwater potential. This is attributed to the predominant geology as well as the low recharge and poor water quality encountered in the region. The metasediments occurring in the region typically have low groundwater potential and are classified as aquitards, however increased potential may be associated with faults and fractures. Although the metasediments are folded and faulted, they respond in a ductile manner to stress and therefore have poorly developed secondary porosity and are hence less transmissive in terms of groundwater flow. This may be deemed advantageous in that groundwater contamination risk is reduced due to the low transmissivity. Similar applies to the granites encountered in the region. The alluvial sediments of the Kuiseb River are however, considered a primary, unconfined aquifer, but are located sufficiently far south not to be impacted by activities at the site.

Groundwater flow is anticipated to closely follow topography with a regional east to west flow direction. Groundwater quality in the area was confirmed to be saline to hypersaline, with TDS values exceeding that of sea water. This reduces the potential use of groundwater in the region. Low groundwater flow rates and high residence time due to low hydraulic conductivity, a gentle hydraulic gradient, limited recharge and high evaporation result in the presence of brines.

During a site visit undertaken to the Project Site on in October 2025, it was evident that construction activities for the highway resulted in daylighting of brine groundwater some ~2 km south of the site. No such daylighting was observed at the local site scale. This may be due

to reduced thickness of quaternary cover resulting in shallower basement rocks pushing groundwater to surface or due to removal of surface cover by construction activities. Interrogation of the national hydrogeological database did not identify any existing registered boreholes within a ~3km radius around the site.

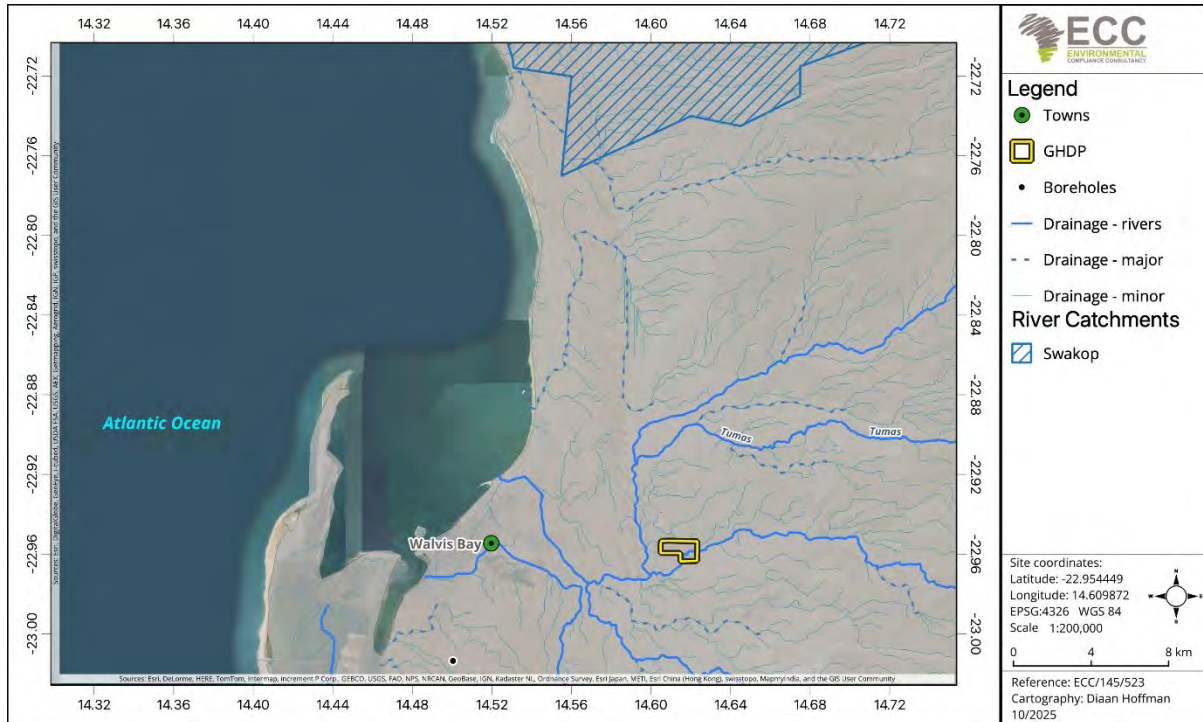


**Figure 14 - Surface water and drainage line within and surrounding the Project area**

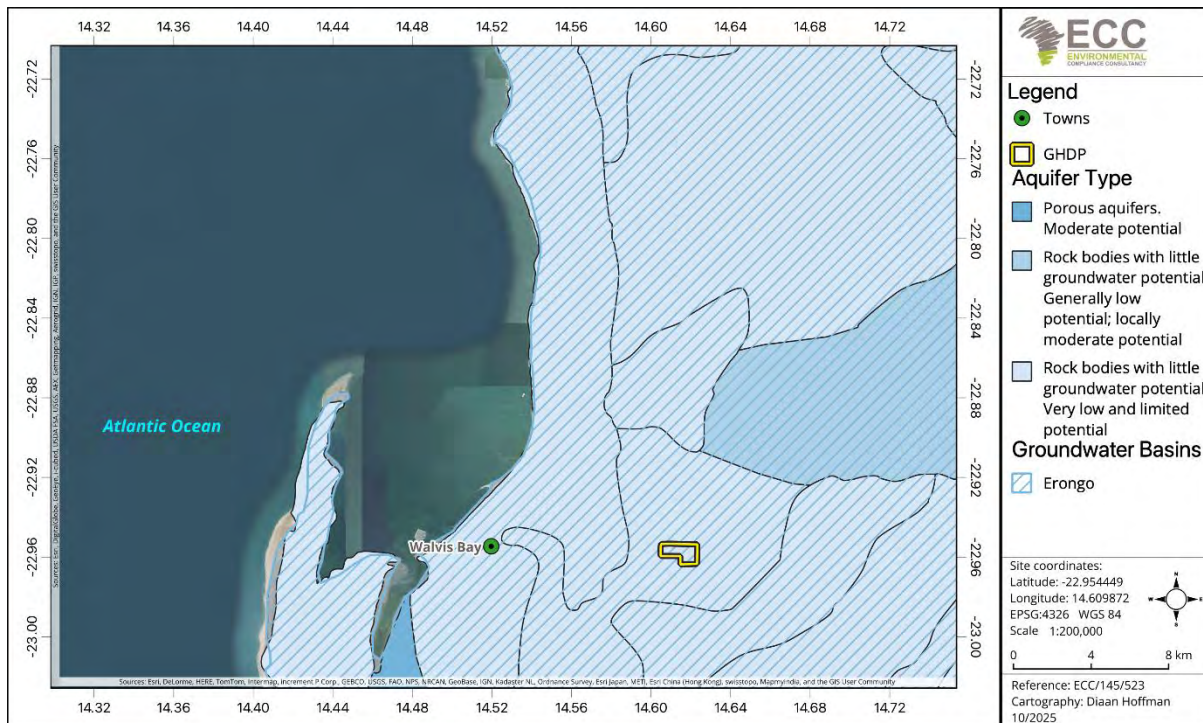


**Figure 15 - Groundwater potential underneath and surrounding the Project area**

## 5.4.6 TERRESTRIAL ECOLOGY: FLORA AND FAUNA

### 5.4.6.1 Flora

The farm falls within the Namib desert and the vegetation structure is classified as grassland and dwarf shrubland (Figure 16). The overall plant diversity in the area is low with an estimated richness of <50. From the general area the plant endemism is also generally low, estimated to be around 2-15 species (John Mendelsohn et al., 2002). Vegetation in this area is sparse as a limited number of plants can root themselves in the shifting sands. There are exceptions to this such as the *Welwitschia mirabilis* which is also endemic to the Namib desert. More stable parts such as stony or rocky outcrops of the Namib desert are home to various hardy plants including bulbs, herbs, grasses and small succulent shrubs. Trees cover is very low, but they are often found along ephemeral rivers throughout the desert. The area on which the Green Hydrogen Demonstration Plant (GHDP) is being built not does have any major unique habitats and is also not in pristine conditions due to the already prevalent impacts by various anthropogenic activities. However, the gravel plains east of the mobile dune belt are classified as a biodiversity yellow flag area due to the lichens and biodiversity associated with the Tumas drainage.

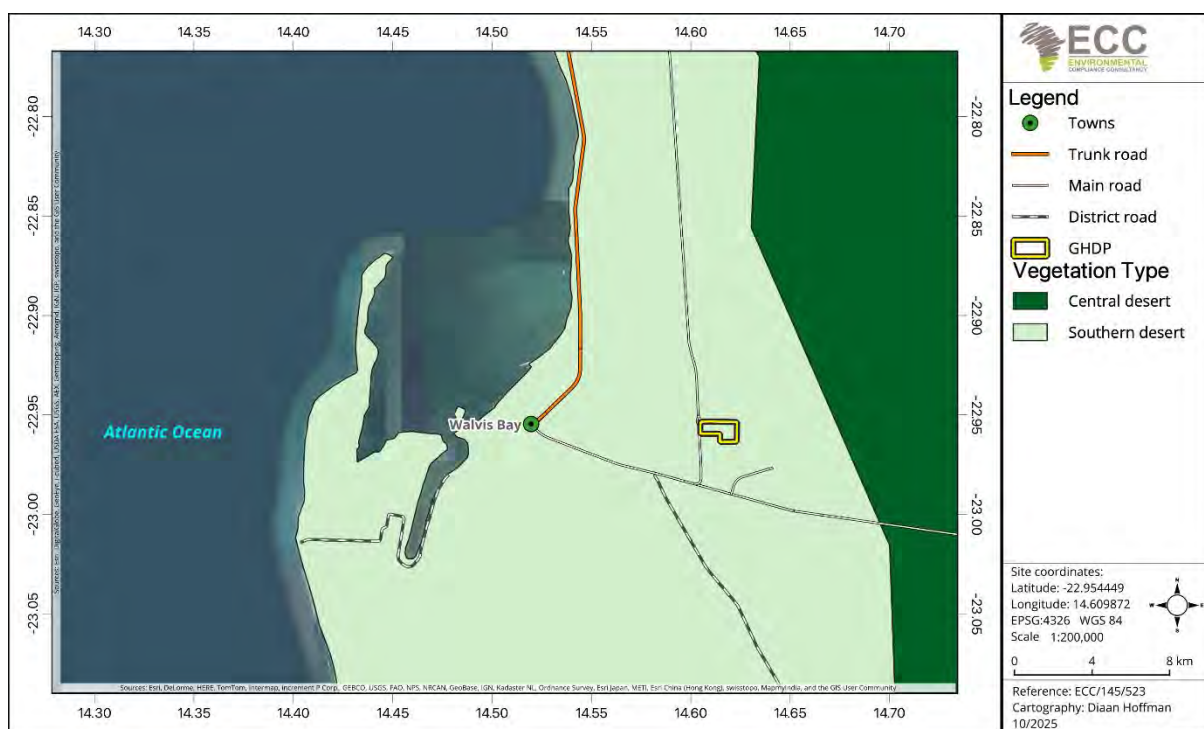


**Figure 16 - Vegetation profile of the Project area**

### 5.4.6.2 Fauna

The overall faunal diversity in this region is relatively low compared to the rest of Namibia but it does have a particularly high level of endemism. The area is particularly low in large herbivores and carnivores due to low vegetation biomass which can sustain them.

Bird diversity is particularly high in the area, with a species richness of around 141 - 170 (John Mendelsohn *et al.*, 2002). A large amount of these birds is attracted to the nearby wetlands located just North of Walvis Bay especially pelicans and flamingos. The nearby wetlands, namely the Walvis Bay Wetlands and Sandwich Harbour, have been identified as RAMSAR sites and are crucial for the local biodiversity. The reptile diversity is also described as low with a species richness of around 41 - 50. Of the reptiles located within the area, lizards make up most of the diversity. The approximate number of mammal species found in the area is around 16 - 31 which is considerably low, and the amphibian diversity is extremely low, with approximately 1 -3 species, due to their strong reliance on moisture for survival. The overall diversity of terrestrial vertebrates is there for relatively low within the area, but endemism seems to be high, with a standout being the reptile diversity of which 21 - 24 of the 16 - 31 approximate species are endemic.

Farm 58 is not in a pristine condition as anthropogenic activities such as construction, waste production and overall land use change have already strongly altered the landscape. Furthermore, a specialist study was also conducted on the vertebrate fauna and flora of the area by Peter Cunningham in June 2025 (Appendix E ). The most important species in the area according to the study include the endemic *Pedioplanis husabensis* (Husab Sand Lizard) and the endemic *Afroedura africana africana* (African flat gecko). Other important reptile species in the area include *Leptotyphlops occidentalis* (western thread snake) and *Lycophidion namibianum* (Namibian wolf snake). The most important of these species is the *Pedioplanis husabensis* which is a restricted range species and due to the other threats posed to this animal it would be put into the endangered category according to the IUCN Red List Categories and Criteria. However, none of the specialist habitats have been noted on the site of the GHDP. Some other findings of the specialist study include that species such as *Chamaeleo namaquensis*, various *Phelsuma* (Rhoptropus) and *Meroles* spp. are probably the only ones inhabiting the proposed GHDP area. As reptiles are generally understudied animals and occur at low densities in such marginal habitat, many more species are expected to occur in the general GHDP area than what is included in the specialist report. However, no reptiles are exclusively associated with the GHDP area. The associated fauna and flora impacts are further assessed and discussed in chapter 7 of this report.

## 6 IMPACT IDENTIFICATION AND EVALUATION METHODOLOGY

### 6.1 INTRODUCTION

This chapter outlines ECC's method to identify and evaluate impacts arising from the proposed activities (infrastructure upgrade). The findings of the assessment are presented in chapter 7.

The evaluation and identification of the environmental and social impacts require the assessment of the Project characteristics against the baseline characteristics, ensuring all potentially significant impacts are identified and assessed.

This chapter provides the following:

- Details on the assessment guidance used to assess impacts;
- Limitations, uncertainties and assumptions with regard to the assessment methodology;
- How impacts were identified and evaluated, and how the level of significance was derived;
- Details how mitigation was applied in the assessment and how additional mitigation was identified; and
- The cumulative impact assessment (CIA) method used.

### 6.2 ASSESSMENT GUIDANCE

The following principal documents were used to inform the assessment method:

- International Finance Corporation (IFC) standards and models, in particular performance standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2012 and 2017);
- International Finance Corporation Cumulative Impact Assessment (CIA) and Management Good Practice Handbook (International Finance Corporation, 2013); and
- Namibian Draft Procedures and Guidance for EIA and E[S]MP (Republic of Namibia, 2008).
- Cleanergy Green Hydrogen Demonstration Plant Environmental Impact Assessment, Walvis Bay, Namibia prepared by SRK Consulting in 2023.

### 6.3 LIMITATIONS, UNCERTAINTIES AND ASSUMPTIONS

The following limitations and uncertainties associated with the assessment methodology were considered in the assessment phase:

- Topic-specific assessment guidance has not been developed in Namibia. A generic assessment methodology will be applied to all topics using IFC guidance and professional judgement; and
- Guidance for CIA has not been developed in Namibia, but a single accepted state of global practice has been established. The IFC's guidance document (International Finance Corporation, 2013) will be used for the CIA.

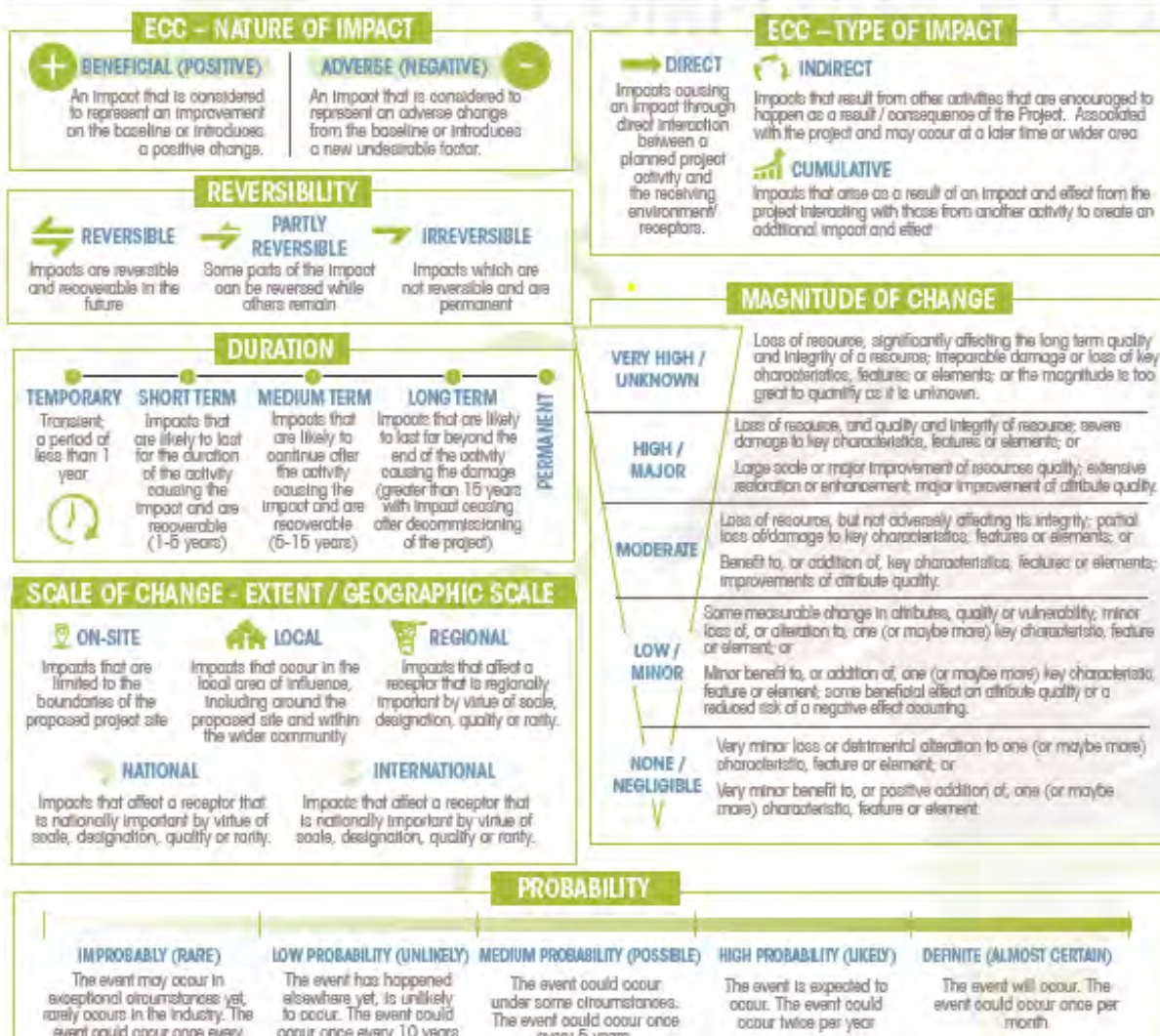
## 6.4 ASSESSMENT METHODOLOGIES

The ESIA amendment methodology applied to this assessment has been developed by ECC using the IFC standards and models, in particular performance standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2017); Namibian Draft Procedures and Guidance for EIA and E[S]MP (Republic of Namibia, 2008); international and national best practice; and over 25 years of combined ESIA experience. The methodology is set out in Figure 17.

The evaluation and identification of the environmental and social impacts require the assessment of the Project characteristics against the baseline characteristics, ensuring that all potentially significant impacts are identified and assessed. The significance of an impact is determined by taking into consideration the combination of the sensitivity and importance/value of environmental and social receptors that may be affected by the proposed activities, the nature and characteristics of the impact, and the magnitude of any potential change. The magnitude of change (the impact) is the identifiable changes to the existing environment that may be negligible, low, minor, moderate, high, or very high; temporary/short-term, long-term, or permanent; and either beneficial or adverse.

Cumulative impacts will also be assessed and can be classified as intraspecific or interspecific. Intraspecific cumulative impacts occur when multiple activities on the same project interact over time or space, leading to intensified effects e.g., dust, noise, and traffic from the GHDP additional activities collectively affecting nearby communities. In contrast, interspecific cumulative impacts arise from the interaction of different types of projects or sectors, within the same area that have a combined effect, thus creating new or amplified impacts (e.g., the combined pressures of dust and traffic contributing to social impacts). This distinction ensures that this assessment captures both the internal and cross-sectoral nature of cumulative impacts. This report will discuss the cumulative impacts related to the added activities to the GHDP.

## ECC IMPACT PREDICATION AND EVALUATION METHODOLOGY



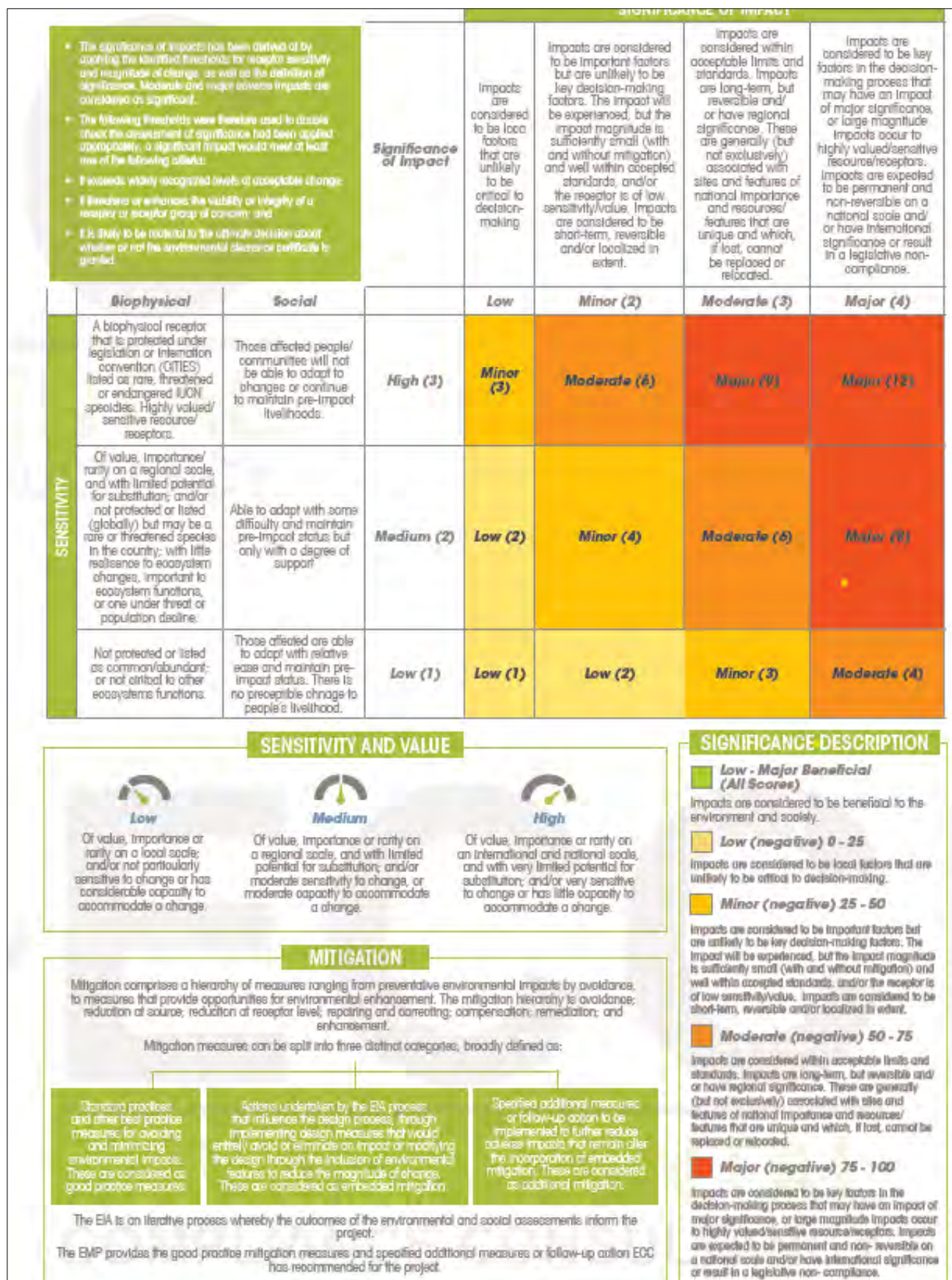


**Figure 17 - ECC ESIA methodology based on IFC standards**

## 6.5 MITIGATION

Impacts that are identified throughout the amendment assessment process will be subjected to a process of impact mitigation, which is inherent in all aspects of the ESIA system. Embedded mitigation and good practice mitigation will be taken into account in the amended assessment. Additional mitigation measures will be identified when the significance of an impact requires it and causes the impact to be further reduced.

The principle of impact mitigation comprises a hierarchy of measures ranging from preventative environmental impacts by avoidance, to measures that provide opportunities for environmental enhancement and will be applied to all impacts associated with the Project. The mitigation hierarchy is: avoidance; reduction at source; reduction at receptor level; repairing and correcting; compensation; remediation; and enhancement. The ESMP (Appendix A ) for the Project provides the good practice measures of impact mitigation and specifies additional measures or follow-up action, where required.

Mitigation measures can be split into three distinct categories, broadly defined as:

1. Actions undertaken by the ESIA process that influence the design process, through implementing design measures that would entirely avoid or eliminate an impact or modifying the design through the inclusion of environmental features to reduce the magnitude of change. These are considered embedded mitigation.
2. Standard practices and other best practice measures for avoiding and minimising environmental impacts. These are considered good practice measures.
3. Specified additional measures or follow-up action to be implemented, in order to further reduce adverse impacts that remain after the incorporation of embedded mitigation. These are considered additional mitigation.

Where additional mitigation is identified, a final assessment of the significance of impacts (residual impacts) will be carried out, taking into consideration the additional mitigation.

## 7 IMPACT ASSESSMENT FINDINGS AND PROPOSED MITIGATION MEASURES

### 7.1 INTRODUCTION

This chapter presents the findings of the impact assessment for the proposed amendment Project, with a focus on significant potential impacts. The new Project design and best practice measures were considered during the desktop assessment to identify likely significant impacts and recommend mitigation measures for implementation. However, the Proponent is advised to obtain the appropriate Project licences, as indicated in section 1.5. A summary list of potential impacts is provided, including water (surface and groundwater), soil, landscape (visual), socioeconomics (employment, demographics, and land use), noise, ecology (fauna and flora), and air quality (emissions, pollutants, and dust).

The impacts assessment findings are presented below, identifying the activities that could be the source of impacts, the receptors that could be affected and the pathways between them. The mitigation measures are outlined in the updated environmental and social management plan (ESMP) (Appendix A ).

### 7.2 IMPACTS DEEMED AS NOT SIGNIFICANT

The impacts that have been assessed as not being significant are summarised in Table 9 and are not discussed further. The listed impacts are non-significant and are not expected to pose a risk to the environment or social receptors in ways that contravene their abilities to sustain their current state.

**Table 9 - Table of non-significant impacts**

| Environmental and social topic | Potential impact                                                                  | Summary of preliminary assessment findings                                                                                                                                                                                                                                                                                        |
|--------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Social environment</b>      |                                                                                   |                                                                                                                                                                                                                                                                                                                                   |
| Human rights                   | The effects that the Project may have on the human rights of the local community. | Farm 58 has been rezoned into an industrial area. Therefore, no residents reside on the footprint area and no communities will be relocated or required to change their way of living to accommodate the Project. The added development within the existing Project footprint will not violate human rights of local communities. |

| <b>Environmental and social topic</b> | <b>Potential impact</b>                                                                                           | <b>Summary of preliminary assessment findings</b>                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Land use                              | Land may no longer be used for other purposes.                                                                    | The Project footprint for the amendment project remains within the bounds of the current Project. Therefore, it is unlikely for land to be of use for other purposes. Farm 58 has been rezoned exclusively for industrial developments; therefore, it is expected that the Project site is expected to remain suitable for other industrial developments, even following Project cessation. |
| Cultural heritage                     | Destruction of and damage to heritage sites and artifacts.                                                        | According to the heritage specialist report (Appendix ), there are no cultural heritage sites or artefacts on portion 8 of Farm 58. A chance find procedure plan is included in the revised ESMP.                                                                                                                                                                                           |
| Tourism                               | Negative impact on the inflow of tourists seeking the natural scenic ambience associated with the Dune landscape. | The amendment is on the already existing GHDP footprint and Farm 58 is specifically set aside for industrial development.                                                                                                                                                                                                                                                                   |
| <b>Biophysical environment</b>        |                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                             |
| Soil                                  | Alteration of soil quality and potential soil erosion.                                                            | The soils are typically low in fertility and as a result, only the hardiest plant species are able to survive in them. No major excavation or civil works will be undertaken.                                                                                                                                                                                                               |
| Vegetation impacts                    | Removal of vegetation.                                                                                            | Farm 58 has already been rezoned as an industrial area, and most vegetation has been cleared. Of the species remaining, none are located solely on the GHDP area and are widespread across the Namibian coast.                                                                                                                                                                              |

## 7.3 SOCIOECONOMIC IMPACTS: ECONOMIC

The significant socioeconomic impacts associated with the construction and operational phase of the GHDP include local markets upliftment, employment creation, skills development and revenue generation for the government. Table 10 summarises the socioeconomic impact findings. An overview of the significant socio-economic, before mitigation are shown in Figure 18, for illustrative purposes only. Each specific impact is discussed further in this section.

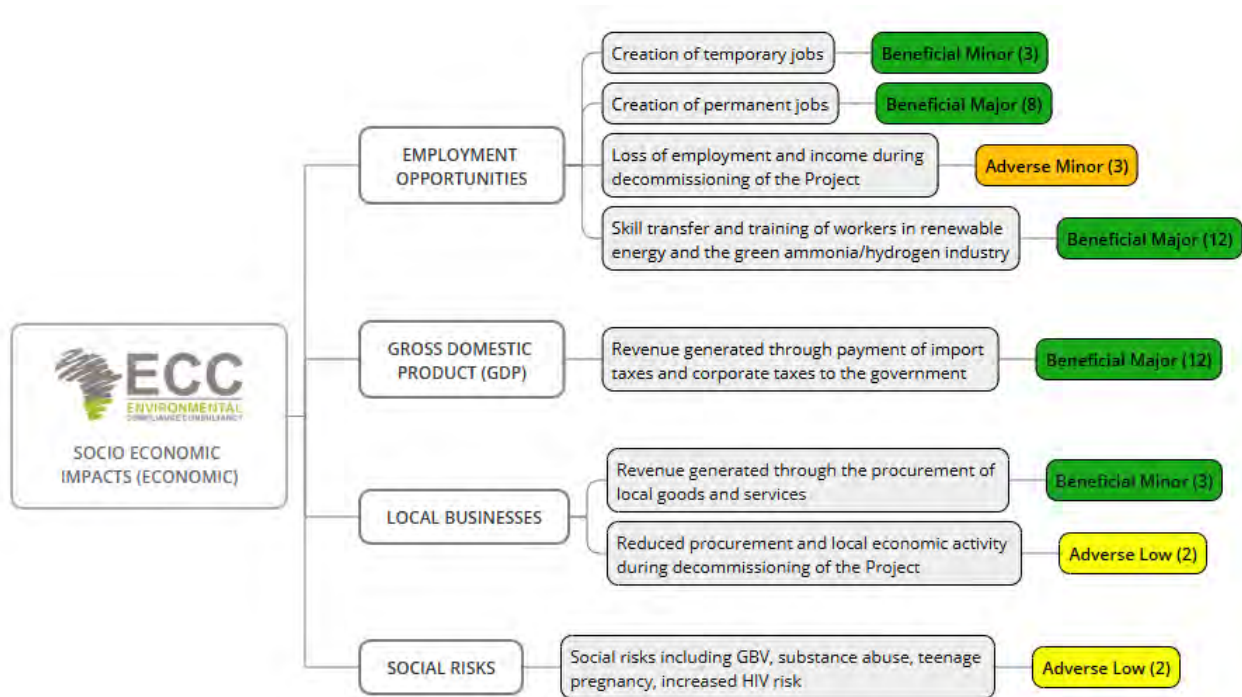


**Figure 18 - Overview of the socioeconomic impacts**

### 7.3.1 EMPLOYMENT GENERATION

One of the key anticipated economic outcomes of the additional GHDP construction activities is increased employment opportunities. This is expected to generate higher household incomes and stimulate money circulation within Walvis Bay and potentially Swakopmund. Infrastructure projects of this scale benefit local economies by enabling households to meet expenses and access better services such as health and education.

#### 7.3.1.1 Construction phase: creation of temporary jobs

Semi-skilled and unskilled workers will be recruited locally. Walvis Bay and Swakopmund have readily available pools of semi-skilled labour, including construction workers, plumbers, electricians, tilers, mechanics and drivers. In addition, a large number of unskilled workers are available, given limited employment opportunities and Walvis Bay's 29.8% unemployment rate (with youth unemployment around 40%) (Namibia Statistics Agency, 2024). The additional construction phase of the GHDP is expected to create employment opportunities for both semi-skilled and unskilled workers.

The impact of these opportunities during construction is beneficial, direct, and definite. Construction work creates an immediate, measurable demand for labour (skilled and unskilled), so the impact is positive for households and local businesses. However, the impact is reversible, since employees will be temporary employed and jobs will end once construction is completed. The impact is expected to occur locally if preference is given to local recruitment to minimise relocation and minimise social cohesion issues that relocation/migrant workers can cause. The magnitude of the change is considered minor, since only a limited workforce will be required/employed. The duration of the impact considered short term, as construction is expected to take ~2 years. Employees employed for the duration of the construction phase will be able to spend their incomes in the local economy. However, the sensitivity of the impact is considered low since it is mostly confined to the local level. The resulting impact rating is therefore minor-beneficial (Table 10). No mitigation measures are required.

#### *7.3.1.2 Operational phase: creation of permanent jobs*

It is expected that a substantial proportion of skilled workers will be sourced nationally as the skillsets required for various operational activities may not be readily and locally available. Additional employees will likely be employed as the Project evolves, for example to accommodate changes in the Project organogram or to address new opportunities arising from adjustments to the Project timeline. The impact is considered beneficial, directly impacting employees and reversible, should the Project activities cease. The likelihood of the impact is considered definite (expected to occur) as employees are required to ensure ongoing Project operations. Although the relative impact categories are comparable to those of the construction phase, the opportunities generated are expected to be long term, thereby increasing their significance. The sensitivity of the receptor is assessed as medium, since skilled labour may be drawn from across the region or nationally (wider labour market), rather than exclusively from the local community. Overall, the significance of the impact is assessed as major-beneficial (Table 10). No mitigation measures are required.

### **7.3.2 WORKFORCE DEVELOPMENT: NEW SKILLS ACQUISITION AND WORK EXPERIENCE**

Cleanergy Solutions Namibia strengthens its workforce by developing skills and enhancing capacity to meet job requirements. Where gaps exist, training is provided, in addition to mandatory occupational health, safety and environmental training. For the additional developments on the GHDP, this presents a significant opportunity for local employees to gain new skills and work experiences within the field of green energy.

The impact of skills development is assessed as beneficial, direct, and permanent, as the knowledge and competencies acquired are expected to be retained by workers over time. The skills gained are largely irreversible as the skills become part of the workers broader competency set and will enable them to adapt and transfer these skills to new tasks and roles. The acquired skill sets and work experience also beyond the Project itself and provide

employees with opportunities to access future jobs within the regional and national green energy industry. The impact is therefore considered national in scale.

The probability of occurrence is definite as the workforce will acquire skills and work experience through the completion of assigned tasks and training programmes. The magnitude of change is rated as moderate as employees will acquire valuable skills and experience that improve their employability. The sensitivity of the impact is assessed as medium, as the specialised technical skills gained may not be easily transferable to all segments of the workforce (e.g., unskilled or semi-skilled workers). If the skills were widely transferable, the sensitivity would be higher. Overall, the significance of the impact is rated as major-beneficial (Table 10).

### 7.3.3 BENEFITS TO THE LOCAL AND NATIONAL ECONOMY THROUGH PROCUREMENT OF GOODS, SERVICES AND UPLIFTMENTS OF THE ECONOMIES THROUGH PAYMENT OF TAXES AND LICENCE FEES

The broader development of the hydrogen sector is expected to have a positive impact on the national economy, particularly through building local production expertise and industry experience within Namibia. The successful commercialisation of locally produced hydrogen is critical towards attracting future investments and the growth of large-scale Green Hydrogen projects in the country. Although the impact could be considered short term if hydrogen production cease, commercially viable production operations have the potential to generate long-term and lasting benefits on the national economy.

In addition to future sectoral growth, the Project will contribute directly to the Namibian economy through the sale of hydrogen and ammonia (albeit modestly, as this is a demonstration plant) and through considerable investment during the design and construction phases. The scale of change is therefore rated as national, as revenues generated by the government can be channelled into broader economic and developmental priorities. The amendment to the Project, which entails an increase in hydrogen production capacity, will further strengthen economic contributions. Both the sensitivity and the magnitude of impact are rated high, considering that the Project will generate tax revenues throughout its operational phase, including corporate income tax, value added tax (VAT), and licence fees. These taxation obligations represent a long-term impact aligned with the Project's operational lifespan. Overall, the impact is assessed as major beneficial (Table 10).

At the local level, additional benefits are anticipated through the procurement of goods (from retail stores and small and medium enterprises (SMEs)) and services (through contracting contractors and subcontractors). This impact is beneficial, direct, and largely irreversible, though its magnitude is considered moderate as most goods will be procured during the construction phase, although goods may also be procured during the operational phase for mechanical repairs or during future Project expansions. The extent of this impact is local, as the Proponent is expected to likely procure goods from nearby businesses (retail stores in

Walvis Bay and Swakopmund) to reduce transport costs and emissions. The probability of such benefits is considered high, and the sensitivity of impact is rated low as continuous spending in the local economy is not guaranteed. Overall, the significance of impact is rated minor beneficial (Table 10).

#### 7.3.4 SOCIAL RISKS: POTENTIAL INFLUX OF WORKERS INTO THE HOST COMMUNITY (WALVIS BAY)

The construction additions to the GHDP will require skilled, semi-skilled, and unskilled labour, which is expected to result in a minor influx of workers into Walvis Bay in pursuit of employment opportunities. This movement of people may generate a range of social impacts on the host community.

In the case of unskilled labour migration, the workforce is expected to be predominantly male, given the gender composition of the construction industry. Owing to the short-term nature of the construction phase, it is unlikely that workers will relocate with their spouses/partners or children. Consequently, the potential impact on local schools and the education sector is expected to be low, with minimal additional pressure on the schooling system from incoming learners.

As highlighted in the baseline, the influx of migrant workers into towns and communities can generate negative and potentially harmful social outcomes. These include increased levels of alcohol and drug abuse, and a heightened risk of gender-based violence (GBV), particularly affecting young women and girls. Increased GBV cases, alcohol and drug abuse within a community are often linked to rises in teenage pregnancy and negative sexual health outcomes, including higher HIV infection rates. Evidence from comparable contexts indicates that the presence of large numbers of male migrant workers is frequently associated with an increase in teenage pregnancies. Adolescent girls who fall pregnant are often compelled to leave school, thereby limiting their future opportunities and increasing their vulnerability to cycles of poverty, particularly when they are left without financial or caregiving support from partners.

The nature of the impact is adverse, direct and irreversible due to potential social outcomes. The impact is expected to occur over the long term due to opportunities available during construction and operations. The impact will affect local communities due to potential relocation of workers due to the Project. The probability of the impact is deemed unlikely as the added activities to the Project is not expected to bring many workers, and many on a temporary basis. The magnitude of change is moderate due substantial changes to community wellbeing, safety, and social cohesion should the impact occur. The sensitivity of the impact is low due to the local scale. The overall significance is deemed adverse low. No mitigation measures are required.

### 7.3.5 DECOMMISSIONING PHASE

The decommissioning phase of the GHDP will mark the cessation of operations, dismantling of facilities, and rehabilitation of the site. Several social impacts may arise that require careful management. These impacts are discussed in detail in the sections below.

#### 7.3.5.1 *Employment and income loss*

At decommissioning, all permanent and contract jobs linked to the GHDP will come to an end. The loss of employment and associated income will have a direct and immediate effect on affected households, especially those with limited alternative livelihood opportunities in Walvis Bay and the Erongo Region. Reduced household income may further affect dependents and reduce spending within the local economy.

The impact is assessed as adverse, direct, and reversible. The likelihood of the impact is deemed definite at decommissioning phase as the hydrogen and ammonia industry is fairly new in Namibia and Project operations may ceased due to several contributing factors. The magnitude of change and sensitivity of impact are rated low, considering the availability of other industries in Walvis Bay. With the acquired skills and work experience, employees will likely acquire other jobs in the local labour market. This reduces the duration of impact to temporary. Overall, the impact is rated as adverse minor (Table 10). No mitigation measures are required.

#### 7.3.5.2 *Reduction in local economic activities*

Decommissioning will result in reduced procurement of goods and services from local suppliers and SMEs that previously supported operations. Businesses providing local services may experience a temporary downturn. The impact is therefore assessed as adverse, direct, and reversible. The likelihood of the impact is deemed to be possible (medium) as the hydrogen and ammonia industry is fairly new in Namibia. The impact will have low sensitivity and temporary duration as service providers will have the opportunities to render services to other Projects, particularly that Farm 58 has been rezoned exclusively for industrial developments. Overall, the significance of the impact is rated as adverse low, before mitigation (Table 10).

**Table 10 - Socioeconomic impact assessment findings**

| Activity           | Receptor             | Impact                      | Nature of impact                                                      | Value & sensitivity | Magnitude of change | Significance of impact |
|--------------------|----------------------|-----------------------------|-----------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Construction phase | Contractor employees | Creation of temporary jobs. | Beneficial<br>Direct<br>Reversible<br>Short term<br>Local<br>Definite | Low                 | Minor               | Beneficial minor (3)   |

| Activity                           | Receptor                                             | Impact                                                                                              | Nature of impact                                                          | Value & sensitivity | Magnitude of change | Significance of impact |
|------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Operational phase                  | Employees                                            | Creation of permanent jobs.                                                                         | Beneficial<br>Direct<br>Reversible<br>Long term<br>Regional<br>Definite   | Medium              | Minor               | Beneficial major (8)   |
| Construction and operational phase | Employees                                            | Skill transfer and training of workers in renewable energy and the green ammonia/hydrogen industry. | Beneficial<br>Direct<br>Irreversible<br>Permanent<br>National<br>Definite | High                | Moderate            | Beneficial Major (12)  |
| Construction and operational phase | National economy                                     | Revenue generated through payment of import taxes and corporate taxes to the government .           | Beneficial<br>Direct<br>Reversible<br>Long term<br>National<br>Definite   | High                | Major               | Beneficial Major (12)  |
| Construction phase                 | Local economy (businesses and healthcare facilities) | Revenue generated through the procurement of local goods and services.                              | Beneficial<br>Direct<br>Irreversible<br>Long term<br>Local<br>Likely      | Low                 | Minor               | Beneficial Minor (3)   |
| Construction and operational phase | Host community (Walvis Bay)                          | Social risks including GBV, substance abuse, teenage pregnancy                                      | Adverse<br>Direct<br>Irreversible<br>Long term<br>Local<br>Unlikely       | Low                 | Moderate            | Adverse Low (2)        |

| Activity              | Receptor         | Impact                                             | Nature of impact                                                  | Value & sensitivity | Magnitude of change | Significance of impact |
|-----------------------|------------------|----------------------------------------------------|-------------------------------------------------------------------|---------------------|---------------------|------------------------|
|                       |                  | and increased HIV risk.                            |                                                                   |                     |                     |                        |
| Decommissioning phase | Employees        | Loss of employment and income.                     | Adverse<br>Direct<br>Reversible<br>Temporary<br>Local<br>Definite | Low                 | Minor               | Adverse<br>Minor (3)   |
| Decommissioning phase | Local Businesses | Reduced procurement and local economic activities. | Adverse<br>Direct<br>Reversible<br>Temporary<br>Local<br>Possible | Low                 | Minor               | Adverse<br>Low (2)     |

## 7.4 SOCIOECONOMIC IMPACTS: SOCIAL

The significant social impacts associated with the construction and operational phase of the GHDP may give rise to impacts on air quality, noise levels, visual amenity and sense of place, traffic, as well as community and occupational health and safety. Each specific impact category is discussed in detail in this section.

### 7.4.1 AIR QUALITY

An overview of the significant air quality impacts before mitigation is shown in Figure 19, for illustrative purposes only. The impact assessment ratings are summarised in Table 11.

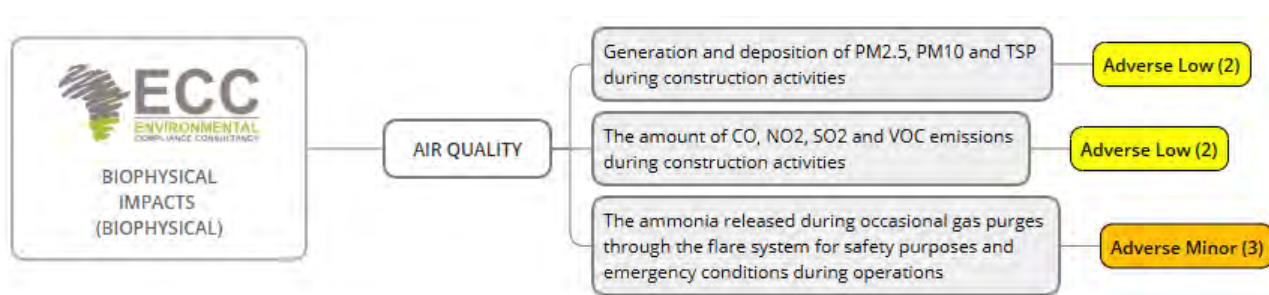


**Figure 19 - Overview of the air impacts**

*7.4.1.1 Generation and deposition of PM<sub>2.5</sub>, PM<sub>10</sub> and TSP during construction activities, potentially affecting air quality and posing health risks to the occupational workforce*

During construction, there are several activities that produces dust (PM<sub>2.5</sub>, PM<sub>10</sub> and TSP) which include earthworks and foundation stages (excavation and levelling), material handling (cement and sand mixing) as well as vehicle movement on unpaved roads within the Project site (Yan, Li, & Zhang, 2023). Particles that are 2.5 microns or less in diameter (PM<sub>2.5</sub>) are released from combustion of gasoline, oil and diesel fuel, while particles with a diameter of 10 microns (PM<sub>10</sub>) are released from construction sites, landfills and agriculture, wildfires and brush/waste burning, industrial sources, wind-blown dust from open lands, pollen and fragments of bacteria (California Air Resource Board, 2024). Total suspended particles (TSP) are mostly generated by bulk earthworks, handling of coarse materials and road dust.

The nature of the impact is assessed as adverse, directly affecting potential sensitive receptors (employees and potential road users), reversible and will occur over a short period of time due to the period of the construction phase (~2 years). The generation of PM<sub>2.5</sub>, PM<sub>10</sub> and TSP is likely as these are generally generated during construction activities including the use of vehicles.

The sensitivity of the impact is considered low, as the activities will be confined to the site and Farm 58 is currently largely unoccupied. The magnitude of change and sensitivity of impact

are considered minor and low, as the main sensitive receptors are employees, who as a precaution, will be required to wear appropriate personal protective equipment (PPE) and follow standard operating procedures (SOPs). These measures will limit exposure to excessive dust and PM concentrations that could otherwise contribute to chronic occupational health issues. The significance of the impact is rated adverse low, before mitigation (Table 11). The mitigation measures are detailed in the ESMP (Appendix A ).

7.4.1.2      *The amount of carbon monoxide (CO), nitrogen oxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>) and volatile organic compounds (VOC) emissions from various construction activities, potentially affecting air quality and posing health risks to the occupational workforce*

Emissions such as CO and SO<sub>2</sub> are characterised as primary pollutants emitted by vehicles, while NO<sub>2</sub> is classified as secondary pollutants. Secondary pollutants are not directly emitted, it however forms when primary pollutants react in the atmosphere (Envira, 2022). In a construction context VOC's are components of diesel fuel. Intense exposure over the short term could lead to headaches, dizziness, nausea and irritation to the respiratory system (World Health Organization (WHO), 2021).

The nature of the impact is adverse, directly affecting employees, reversible and will occur over a short period of time due to the period of the construction phase (~2 years). Light and heavy-duty vehicles are expected to be used during the construction phase and therefore the probability of the impact is likely.

The sensitivity of the impact is considered low, as the activities will be carried out on-site. The magnitude of change before mitigation is rated minor as the only sensitive receptors impacted will be employees. The significance of the impact is rated adverse low, before mitigations (Table 11). The mitigation measures are detailed in the ESMP (Appendix A ).

7.4.1.3      *The ammonia released during occasional gas purges through the flare system for safety purposes and emergency conditions during operations*

During operations, occasional gas purges may be expected (~1 time per month) through the flare system for safety and emergency purposes, such as pressure relief, system maintenance, or venting of hazardous gases. These purges can result in the release of small quantities and low concentrations of ammonia into the atmosphere.

The nature of the impact is adverse, directly impacting employees and potentially the adjacent community (operators at Dune 7). Additionally, the impact is irreversible and may alter the air quality by forming particulates and ammonium compounds. The gas may may disperse quickly and have a low impact on the local community. For safety purposes and to prevent pressure build up, occasional gas purges are expected and are likely to occur. The sensitivity of the impact is considered low due to the local dispersion of emitted gases into the wider community. The magnitude of change is considered minor as purges are expected to occur in small quantities and at a low concentration over on a monthly basis. The ammonia gas is highly soluble and able to disperse within hours. The significance of the impact is rated

adverse minor, before mitigations (Table 11). The mitigation measures are detailed in the ESMP (Appendix A ).

**Table 11 - Air quality impacts**

| Activity           | Receptor                                                    | Impact                                                                                                                                               | Nature of impact                                                   | Value & sensitivity | Magnitude of change | Significance of impact |
|--------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Construction phase | Air quality (occupational workforce and adjacent community) | Generation and deposition of PM <sub>2.5</sub> , PM <sub>10</sub> and TSP during construction activities on occupational workforce.                  | Adverse<br>Direct<br>Reversible<br>Short term<br>On-site<br>Likely | Low                 | Minor               | Adverse<br>Low (2)     |
|                    |                                                             | The amount of CO, NO <sub>2</sub> , SO <sub>2</sub> and VOC emissions during construction activities may lead to chronic occupational health issues. | Adverse<br>Direct<br>Reversible<br>Short term<br>On site<br>Likely | Low                 | Minor               | Adverse<br>Low (2)     |
| Operational phase  |                                                             | The ammonia released during occasional gas purges through the flare system for safety purposes and emergency conditions during operations            | Adverse<br>Direct<br>Irreversible<br>Permanent<br>Local<br>Likely  | Low                 | Minor               | Adverse<br>Minor (3)   |

| Activity | Receptor | Impact                             | Nature of impact | Value & sensitivity | Magnitude of change | Significance of impact |
|----------|----------|------------------------------------|------------------|---------------------|---------------------|------------------------|
|          |          | may lead to chronic health issues. |                  |                     |                     |                        |

#### 7.4.2 VISUAL IMPACTS

An overview of the significant visual (and sense of place) impacts before mitigation is shown in Figure 20, for illustrative purposes only. The impacts are discussed in detail in the sections below.

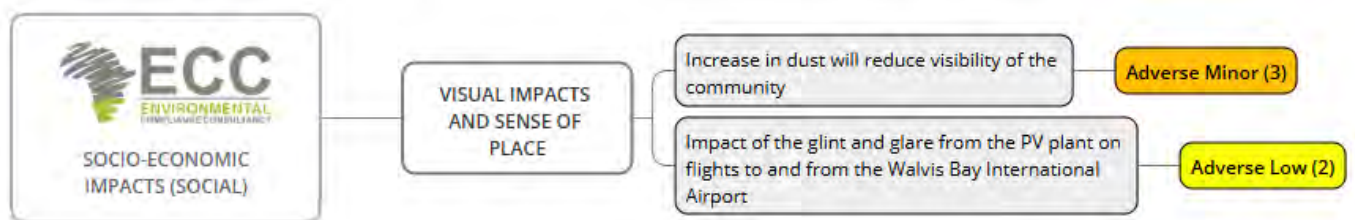


**Figure 20 - Overview of the visual impacts**

##### 7.4.2.1 Increase in dust will reduce visibility

During construction, the generation of dust is inevitable, potentially impacting adjacent road users, businesses such as Dune 7 Adventures (~1 km from site), the Walvis Bay International Airport (2.5 km from site) and the Rooikop Army Base (~4 km from site). In desert environments, background dust levels are naturally elevated and additional emissions from Project activities may exacerbate “dust haze” conditions and contribute to temporary reductions in road and aviation safety (Goossens & Buck, 2009). The severity of visibility largely depends on meteorological conditions such as wind speed, wind direction and atmospheric moisture content. Coastal towns experience high wind speeds during certain times of the year. Moreover, high moisture content due to coastal fog lessens dust in the air.

The nature of the impact is adverse and direct as it results in reduced visibility of the immediate areas. The impact is considered reversible and over a short term due to the duration of the construction phase (~2 years). The impact is localised as the dust may reduce visibility, particularly impacting road users on the D1984 road and local airplane navigations. The sensitivity of the impact is considered low due to the localised nature of the impact. The magnitude of change is considered minor as no significant propagation of dust is expected during the construction phase. The significance of the impact is rated adverse minor, before mitigations (Table 12). The mitigation measures are detailed in the ESMP (Appendix A ).

*7.4.2.2 Impact of the glint and glare from the PV plant on flights to and from the Walvis Bay International Airport*

The proposed photovoltaic (PV) plant has the potential to generate glint and glare of sunlight from the surface of the solar panels. These reflections can vary in intensity and duration depending on the position of the sun, the angle of the panels, and atmospheric conditions (Sreenath, Sudhakar, Yusop, Cuce, & Solomin, 2020). Glint and glare may cause temporary visual distraction or discomfort to pilots during landing, or take-off phases of flight operations at Walvis Bay International Airport, which is located approximately 2.5 km southeast (SE) of the Project site.

The nature of the impact is adverse, directly impacting the aircraft navigating in the immediate airspace. The impact is considered reversible and temporary as the impact will likely occur during aircraft take-off and landing operations. The likelihood of the impact is rated possible (medium), although low reflective material and/or anti-reflective coating will be used. The sensitivity of the impact is considered low as the PV plant is only present on site. The magnitude of change is considered minor due to standard industry practices of PV plant installations will be enforced. These are expected to minimise the glint and glare effect. The significance of the impact is rated adverse low, before mitigations (Table 12). The mitigation measures are detailed in the ESMP (Appendix A ).

**Table 12 - Visual impacts**

| Activity           | Receptor                                                             | Impact                                                                                                      | Nature of impact                                                  | Value & Sensitivity | Magnitude of change | Significance of impact |
|--------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Construction phase | Visual (road users, businesses and Walvis Bay International Airport) | Increase in dust will reduce visibility of the community                                                    | Adverse<br>Direct<br>Reversible<br>Short term<br>Local<br>Likely  | Low                 | Minor               | Adverse Minor (3)      |
| Operational phase  |                                                                      | Impact of the glint and glare from the PV plant on flights to and from the Walvis Bay International Airport | Adverse<br>Direct<br>Reversible<br>Temporary<br>On site<br>Likely | Low                 | Minor               | Adverse Low (2)        |

### 7.4.3 NOISE

An overview of the significant noise impacts before mitigation is shown in Figure 21, for illustrative purposes only. The impacts are discussed in detail in the sections thereafter.

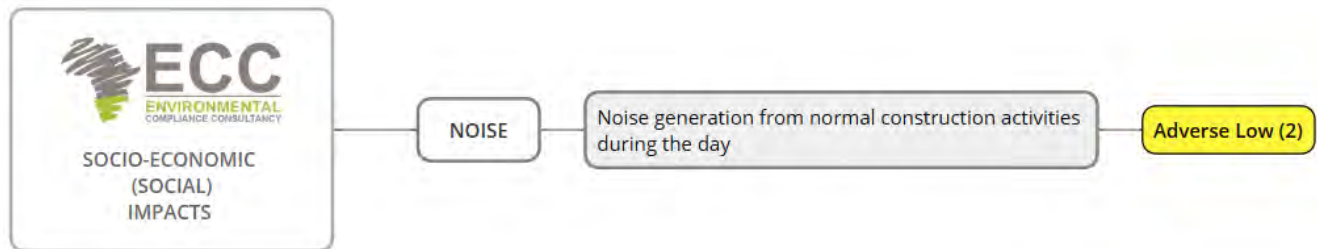


**Figure 21 - Overview of the noise impacts**

#### 7.4.3.1 Noise generation from normal construction activities during the day

During normal construction activities, noise will be generated by the use of construction equipment and machinery. The nature of the impact is adverse and directly affects the noise sensitive receptors (NSR). In this instance, the NSRs are the employees undertaking various construction activities as no excessive noise levels are expected to be generated throughout the construction phase. The impact is reversible and will impact NSR's for a short period of time (~2 years). Moreover, noise generated will likely be limited to the Project site (on-site).

The impact is considered negligible as Farm 58 is largely vacant, having been rezoned for industrial use, with land currently being acquired for various business and industrial developments. Other potential NSRs include motorists traveling on the D1984 and Dune 7 Adventurers (~ 1 km away). The sensitivity rating is considered low as the activities will occur on-site only and no night work will be undertaken. Overall, the significance of the impact is rated adverse low, before mitigations (Table 13). The mitigation measures are outlined in the ESMP (Appendix A ).

**Table 13 - Noise impacts**

| Activity           | Receptor                                                                    | Impact                                                              | Nature of impact                                                   | Value & sensitivity | Magnitude of change | Significance of impact |
|--------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Construction phase | Noise (nearby communities, businesses and Walvis Bay International Airport) | Noise generation from normal construction activities during the day | Adverse<br>Direct<br>Reversible<br>Short term<br>On site<br>Likely | Low                 | Negligible          | Adverse Low (2)        |

#### 7.4.4 TRAFFIC IMPACTS

An overview of the significant traffic impacts before mitigation is shown in Figure 22, for illustrative purposes only. Each specific impact is discussed in detail in the section below.

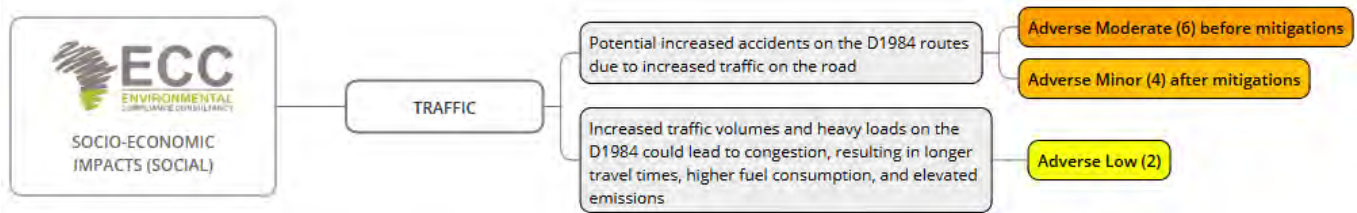


**Figure 22 - Overview of the traffic impacts**

##### 7.4.4.1 *Potential increased accidents on the D1984 routes due to increased traffic on the road*

The increased traffic on the D1984 district road may result in added risk of potential accidents on the road. The impact is adverse, directly affecting all road users, irreversible and permanent as serious injuries may be sustained, or lives may be lost (worse-case scenario). The impact is rated as possible.

The sensitivity of the impact is rated medium due to change to livelihood as a result of injuries and the magnitude of change is rated as major due to the potential serious injuries or death that may result from road accidents. Overall, the significance of the impact is rated adverse moderate, before mitigations (Table 14).

The following mitigation measures are also included in the ESMP (Appendix A):

- Strict compliance to warning and speed limit signs erected along the D1984 route, particularly near construction access points and turn off junctions;
- Ensure all signage are clearly visible, reflective and maintained regularly;
- Ensure all Project vehicles are well maintained, roadworthy and equipped with functioning safety devices (e.g., lights, seatbelts, reflectors, brakes);
- Schedule heavy vehicle movements during off-peak hours to minimise congestion and interaction with public traffic; and
- Conduct regular toolbox talks on safe driving practices.

##### 7.4.4.2 *Increased traffic volumes and heavy loads on the D1984*

The increase in vehicle use to transport industrial goods and materials may lead to increased traffic volumes on the D1984. Increase traffic could result in congestion, resulting in longer travel times, higher fuel consumption and elevated exhaust emissions. It should be noted that the newly upgraded district road has the capacity to support high volume traffic. The D1984 district road supports vehicle fleets for industrial and mining projects and facilitate

logistical movement of goods, materials and personnel between project sites, regional service providers and the coastal towns. The road also serves as an alternative service access road to Walvis Bay and Swakopmund, easing traffic on the B2 trunk road.

The impact is rated as adverse, directly impacting road users and reversible should the Project cease. The Project duration will occur over a long term (>15 years). The likelihood of the impact is rated unlikely as the road is well designed to support high industrial traffic volumes.

The magnitude of the impact is considered minor as the additional traffic is unlikely to significantly affect motorists, particularly tourists visiting Dune 7 Adventures. The sensitivity rating is low due to the localised nature of the impact and congestions are not expected as the road is dual carriageway. Overall, the significance of the impact rated adverse low, before mitigations (Table 14). The mitigation measures are outlined in the ESMP (Appendix A ).

**Table 14 - Traffic and road related impacts**

| Activity                                 | Receptor             | Impact                                                                                                                                                              | Nature of impact                                                    | Value & Sensitivity | Magnitude of change | Significance of impact |
|------------------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Construction phase and operational phase | Traffic and road use | Potential increased accidents on the D1984 routes due to increased traffic on the road                                                                              | Adverse<br>Direct<br>Irreversible<br>Permanent<br>Local<br>Possible | Medium              | Major               | Adverse Moderate (6)   |
|                                          |                      | Increased traffic volumes and heavy loads on the D1984 could lead to congestion, resulting in longer travel times, higher fuel consumption , and elevated emissions | Adverse<br>Direct<br>Reversible<br>Long term<br>Local<br>Possible   | Low                 | Minor               | Adverse Low (2)        |

#### 7.4.5 COMMUNITY HEALTH AND SAFETY

An overview of the significant community health and safety impact, before mitigation is shown in Figure 23, for illustrative purposes only. The impact is discussed in detail in the section thereafter.



**Figure 23 - Community health and safety**

##### 7.4.5.1 Exposure to health hazards due to ammonia releases on nearby receptors

Short-lived gas purges are expected to be on occasions. In small concentrations, ammonia rapidly disperses in air and typically does not pose a significant health risk. However, prolonged or repeated exposure to concentrations above recommended public exposure limits could result in health issues. According to World Health Organisation guidelines, the average exposure limit is 1.5 mg/m<sup>3</sup> for an hour and 0.3 mg/m<sup>3</sup> per 24 hours (World Health Organization (WHO), 2000). The odour of ammonia can be detected by humans at concentrations >5 ppm; the odour is highly penetrating at 50 ppm (10 min). The corrosive and exothermic properties of ammonia can result in damage (severe irritation and burns) to the eyes, skin and mucous membranes of the oral cavity and respiratory tract (National Research Council, 2008).

The impact is rated as adverse, directly impacting nearby receptors. The nearest residential community is ~6 km from the site with recreational activities occurring ~ 1.5 km (at Dune 7). Should an individual be affected, the health risk is considered irreversible and permanent. The impact may affect people on a local scale. The probability of adverse health effects on nearby communities resulting from ammonia exposure is unlikely, as ammonia rapidly disperses in the air and purges are expected to be short lived. It is important that purges are conducted with consideration of the prevailing meteorological conditions.

The magnitude of the impact is considered major, due to the serious health hazards that could result from exposure to released ammonia (worse-case scenario). The sensitivity of the impact is rated medium, as ammonia naturally disperses rapidly dispersing into the broader airspace. It is expected that the nearby receptors will unlikely be exposed to released ammonia. Overall, the significance of the impact is rated adverse minor, before mitigations (Table 15). The mitigation measures are outlined in the ESMP.

**Table 15 - Community health and safety**

| Activity          | Receptor                    | Impact                                                                                                    | Nature of impact                                                    | Value & sensitivity | Magnitude of change | Significance of impact |
|-------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Operational phase | Community health and safety | Risk for nearby receptors to be exposed short-lived ammonia purges, leading to health hazards and issues. | Adverse<br>Direct<br>Irreversible<br>Permanent<br>Local<br>Unlikely | Medium              | Major               | Adverse Minor (4)      |

#### 7.4.6 EMPLOYEE OCCUPATIONAL HEALTH AND SAFETY

An overview of the significant occupational health and safety impacts before mitigation is shown in Figure 24, for illustrative purposes only. Each specific impact is discussed in detail in the sections thereafter.

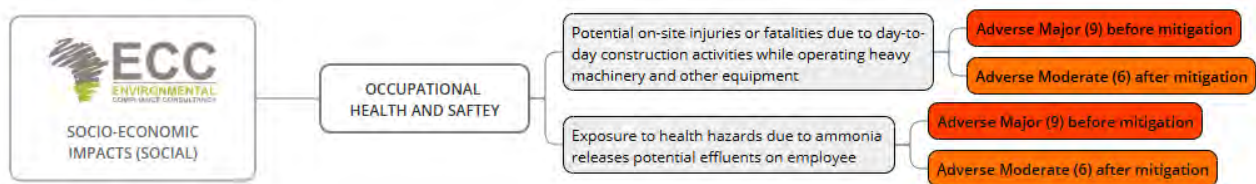


**Figure 24 - Overview of occupation health and safety impacts**

##### 7.4.6.1 *Potential on-site injuries or fatalities due to day-to-day construction activities while operating heavy machinery and other equipment*

Activities associated with construction often involve complex operations that utilise heavy machinery, power tools and potentially hazardous materials, all of which require specialised skills and training to ensure safe handling. The fast-paced and high-pressure nature of construction sites increases the risk of accidents, especially when workers are operating machinery, using tools, or working near one another. Resulting injuries may vary from minor cuts, bruises, and sprains to more serious cases such as fractures, dislocations or traumatic head injuries. In severe instances, accidents involving machinery, falls, or collisions with heavy equipment may lead to fatalities.

The nature of impact is adverse and will directly affect workers on-site. Injuries sustained could be serious and may lead to death, therefore, the impact is rated irreversible and permanent. It is anticipated that contractor workers will be appointed through a tendering process, ensuring that those selected possess the necessary skills, qualifications, and industry expertise (work experience) to perform the required tasks effectively and safely. As a result,

injuries are more likely to occur due to accidents rather than a result of incompetency. The probability of impact is therefore rated possible (medium). The magnitude of impact is rated high due to varying degrees of injury severity that can occur, ranging from minor injuries to potentially life-threatening incidents. The sensitivity of impact is rated as high as injuries could lead to permanent disabilities, which limit workers future employment opportunities and their ability to perform tasks within the industry. Overall, the significance of impact, before mitigations is rated adverse major (Table 16).

The following mitigation measures are also included in the ESMP (Appendix A ):

- Incorporate occupational health and safety requirements into the bidding and tendering process to ensure contractors meet safety standards;
- Comply with the safety and health requirements as outlined in the Labour Act, No. 11 of 2007 and ISO 45001 standards for occupational health and safety management;
- Develop and implement standard operating procedures (SOPs) for all work areas;
- Provide on-site safety inductions to all employees, with specific focus on mobile equipment and on-site traffic safety;
- Conduct regular site inspections to monitor compliance with safety standards, document any non-conformances and identify the corrective actions required; and
- Document injury statistics, track corrective actions and record lessons learnt to improve safety practices on-site.

7.4.6.2      *The potential risk for the workforce to be exposed to health hazards associated with ammonia releases*

When ammonia and ammonia effluents are released, employees may come in direct contact with emissions, causing reactions such as skin, eye and throat irritation or burns. In the event of an accidental or worst-case emission, scenarios are assessed due to the acute toxicity of gaseous ammonia. Should an employee be exposed to considerable volumes of toxic gaseous ammonia, this may lead to various reactions such as skin burns, irritation, eye injuries, serious injuries and potential fatalities.

The impact is adverse and affects employees directly on-site. The impact is rated irreversible as it could be fatal. The impact is considered permanent as there is potential for serious injuries to occur. The likelihood of the impact is rated possible (medium), assessed from a worst-case scenario perspective. It should be noted that preventative measures will be developed, and SOP's will be available and enforced on-site.

The magnitude of impact is very high/unknown due to the danger it poses to the health and safety of employees. The sensitivity of impact is rated as high due to potential for fatalities in the event that employees are exposed to significant ammonia releases. The significance of impact is rated adverse major prior to mitigation measures (Table 16).

The following mitigation measures are also included in the ESMP (Appendix A ):

- The Proponent shall ensure the flare and ammonia handling systems are designed and maintained to detect and prevent leaks;
- All employees are required to wear the appropriate PPE;
- An emergency response plan should be developed, which must include evacuation plans and first-aid procedures for ammonia exposure; and
- The Proponent shall conduct regular training and safety drills with site personnel on the safe handling of ammonia, response to leaks, and the use of PPE.

**Table 16 - Occupational health and safety impacts**

| Activity           | Receptor                       | Impact                                                                                                                                  | Nature of impact                                                      | Value & sensitivity | Magnitude of change | Significance of impact |
|--------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Construction phase | occupational health and safety | Potential on-site injuries or fatalities due to day-to-day construction activities while operating heavy machinery and other equipment. | Adverse<br>Direct<br>Irreversible<br>Permanent<br>On-site<br>Possible | High                | Very high/unknown   | Adverse Major (9)      |
| Operational phase  |                                | Occupational health hazards due to exposure to ammonia releases.                                                                        | Adverse<br>Direct<br>Irreversible<br>Permanent<br>On-site<br>Possible | High                | Very high/unknown   | Adverse Major (9)      |

## 7.5 BIOPHYSICAL IMPACTS:

Biophysical impact refers to the effects of human activities or processes on the physical and biological aspects of the environment. It encompasses changes to ecosystems, species, habitats and the physical environment, such as air, water and soil. An overview of the significant biophysical impacts, before mitigations is shown in Figure 25. Each specific impact is discussed further in this section. Dr. Peter Cunningham (2025) revised the initial biodiversity

specialist study for the overall Project to provide in-depth context of the Project area's vertebrate fauna and flora (Appendix E ).

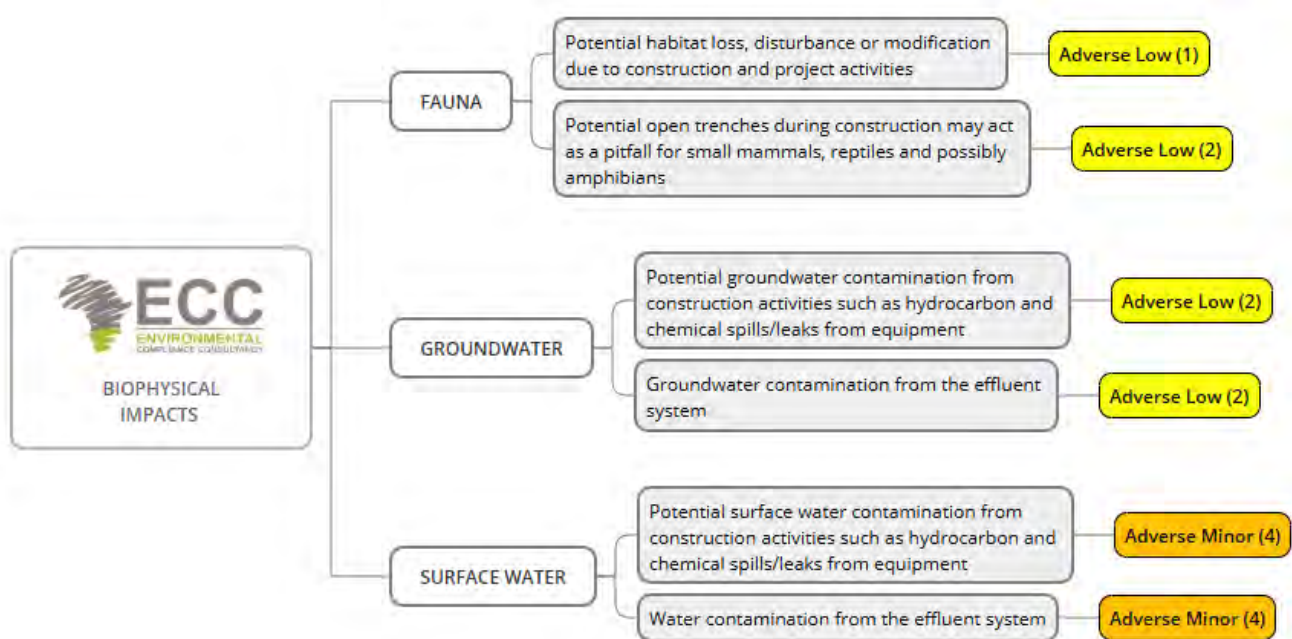


**Figure 25 - Overview of biophysical impacts**

#### 7.5.1 BIODIVERSITY – FAUNA

##### 7.5.1.1 *Potential habitat loss, disturbance or modification due to Project construction activities*

Additional construction and Project activities may result in habitat loss, disturbance, or modification for local faunal species. Although the area has previously been altered, further site preparation and increased human activity can displace small fauna (e.g. burrowing vertebrates) and reduce the ecological functionality of residual habitat patches. Construction noise, vehicle movement and temporary storage of materials may also disturb local species and contribute to incremental habitat degradation.

The nature of the impact is adverse, directly impacting faunal species. The impact is deemed irreversible as disturbed habitats cannot be fully restored. The construction phase is expected to be completed within two (2) years. Therefore, the duration of impact is considered short term. The Project construction activities will be conducted within the Project footprint; therefore, the extent of the impact is on-site. The likelihood of the impact is considered unlikely as the area has already been cleared for existing development and any additional activity is expected to be negligible. Additionally, the Project area is not pristine and is heavily impacted by various anthropogenic activities (past and present) which include road construction activities, pipelines and overhead transmission line infrastructures, litter dumping and various tracks (off road driving) (Cunningham, 2025). The sensitivity of the impact is considered low due to the small extent of the Project footprint. Overall, the

significance of the impact is adverse low, before mitigations (Table 17). Mitigation measures are outlined in the biodiversity specialist study (Appendix E ) and the ESMP (Appendix A ).

*7.5.1.2 Potential open trenches during construction may act as a pitfall for small mammals, reptiles and possibly amphibians*

Potential open trenches created during construction activities may pose a pitfall risk for small mammals, reptiles and potential amphibians. Open excavations can unintentionally trap wildlife that enter in search of shelter, moisture, or food, leading to injury, dehydration, or mortality if escape routes are not available (Andrews & Gibbons, 2005). Small vertebrates are particularly vulnerable because of their limited climbing ability and attraction to shaded or moist microhabitats created within trenches.

The nature of the impact is adverse, directly impacting faunal species and reversible should the Project be decommissioned. The construction phase is expected to occur a short-term period (~2 years). The impact may occur on-site as development will only occur within the Project footprint. The likelihood of the impact is rated possible as open trenches are an attraction to small vertebrates especially reptiles and mammals and should not be left open overnight (Cunningham, 2025).

The magnitude of the impact is considered minor due to the potential loss of some small mammals and/or reptile species. The sensitivity of the impact is low due to the small extent of the Project footprint. The overall significance of the impact is adverse low, before mitigations (Table 17). Mitigation measures are outlined in the biodiversity specialist study (Appendix E ) and the ESMP (Appendix A ).

**Table 17 - Biodiversity impacts – fauna**

| Activity           | Receptor             | Impact                                                                                          | Nature of impact                                                       | Value & sensitivity | Magnitude of change | Significance of impact |
|--------------------|----------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Construction phase | Biodiversity - fauna | Potential habitat loss, disturbance or modification due to construction and project activities. | Adverse<br>Direct<br>Irreversible<br>Short term<br>On-site<br>Unlikely | Low                 | Negligible          | Adverse Low (1)        |
| Construction phase |                      | Potential open trenches during                                                                  | Adverse<br>Direct<br>Irreversible<br>Short term                        | Low                 | Minor               | Adverse Low (2)        |

| Activity | Receptor | Impact                                                                                 | Nature of impact    | Value & sensitivity | Magnitude of change | Significance of impact |
|----------|----------|----------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|------------------------|
|          |          | construction may act as a pitfall for small mammals, reptiles and possibly amphibians. | On-site<br>Possible |                     |                     |                        |

## 7.5.2 GROUNDWATER

### 7.5.2.1 *Potential groundwater contamination from hydrocarbon and chemical spills/leaks from construction equipment, machinery and fuel storage tanks*

Potential unanticipated leaks resulting from damaged or faulty machinery or accidental spillages of hydrocarbons or chemicals may occur during the Project and infiltrate the soil. The aquifers within the Project area are generally characterised by very low yield potential and predominantly saline to hypersaline water quality, therefore not potable.

The impact is adverse, direct and irreversible. Any harmful spills to groundwater are not easily recovered and therefore the impact is permanent. The likelihood of the impact is deemed possible as construction activities may result in unintended/accidental spills.

The magnitude of change and the sensitivity of impact are both rated low, considering the low quality and quantity of groundwater in the Project area. However, this does not preclude the precautionary preservation of the groundwater resource in its current state. The overall significance of the impact is low. Mitigation measures are indicated in the ESMP.

### 7.5.2.2 *Potential groundwater contamination from the effluent system*

Effluents released from the reverse osmosis system during operations are not expected to be toxic or harmful. However, effluents of treated water could cause build-up of nutrients to seep into groundwater, further degrading the quality of groundwater. It should be noted that the groundwater has generally low yields, with predominantly saline to hypersaline water quality. This makes the water unsuitable for human consumption or agricultural use. The impact is adverse, directly impacting groundwater resources. Furthermore, the impact is irreversible and permanent and contaminants may not be easily recovered. Although the groundwater resource in the Project area is generally characterised as low yield and poor quality (saline to hypersaline), the likelihood of the impact is considered unlikely as proper effluent management systems will be in place.

The magnitude of change is considered minor due to the low quality and potential of groundwater in the Project area. The sensitivity of the impact is considered low, as it will be confined to the Project site. Overall, the significance of the impact is rated adverse low, before mitigations (Table 18). Mitigation measures are outlined in the ESMP (Appendix A ).

**Table 18 - Groundwater impacts**

| Activity           | Receptor    | Impact                                                                                                                   | Nature of impact                                                      | Value & sensitivity | Magnitude of change | Significance of impact |
|--------------------|-------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------|---------------------|------------------------|
| Construction phase | Groundwater | Potential groundwater contamination from construction activities (hydrocarbon and chemical spills/leaks from equipment). | Adverse<br>Direct<br>Irreversible<br>Permanent<br>On-site<br>Medium   | Low                 | Minor               | Adverse Low (2)        |
| Operational phase  |             | Potential groundwater contamination from the effluent system.                                                            | Adverse<br>Direct<br>Irreversible<br>Permanent<br>On-site<br>Unlikely | Low                 | Minor               | Adverse Low (2)        |

### 7.5.3 SURFACE WATER

#### 7.5.3.1 *Potential surface water contamination from hydrocarbon and chemical spills/leaks from equipment, machinery and fuel storage tanks*

The construction of the additional Project components may pose a risk of surface water contamination through accidental hydrocarbon or chemical spills and leaks from machinery, fuel storage and equipment. During site preparation, earthworks and the operation of heavy vehicles, fuels, lubricants and hydraulic fluids can be released onto the ground, where they may be mobilised by rainfall or surface runoff into nearby watercourses, drainage lines, or catchment areas (Feng, Yang, & Niu, 2020) (Naidoo & Olaniran, Treated wastewater effluent as a source of emerging chemical contaminants in the environment: A review, 2014). Such contamination can degrade surface water quality and impair downstream ecosystem functioning. Even small spills can introduce toxic substances that persist in the environment and accumulate in sediments, if not promptly contained and remediated (Zhu, Li, & Liu, 2019).

The impact is adverse, directly impacting potential drainage lines and partly reversible should remediation measures be applied. The impact may occur over a long term due to the foreseen Project life cycle (>15 years). The likelihood of the impact is deemed possible due to the low, yet unpredictable rainfall patterns at the coastal towns of central Namibia and run off to nearby water courses.

The magnitude of change is considered minor as any contamination from the Project is expected to have a limited and localised effect on nearby watercourses. The sensitivity of the impact is considered medium, as pollutants may be transported off site due to a drainage line passing through the site (refer to Figure 14 under section 5.4.5). Overall, the significance of the impact is rated adverse minor (Table 19). Mitigation measures are outlined in the ESMP (Appendix A ).

#### *7.5.3.2 Potential surface water contamination from the effluent system*

The operation of the effluent system may pose a risk of surface contamination if effluent is not properly treated or managed. Effluent containing nutrients, pathogens, or chemicals can degrade water quality, impacting local watercourses and the fragile desert ecosystem (Gunkel, 2004) (Naidoo & Olaniran, 2014). Leaks, system overflows, or accidental releases could transport contaminants into ephemeral drainage lines, particularly during rare but intense rainfall events.

The nature of the impact is adverse, directly impacting potential drainage lines and nearby surface water. The impact is partly reversible through a combination of contaminant management mechanisms. The impact may occur over a long-term due to the foreseen Project life cycle (>15 years). The likelihood of the impact is rated possible, as contaminants transport could occur, especially during intense rainfall events.

The magnitude of change is considered minor due to the measurable changes to nearby water courses due to proposed effluent system. The sensitivity of the impact is considered medium, as pollutants may be transported off site due to a drainage line passing through the site (refer to Figure 14 under section 5.4.5). Overall, the significance of the impact is rated adverse minor. Mitigation measures are outlined in the ESMP (Appendix A ).

**Table 19 - Surface water impacts**

| Activity           | Receptor      | Impact                                                            | Nature of impact                                             | Value & sensitivity | Magnitude of change | Significance of impact |
|--------------------|---------------|-------------------------------------------------------------------|--------------------------------------------------------------|---------------------|---------------------|------------------------|
| Construction phase | Surface water | Potential surface water contamination by hydrocarbon and chemical | Adverse<br>Direct<br>Partly reversible<br>Long term<br>Local | Medium              | Minor               | Adverse Minor (4)      |

| Activity          | Receptor | Impact                                                          | Nature of impact                                                         | Value & sensitivity | Magnitude of change | Significance of impact |
|-------------------|----------|-----------------------------------------------------------------|--------------------------------------------------------------------------|---------------------|---------------------|------------------------|
|                   |          | spills/leaks from equipment, machinery and fuel storage tanks.  | Possible                                                                 |                     |                     |                        |
| Operational phase |          | Potential surface water contamination from the effluent system. | Adverse<br>Direct<br>Partly reversible<br>Long-term<br>Local<br>Possible | Medium              | Minor               | Adverse<br>Minor (4)   |

## 7.6 CUMULATIVE IMPACT

An overview of the interspecific impact before mitigations is shown in Figure 26. The impact is discussed in detail in the section thereafter.



**Figure 26 - Cumulative impact**

### 7.6.1 INTERSPECIFIC IMPACTS

*7.6.1.1 Increased traffic volumes and heavy loads on the D1984 could accelerate road deterioration, creating a greater need for maintenance*

The Project, along with other expected new developments at Farm 58 (Walvis Bay), may increase traffic volumes, and heavy loads on the D1984 that could accelerate road deterioration, creating a greater need for maintenance.

The nature of this impact is adverse, partly reversible and cumulative, due to added traffic from surrounding developments and impact both traffic flow and the road quality. The impact duration of the impact is long-term due to the life cycle of the Project (> 15 years). The scale of this impact is local, and the magnitude of the impact is minor. The probability of this impact occurring is likely as vehicles will be used by employees and it is expected that heavy load trucks will be using the road to transport industrial goods, materials and equipment to various Project sites. The sensitivity of this impact is rated low due to the local scale of the impact and the costly maintenance measures. Overall, the significance of the impact is rated adverse minor. The mitigation measures are outlined in Table 20 and the ESMP (Appendix A ).

**Table 20 - Cumulative impacts**

| Receptor                              | Impact                                                                                                                                                                                                                                                                                                           | Significance of impact | Impact management                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Traffic (road users and road quality) | <p><b>Activity:</b> Transportation of industrial goods, materials and equipment to multiple businesses and commuting people (including tourists).</p> <p><b>Impact:</b> Increased traffic volumes and heavy loads on the D1984 could accelerate road deterioration, creating a greater need for maintenance.</p> | Adverse Minor (3)      | <ul style="list-style-type: none"> <li>– Enforce weight limits and ensure vehicles comply with axle load regulations.</li> <li>– Implement a structured maintenance schedule to address wear and tear, including resurfacing, grading, and drainage crossings.</li> <li>– Schedule frequent inspections to identify early signs of damage.</li> </ul> |

## 8 CONCLUSION

An amendment application has been undertaken for the proposed infrastructure upgrade of the GHDP, as per condition 16 on the approved environmental clearance certificate which states that *“any changes to, or deviations from the scope of project activities approved in respect to the assessment received and reviewed for the purpose or granting this ECC Number (ECC2300257) are subject to an amendment application and approval by the Environmental Commissioner prior to adopting / implementing any such changes / deviations.”*

In compliance with the current environmental clearance certificate, this report identifies the potential significant impacts that may be triggered by the infrastructure upgrades to the GHDP and assesses their severity and significance. The potential impacts likely to be triggered by the Project include impacts relate to socioeconomic development, employment creation, community and occupational health and safety, visual impacts, traffic impacts, air quality, noise, biodiversity (fauna), surface and groundwater and cumulative impacts. Additional specialist studies on biodiversity, water and social aspects were undertaken, and no significant impacts were identified as being associated with the additional GHDP activities.

The areas of concern will need to be carefully monitored and managed according to the ESMP (Appendix A ) to ensure that the significance of these impacts are reduced as far as reasonably possible.

Table 21 summarises the impacts after mitigation. On a scale of 1 to 12, low to high, the beneficial (B) and negative (N) impact significance is stated.

**Table 21 - Summary of the significance rating after mitigation for the expected impact**

| Socioeconomic environment:<br>economic                                 |     | Socioeconomic: social             |    | Biophysical environment |    |
|------------------------------------------------------------------------|-----|-----------------------------------|----|-------------------------|----|
| Creation of temporary jobs                                             | B6  | Air quality impacts               | N2 | Fauna impacts           | N2 |
| Skills development and work experience                                 | B12 | Visual impacts and sense of place | N2 | Groundwater impacts     | N2 |
| Revenue generated through licencing fees, exploration levies and taxes | B12 | Noise impacts                     | N2 | Surface water           | N4 |
| Contribution to local businesses and vendors                           | B3  | Traffic impacts                   | N4 |                         |    |

| Socioeconomic environment:<br>economic                                       |    | Socioeconomic: social          |    | Biophysical environment |  |
|------------------------------------------------------------------------------|----|--------------------------------|----|-------------------------|--|
| Social risks including GBV, substance abuse, teenage pregnancy and HIV risks | N2 | Community health and safety    | N4 |                         |  |
|                                                                              |    | Occupational health and safety | N6 |                         |  |

The assessment of the additional activities on the GHDP Project on the receiving environment has shown to have adverse low to moderate impacts and beneficial impacts (Table 21). These areas should be managed as per the commitments outlined in the ESMP (Appendix A ). This will ensure that the Project remains compliant with the relevant legislation and environmental best practices.

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## **APPENDIX A – AMENDED ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN**

## **APPENDIX B – ENVIRONMENTAL CLEARANCE CERTIFICATE (ECC-2300257)**

## **APPENDIX C – CLEANERGY GREEN HYDROGEN DEMONSTRATION PLANT EMP**

## **APPENDIX D - STAKEHOLDER/I&AP LETTER**

## **APPENDIX E – BIODIVERSITY SPECIALIST STUDY**

## **APPENDIX F – HERITAGE IMPACT ASSESSMENT STUDY CONDUCTED IN 2022**