BACKGROUND INFORMATION DOCUMENT

Environmental Impact Assessment for the Proposed Construction and Operation of Green Hydrogen Electrolysis Plant and Green Ammonia Synthesis, and Associated Infrastructure on the Remainder of Farm Geluk No.116 and Portion 7 of Farm 58, Walvis Bay, Erongo Region

For: Elof Hansson Hydrogen Namibia (Pty) Ltd

ECT
ENVIRONAM CONSULTANTS TRADING

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1 INTRODUCTION

1.1 Purpose of this document

The purpose of this Background Information Document (BID) is to provide a brief description of the proposed project and the Environmental Impact Assessment (EIA) process to be undertaken for the proposed development of Green Hydrogen Electrolysis and Green Ammonia Synthesis plants and their associated infrastructure on the Remainder of Farm Geluk No.116 and Portion 7 of Farm 58, Walvis Bay, Erongo Region respectively. The BID explains the environmental assessment process and provides an opportunity for Interested and Affected Parties (I&Aps) to register for the EIA process and to submit any initial comments or issues regarding the proposed project. The comments and concerns received will be evaluated during the assessment and included in the reports that will be submitted to the Department of Environmental Affairs (DEA) of the Ministry of Environment, Forestry and Tourism (MEFT) for consideration.

1.2 The Proponent

Elof Hansson Hydrogen Namibia (Pty) Ltd focuses on becoming one of the first Green Hydrogen manufacturers in Namibia. The investors/proprietaries intend to manufacture Green Hydrogen and Green Ammonia at Walvis Bay, Namibia as Namibia offers globally leading low-cost hydrogen production possibilities.

1.3 Project Description

1.3.1 Alkaline Electrolysis Plant

Water is made up of two hydrogen and one oxygen atom to form H_2O. Hydrogen is highly combustible, hence important in electricity generation. To separate hydrogen from oxygen, water is decomposed by introducing an electrochemical process that splits water molecules into hydrogen and oxygen gases, a process referred to as 'water electrolysis'. Due to the low conductivity of pure water, an acid or base is used to improve the conductivity.

Hence, in an alkaline electrolyser, Pottasium Hydroxide (KOH), Sodium Hydroxide (NaOH) and Sulphuric acid (H_2SO_4) solution are mainly used with water. The solution splits into positive ions and negative ions and these ions readily conduct electricity in a water solution by flowing from one electrode to the other.

When a high voltage is applied to an electrochemical cell in the presence of water, hydrogen and oxygen gas bubbles evolve at cathode (negative electrode) and anode (positive electrode) respectively[1].

[1]Mamoon Rashid, Mohammed K. Al Mesfer, Hamid Naseem, Mohd Danish., 2015 Hydrogen Production by Water Electrolysis: A Review of Alkaline Water Electrolysis, PEM Water Electrolysis and High Temperature Water Electrolysis: International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-4 Issue-3, February 2015

1.3.2 Ammonia Synthesis Plant

Ammonia synthesis was developed by German Scientist Fritz Haber. His objective was to enhance the intensive production of food. There is a long history behind this invention which led to Fritz Haber being awarded a Nobel Peace Prize. According to literature, Haber achieved ammonia synthesis by inventing a large-scale catalytic synthesis of ammonia from elemental hydrogen and nitrogen gas, reactants. He used high temperature and high pressure and iron catalyst, to force a relatively unreactive gaseous nitrogen and hydrogen to combine into ammonia (NH_3)[2]. His invention presented the essential precursor to produce fertilizers and explosives used in mining and warfare. Currently, synthetic ammonia produced from the reaction between nitrogen and hydrogen is the base from which virtually all nitrogen-containing products are derived (Jayant M Modak., 2002).

1.3.3 Hydrogen pipeline

The hydrogen pipeline will be constructed from the electrolysis plant 70km to the ammonia synthesis plant. The distance presents an opportunity for hydrogen storage, thereby limiting the project footprint as well. Hydrogen has the lowest density of all gases and its extremely flammable. Due to its properties, it is able to penetrate through steel and make it brittle, a phenomenon commonly known as embrittlement. It is therefore critical that the manufacturing of hydrogen pipelines is done in accordance with approved and published standards.

Namibia does not have standards pertaining to the manufacturing of hydrogen pipelines. The project will use international standards like the American Society of Mechanical Engineers (ASME) Hydrogen Piping and Pipelines (B31.12) 2019 standards. These standards provide guidelines on the design, construction, operation, and maintenance of piping, pipelines, and distribution systems in H_2 service, and target applications including power generation, process plants, pipelines, distribution, and automotive filling stations. Under these standards, the following factors are put into consideration[3];

- **Brittle Fracture Control:** To ensure that the pipe has adequate ductility and fracture toughness.
- **Ductile Fracture Control:** To ensure that the pipeline has adequate toughness to arrest a ductile fracture.

For purposes of the EIA, the relevant standards and codes will be appended as part of the Environmental Management Plan.

1.3.4 Ammonia pipeline

Ammonia from the synthesis plant will be in a liquid form and refrigerated at a low temperature. Chemically, ammonia is a

[2] Jayant M Modak., 2002., Haber Process for Ammonia Synthesis

[3] Austin M. Glover (SNL), Jeffrey T. Mohr (NREL), Austin R. Baird (SNL) 2021., Codes and Standards Assessment for Hydrogen Blends into the Natural Gas Infrastructure
)

colourless and non-flammable liquefied gas made of 82% nitrogen (N) and 18% hydrogen (H) with a chemical formula NH_3. It is the ammonia synthesis process that enables the transportation of hydrogen.

Ammonia is corrosive and can corrode galvanized metals, cast iron, copper, brass, or copper alloys. Namibia does not have standards and codes for the construction of ammonia pipelines. The project will adopt to international standards like the American Society of Mechanical Engineers (ASME) Process Piping B31.3 – 2022 standard and codes for the pipeline construction[4].

Some chemical/physical properties of ammonia are[5]:

- At room temperature, ammonia is a colourless, highly irritating gas with a pungent, suffocating odor.
- In pure form, it is known as anhydrous ammonia and is hygroscopic (readily absorbs moisture).
- Ammonia has alkaline properties and is corrosive.
- Ammonia gas dissolves easily in water to form ammonium hydroxide, a caustic solution and weak base.
- Ammonia gas is easily compressed and forms a clear liquid under pressure at low temperature.
- Ammonia is usually shipped as a compressed liquid in steel containers.
- Ammonia is not highly flammable, but containers of ammonia may explode when exposed to high heat.

For purposes of the EIA, the relevant standard and codes will be appended as part of the Environmental Management Plan.

1.3.5 Transportation

Liquid ammonia will be pumped to a storage facility near the recently constructed jetty at Walvis Bay. NAMPORT indicated that the jetty is currently under-utilized. At full scale, the project will produce about 36,000 metric tons of ammonia per month to supply at least one (1) ammonia vessels monthly. It will be the duty of NAMPORT to ensure that ammonia vessels meet international standards.

[4] DSc PhD Dževad Hadžihafizović (DEng) Sarajevo 2023., ASME B31.3 Process Piping Guide

[5] Agency for Toxic Substances and Disease Registry. 2004. ToxFAQs for Ammonia. Division of Toxicology, U.S. Department of Health and Human Services. Public Health Service: Atlanta, GA.

1.3.6 Overall plant concept

Figure 3 below provides an overview of the plant concept for the entire Green Hydrogen and Green Ammonia production project components.

1.4 Project Location

1.4.1 Electrolysis Plant

The solar farm is located on a 7, 100 ha desert land on Remainder of Farm Geluk No.116, about 70km north-east of Walvis Bay (-22.551793°S, 15.349920°E) (Figure 1). This site also houses the solar farm and the distilled water storage facility.

The surrounding environment is known as Central Namib Uranium Province as it is home to some of the world's largest Uranium producing mines namely; the Husab and Rossing mines.

Figure 1. Farm Geluk location and surrounding area

1.4.1 Ammonia Synthesis

The ammonia synthesis is proposed to be located on Portion 7 of Farm 58, Walvis Bay in the Erongo Region.

The site is situated west of Walvis Bay International Airport and east of the landmark, Dune 7, about 70km west of Farm Geluk at coordinates 22.945214°S; 14.613832°E (see figures 2 below).

Figure 2: Locality Map of Portion 7 of Farm 58

1.4.2 Hydrogen Pipeline

The hydrogen pipeline will be constructed from the alkaline electrolysis plant, and traverses through the Namib Naukluft Park for 70km to Farm 58 where ammonia will be produced.

A desktop study complemented by site assessment to assess feasible servitudes for linear infrastructure was undertaken. The study considered environmental sensitive areas (*Welwitschia* fields), topography and economic viability.

A reference line from the proposed solar farm to Farm 58 at the Ammonia Synthesis and Desalination plant was created as a baseline to inform other alternatives route. Any alternative that performs poorly against the reference line was automatically disregarded.

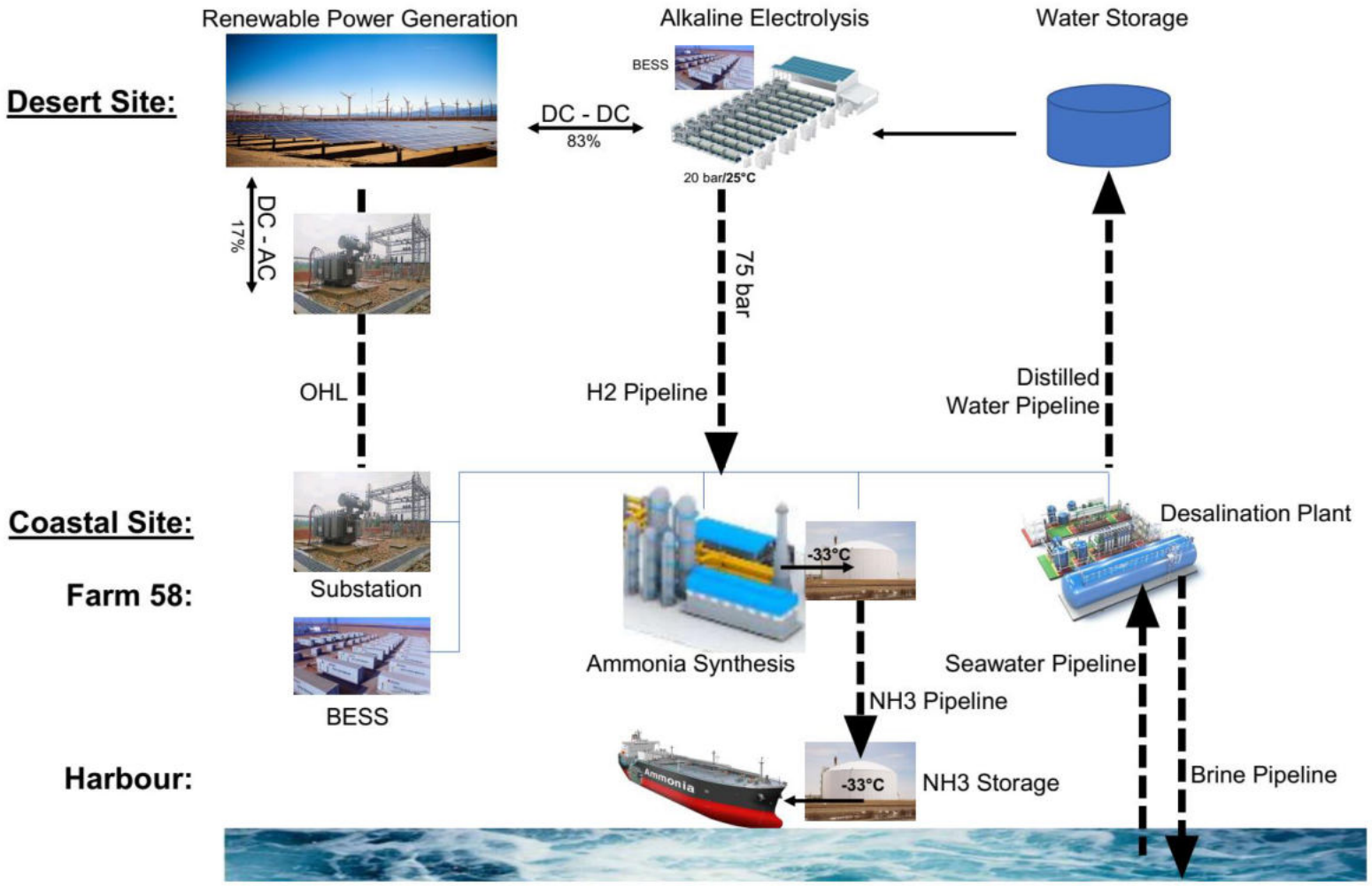

Figure 3: Overall Green Hydrogen and Green Ammonia Production Plant Concept

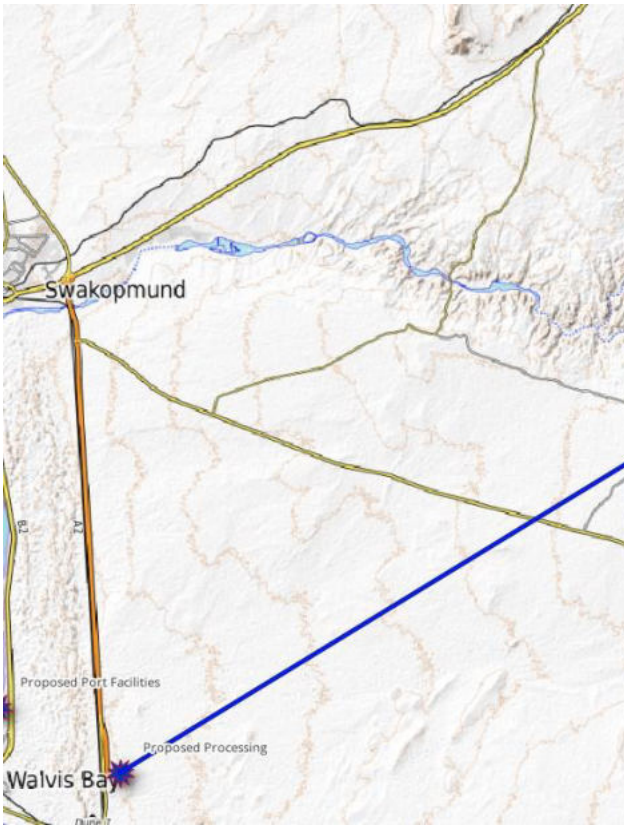

Figure 4. Reference line / Baseline between Farm 58 the solar farm.

With the available vegetation data of the *Welwitschia* fields, boundaries for the linear infrastructures were determined. Eventually, the topography and Swakop river crossings were the determining factors for the routes of linear infrastructure.

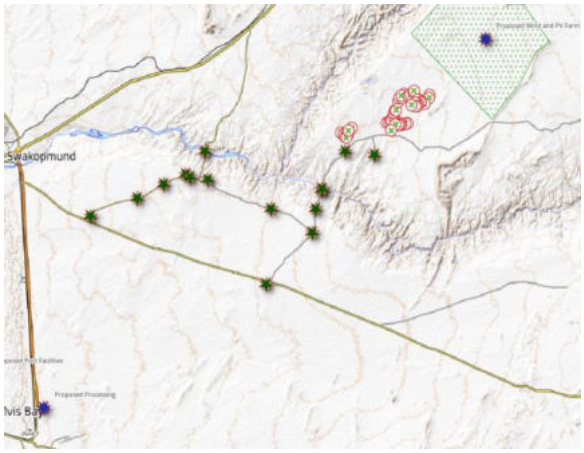

Figure 5. Map indicating the distribution of the *Welwitschia Mirabilis*

The routes were overlaid over the *Welwitschia* fields and other constraints such as topography to determine their feasibility as shown in figure 5 below. The area, terrain and topography with green colours in the map below were undesirable.

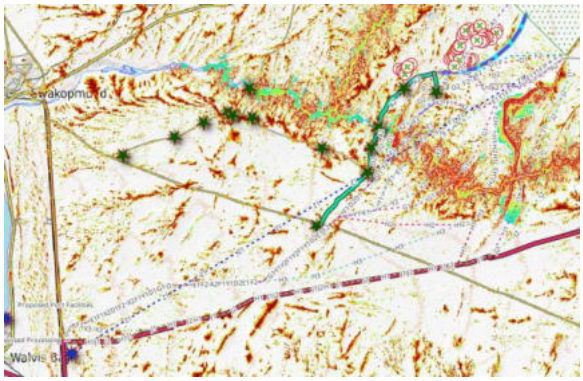

Figure 6. Map indicating constraints and routes considered

It was therefore concluded that, routes A & B depicted in figure 7 below were the most feasible for the hydrogen pipelines.

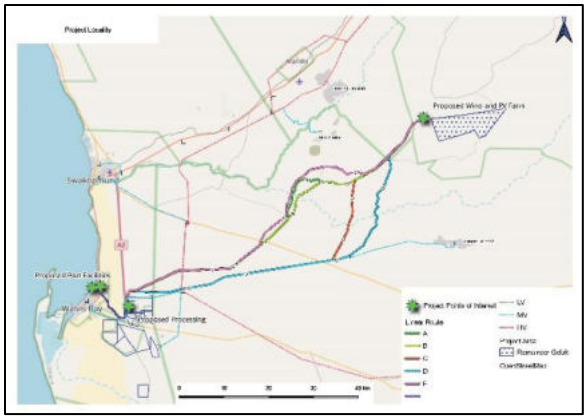

Figure 7. Map showing the project site and the proposed linear routes

Determining the preliminary routes was necessary to inform a compressive field assessment. With various uncertainty, these routes may change.

1.4.3 Ammonia pipeline

Ammonia from the synthesis plant will be transported via a 15km pipeline to the ammonia storage plant on the coast. From the storage plant, a pipeline will be constructed under the existing jetty, that will pump ammonia into the ammonia vessel.

2 STATUTORY REQUIREMENTS

The protection of the Namibian environment is enshrined in the Namibian constitution under article 95(l)[6]. This constitutional provision provided for the enactment of the Environmental Management Act 2007 (Act No. 7 of 2007) (EMA) and its Environmental Impact Assessment Regulation, Government Gazette 6 February 2012 No. 4878.

The EMA promotes the sustainable management of the environment and the use of natural resources by establishing principles for decision-making on matters affecting the environment. These principles must be applied by Government institutions, private persons, companies, institutions, and organisations when planning for activities that may have significant impacts on the environment. The EMA provides for a process of assessment and control of activities which may have significant effects on the environment; and to provide for incidental matters.

Section 27(2)(b) of EMA provides a list of activities that may not be undertaken without an Environmental Clearance Certificate (ECC). The production of green hydrogen and green ammonia are listed activities that may not be undertaken without an ECC as indicated in Table 1 below

[6]The Constitution of Namibia Article 95(l) *"The State shall actively promote and maintain the welfare of the people by adopting policies aimed at … The maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future".*

Table 1. Identified listed activities for the proposed solar farm.

Environmental Impact Assessment Regulation 2012 GRN Gazette No. 4878	
Activity	**Applicability to the project**
The construction of facilities for: 1. (c) refining of gas, oil and petroleum products.	The project will involve the construction of facilities for gas refining
9.1 The manufacturing, storage, handling or processing of a hazardous substance defined in the Hazardous Substances Ordinance, 1974.	The project will involve the manufacturing, storage and processing hydrogen gas which is highly flammable and can cause explosion
9.3 The bulk transportation of dangerous goods using pipeline, funiculars or conveyors with a throughout capacity of 50 tons or 50 cubic meters or more per day.	The project will transport hydrogen gas via a pipeline
9.4 The storage and handling of a dangerous goods, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic meters at any one location.	The project will involve storing hydrogen in the pipeline
9.5 Construction of filling stations or any other facility for the underground and aboveground storage of dangerous goods, including petrol, diesel, liquid, petroleum, gas or paraffin.	The project will involve constructing above ground hydrogen pipeline.
10.1 The construction of- (a) oil, water, gas and petrochemical and other bulk supply pipelines;	The project will involve constructing hydrogen supply pipeline.

3 OVERVIEW OF THE AFFECTED ENVIRONMENT

3.1 Alkaline Electrolysis Plant

The Alkaline Electrolysis Plant at Farm Geluk is located near Uranium mines and various other mining activities. Strategic Environmental Assessment for the central Namib indicates that the area is suitable for mining and other industries. The area is flat desert barren land.

3.2 Ammonia synthesis Plant

The ammonia synthesis plant will be located at Farm 58 which is part of Walvis Bay townlands. The proposed site is already zoned as an industrial area. The proposed project area is in desert land, which is mostly free of vegetation.

3.3 Hydrogen Pipeline

The hydrogen pipelines will traverse through the Namib Naukluft Park. The preliminary route was carefully studied to avoid desert-sensitive areas, such as *Welwitschia mirabilis* fields and tourism sites.

3.4 Ammonia Pipeline

The ammonia pipeline servitude from farm 58 to the sea traverses through an area generally known as a breeding area for the Damara terns, which are near-endemic to Namibia and near-threatened. Damara Terns are found in concentrated numbers along the coastline stretching north from the south of Walvis Bay to the Ugab River. They nest on gravel plains within 3–5 km of the shore where they forage over the shallow Bay water, over reefs, or in salt ponds (NACOMA, 2010).

This servitude follows the railway line however it needs to be formally defined and registered with the relevant authorities.

4 POTENTIAL SOCIAL AND ENVIRONMENTAL IMPACTS

4.1 Socio-economics

The construction and operation of the alkaline electrolysis and ammonia synthesis and their associated infrastructure will create significant direct and indirect employment opportunities, contribute to state revenues through direct taxes and improve Namibia's competitiveness in the fourth industrial revolution.

Construction projects are generally associated with increased rural-urban migration and associated risk of the increase in social ills such as petty crimes, increased alcohol abuse, and social disturbances to family structures.

4.2 Bio-Physical

The construction of the ammonia synthesis at Farm 58 is not expected to cause a significant impact since the area is zoned as an industrial area. However, the construction of alkaline electrolysis and hydrogen pipelines will change the aesthetic sense of the area. It should however be noted that the project area is located on desert land, mostly free of vegetation, hence the project's footprint is not anticipated to be significantly detrimental to the biodiversity. If inevitable, affected vegetation (mostly *Welwitschia mirabilis)* could be transplanted.

4.3 Waste Generation

During construction, huge amount of domestic waste and construction waste will be produced. The project will be required to put in place solid and liquid waste management plan. The are no by-products from the production of hydrogen and ammonia.

4.4 Land Degradation

Uncoordinated movement of heavy vehicles and other vehicles at undesignated areas may cause land degradation.

4.5 Safety

The transportation and storage of hydrogen could be a safety risk if standards of design and construction are not followed.

4.6 Heritage and Archaeological materials

The National Heritage Council Act 27 of 2004 provides for the protection and conservation of places and objects of heritage significance and the registration of such places and objects; to establish a National Heritage Register; and to provide for incidental matters. There are currently no known heritage sites of special importance in the proposed area and hence, no negative impacts to any sites of heritage significance are expected.

Project construction may unearth heritage or archaeological material. A comprehensive heritage resource study will be undertaken.

4.7 Wild Animal Routes

The Namibia desert is home to various wild animals. The construction of pipelines may impede the movement. The construction will consider the areas of wildlife crossing, as will be informed by the avifauna study.

5 THE EIA PROCESS

The Namibia EIA process is explained in the EIA regulation 2012, GRN Gazette No. 4878. The process is summarised in Figure 8 below.

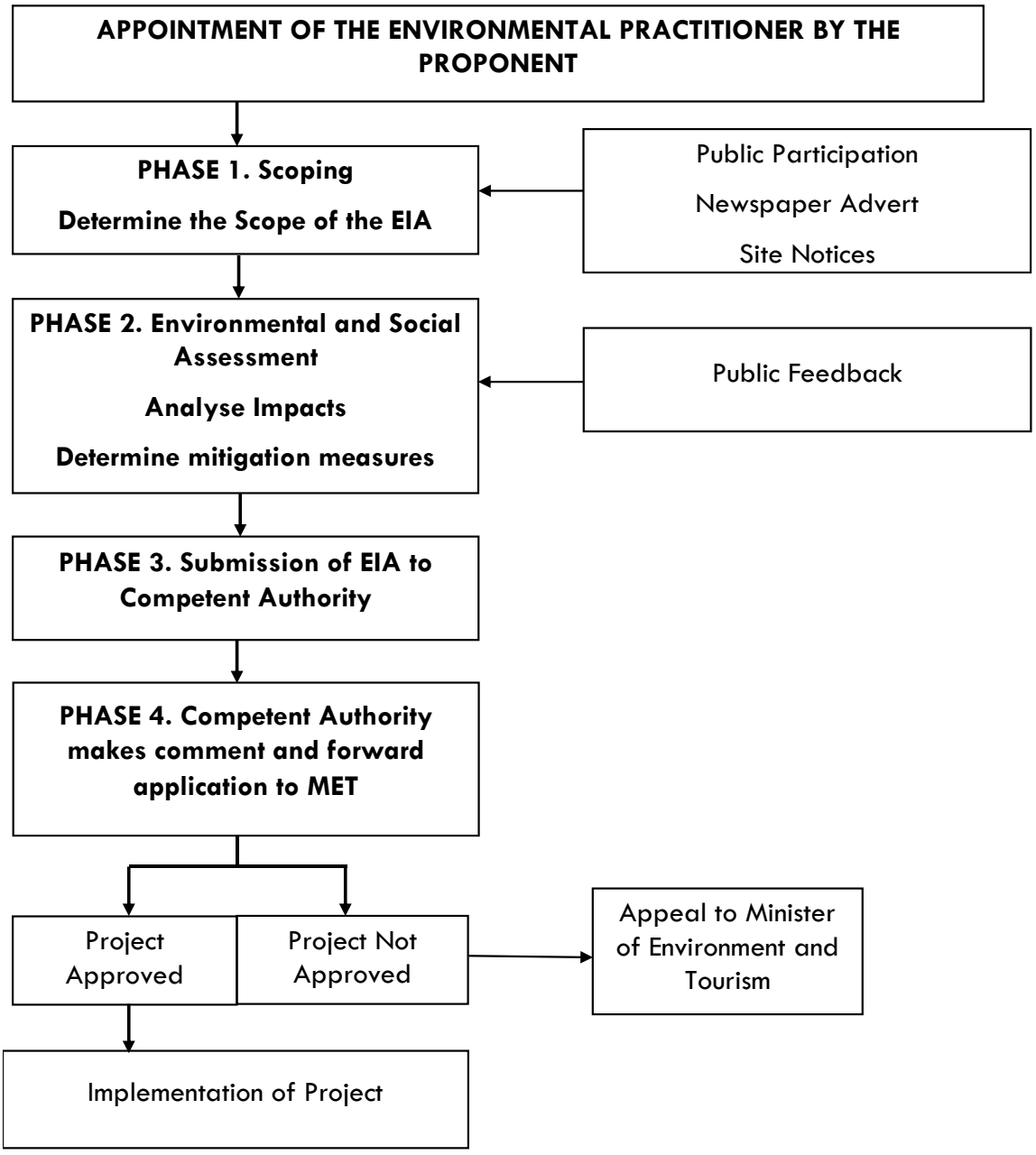

Figure 8. The EIA process in Namibia

6 TERMS OF REFERENCE FOR UNDERTAKING THE EIA

The scope of the EIA is guided by the Terms of References as provided for by the EIA Regulation 2012, Section 9 (a-b) but, not limited to the following;

- Provide a comprehensive description of the proposed Project;
- Identify relevant legislation and guidelines for the project;
- Identify potential environmental (physical, biological and social) conditions of the project location and conduct risk assessment;
- Inform Interested and Affected Parties (I&APs) and relevant authorities about the proposed project to enable their participation and contribution;
- Develop an Environmental Management (EMP) that would be a legal guideline for the environmental protection by the project.

7 PUBLIC CONSULTATION

Section 21 of the EIA Regulation requires the undertaking of an Environmental Impact Assessment (EIA) to follows a robust and comprehensive public consultation. This is an important process, because it gives members of the public, especially the Interested and Affected Parties the opportunity to comment or raise concerns on issues that may affect their socio-economic or general environment because of the project. Further, it solicits crucial local knowledge that the Environmental Assessment Practitioner may not have. The process will be undertaken as follows;

I. **Notice board:** In accordance with Section 21 (a) a notice board will be placed at the project site and other public places to inform and create public awareness about the project and the application of ECC.

II. **Written notice**: In accordance with Section 21 (b) written notices will be given to the public, particularly in the surrounding areas to inform them and create awareness about the project and the application of ECC.

III. **Newspaper advertisement:** In accordance with Section 21 (c), the project must be advertised once a week for two consecutive weeks in

two newspapers that are widely circulated in Namibia.

IV. **Public Meeting** In accordance with Section 21 (5,6) a public meeting will be undertaken in Walvis Bay on Wednesday **13 December 2023** at the Walvis Bay Side Hall at 14:00.

8 REGISTRATION AS AN INTERESTED AND AFFECTED PARTY

The public, individuals, scholars, community leaders and organizations are urged to register as Interested and Affected Parties (I&AP) and provide comments and input using the comment form in Annex 1 at the following address;

Name of Consultant:	Colin P Namene
Email Address:	colin@environam.com/ spike@environam.com
Postal Address:	P.O. Box 24213 Windhoek
Cell phone:	+264 81 458 4297/ +264 81 240 5365
Deadline for submission of comment:	20th December 2023

9 ANNEX 1. COMMENT FORM

Environmental Impact Assessment for the Proposed Construction and Operation of Green Hydrogen Electrolysis Plant and Green Ammonia and Associated Infrastructure at Farm Geluk and Farm 58, Walvis Bay, Erongo Region

Date		**Time**	
Particulars of I&APs			
Surname		**Initials**	
First Name (s)		**Tel/Cell**	
Organisation		**Postal Address**	
Email		**Postal Code**	
Town			

What is your area of interest in the Project?

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Kindly write your comment, Concerns, Recommendations and or Questions below.

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Thank you for your comments ☺