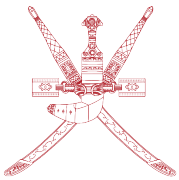
الهيئة العامة للمناطق الاقتصادية الخاصة والمناطق الحرة
Public Authority for Special Economic Zones and Free Zones
Sultanate of Oman
سلطنــة عمـان



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT GUIDELINE

PREPARED BY THE COMPLIANCE AND ENVIRONMENTAL AFFAIRS DEPARTMENT

CONTENTS

1- INTRODUCTION:

The Public Authority for Special Economic Zones and Free Zones was established under Royal Decree No. 105/2020, which entrusted it with the responsibility of supervising special economic zones and free zones, regulating the investment environment within them, and ensuring compliance. Subsequently, Royal Decree No. 53/2022 concerning the Public Authority for Special Economic Zones and Free Zones and the Public Establishment for Industrial Estates was issued, assigning the Authority the responsibility of overseeing industrial zones in the Sultanate of Oman. Later, Royal Decree No. 44/2023 was issued to establish the Khazaen Economic City and its regulations, further entrusting the Authority with the supervision of this city.

In alignment with its commitment to effectively carrying out its supervisory and regulatory responsibilities over these zones, fostering a culture of compliance among zone operators and operating companies, and establishing a unified methodology for regulatory oversight and compliance, the Authority has developed mechanisms and procedures for monitoring, inspection, compliance, and addressing arising outcomes within the work environment. Additionally, it has established a framework for cooperation and coordination to streamline efforts between the Authority and zone operators in OPAZ decision NO (37/2023). In this context, the Authority has issued the Environmental and Social Impact Assessment (ESIA) Guideline to unify the procedures among all OPAZ's zones to ensure all investors obligate with this Guideline alien with OPAZ decision NO(17/2021) .

1-1 DEFINITION OF ESIA

Introduction ESIA to Projects

An Environmental and Social Impact Assessment (ESIA) is a comprehensive process that begins at a project's conceptual design phase and continues through construction, operation, and decommissioning. Throughout this process, several deliverables are developed to guide activities specific to each project stage.

The primary objective of an Environmental and Social Impact Assessment (ESIA) is to evaluate the positive and negative impacts associated with project implementation while aligning with the principles of sustainable development. This involves analyzing the interactions between environmental and social elements and the various activities and phases of the project, including temporary facilities (such as those utilized during the construction phase) and associated infrastructure.

The scope and analytical approach of an ESIA differ based on the specific characteristics of the proposed project. Each element of the project should be reviewed for its potential impact on the environment and society at every phase (construction, operation, and decommissioning).

An ESIA addresses the environmental and social costs and benefits of a project and includes an evaluation of its economic implications. It should consider the project's design alongside possible alternatives, including the "no-action" option.

In addition to direct impacts, the ESIA should examine potential interactions among various environmental components (indirect effects) and consider cumulative effects arising from simultaneous activities occurring nearby.

1-2 Importance ESIA to Projects:

In most countries, regulations mandate that an ESIA be conducted before authorizations—such as permits, licenses, or planning consents—are granted for certain types of projects. Since national legislation varies widely, it is essential to understand local requirements before initiating the ESIA process. This involves:

- Developing a comprehensive understanding of the current environmental and social context.
- Identifying potential positive and negative impacts on the environment and local communities from the proposed changes and
- Ensuring that the design, implementation, operation, and eventual decommissioning of the project are managed to minimize adverse effects while maximizing benefits for the environment and affected communities.
- Ensuring to comply with the principle of sustainable development.

1-3 ENVIRONMENTAL PERMITTING PROCESS:

1-Screening: The first step involves obtaining an Environmental Permit to classify the project appropriately. In accordance with OPAZ Decision 17/2021, the investor must determine whether the project falls under the First Category (Heavy Project), Second Category (Medium Project), or Third Category (Light Project). For projects not explicitly listed in Appendix No. 1, Article 17 of OPAZ Decision 17/2021 stipulates that "The competent department may require project, not listed in Appendix (No. 1) to this Decision, to conduct an environmental and social impact assessment study, if assessed within a high environmental risk category". Upon receiving the project application, OPAZ/Zone operators will evaluate the details provided to determine whether the project is applicable for approval.

Based on the screening of Project, if the project is Categorized as Second Category , the Proponent might be required to submit an Environmental Management Plan. Depending on the type of project, the proponent may be required to submit a Construction Environmental Management Plan(CEMP), an Operational Environmental Management Plan (OEMP) and Decommissioning Environment Management Plan (DEMP) or only one of the EMP, depending on the project.

2-Scoping: Following project approval, if the project falls under First Category , the investor or proponent must submit an Environmental Scoping Report before submitting the ESIA report. The Environmental Scoping Report and ESIA study must be conducted by an environmental consultant approved by the competent authority. This report serves as the Terms of Reference (TOR). Upon submission of all necessary documentation, the scoping report will be approved once it satisfies all OPAZ requirements.

3-ESIA report: Once the scoping report is approved, the investor or proponent must submit the ESIA report. Upon completion and review of all required documentation, OPAZ will grant approval for the ESIA report.

4-Permitting: Upon approval of the ESIA study, the investor or proponent will receive an Environmental Permit, along with the associated environmental conditions, from the Zone Operator.

FIGURE(1) ENVIRONMENTAL PERMITTING PROCESS FOR FIRST CATEGORY

1-4 DEFINITIONS AND ABBREVIATIONS:

OPAZ: Public authority for economic zones and free zone
Zone operators: An organization or company authorized to oversee the management and operations of a designated zone

Project/Operating Company: A licensed entity authorized to operate within the region, which may include a sole proprietorship, a company, a branch of a foreign organization, institution, or a commercial representative office.

Environmental permit: The approval issued by the competent department, which allows the project to engage in one specific activities or more after ensuring its environmental safety. The permit includes general and technical environmental conditions for the project.

Proponent: The individual or organization, such as a developer, permit applicant, company, or agency, responsible for proposing and initiating a project or development.

ESIA: Environmental and social impact assessment

EMP: Environment management plan

BAT: Best available techniques

TOR: Terms of Reference

Environmental Components: A specific attribute or constituent of the environment (e.g., air quality, marine water, waste management, geology, seismicity, soil, groundwater, marine ecology, terrestrial ecology, noise, traffic, or socio-economic factors etc....) that may be affected by a proposed project.

Environmental Impact: Any positive or negative change to an environmental component caused by a proposed project, whether occurring directly or indirectly, across its lifecycle stages such as construction, operation, and decommissioning.

Construction: The phase of a project that encompasses all events, processes, andactivities related to the building and development of the site, infrastructure, and facilities (e.g., buildings, processing units). This phase concludes when the project transitions into full operation or use.

Operation: The phase of a project during which all events, processes, and activities take place while the project is fully functional. This phase follows construction and ends when the project transitions into the decommissioning phase.

Decommissioning: The phase of a project that involves the systematic cessation of operations, including the dismantling, demolition, or safe disposal of infrastructure and equipment. This phase occurs after the operational phase and ensures compliance with environmental and safety standards.

1-5 ESIA REPORT FORMAT AND CONTENTS:

TABLE OF CONTENTS		
LIST OF ABBREVIATIONS		
DEFINITIONS OF TERMS		
TABLES		
FIGURES		
CHAPTER 1	**EXECUTIVE SUMMARY (ARABIC & ENGLISH)**	1-1 Project Description 1-2 Summary of Findings
CHAPTER 2	**INTRODUCTION**	2-1 Project Title and Project Proponent 2-2 ESIA Consultants 2-3 Project Description and Rationale
CHAPTER 3	**LEGAL FRAMEWORK AND STANDARDS**	
CHAPTER 4	**PROJECT DESCRIPTION**	4-1 Type of project activity 4-2 Statement of Need 4-3 Project Location and Scale 4-4 Project and Activity Description 4-5 Project Status and Schedule
CHAPTER 5	**PROJECT ALTERNATIVES**	5-1 Project Alternatives 5-2 BAT Assessment instruction

CHAPTER 6	**DESCRIPTION OF THE**	6.1 Air Quality 6.1.1 Description of the Environment 6.1.2 Environmental Impact Prediction and Evaluation 6.13 Mitigation Measures 6.13.1 Selected Mitigation Measures 6.13.2 Mitigation Measures to Address Cumulative Impacts 6.13.3 Residual Impacts 6.14 Monitoring Program 6.14.1 Monitoring Program for Compliance with Selected Mitigation Measures 6.1.4.2 Monitoring Program for Cumulative Impacts 6.1.4.3 Monitoring Program for Residual Impacts * NOTE: Sections 6.2–6.9 should also include the subsections listed for 6.1, Air Quality 6.2 Marine Water 6.3 Waste Management 6.4 Geology, Seismicity, Soil, and Groundwater 6.5 Ecology(Terrestrial, Marine) 6.6 Noise 6.7 Traffic 6.8 Socio-economic 6.9 Climate Affairs

		6.10 Other Environmental Component(s) 6.111 Impacts, Mitigation, and Monitoring Summary 6.11.1 Selected Impacts 6.11.2 Cumulative Impacts 6.11.3 Residual Impacts 6.12 Risk Assessments 6.12.1 Accidental Environmental Impacts 6.13 Environmental Management plan 6.13.1 Environmental Management Program Objectives 6.13.2 Roles and Responsibilities 6.13.3 Environmental Permitting 6.13.4 Training and Competence 6.13.5 Communication 6.13.6 Monitoring and Reporting 6.13.7 Audit and Inspection
CHAPTER 7	**BENCHMARK**	
CHAPTER 8	**STATEMENT OF COMMITMENTS**	
CHAPTER 9	**CONCLUSION**	
ANNEXURE		

TABLE(1). STANDARD TABLE OF CONTENTS FOR THE ESIA REPORT

2- SCOPING REPORT:

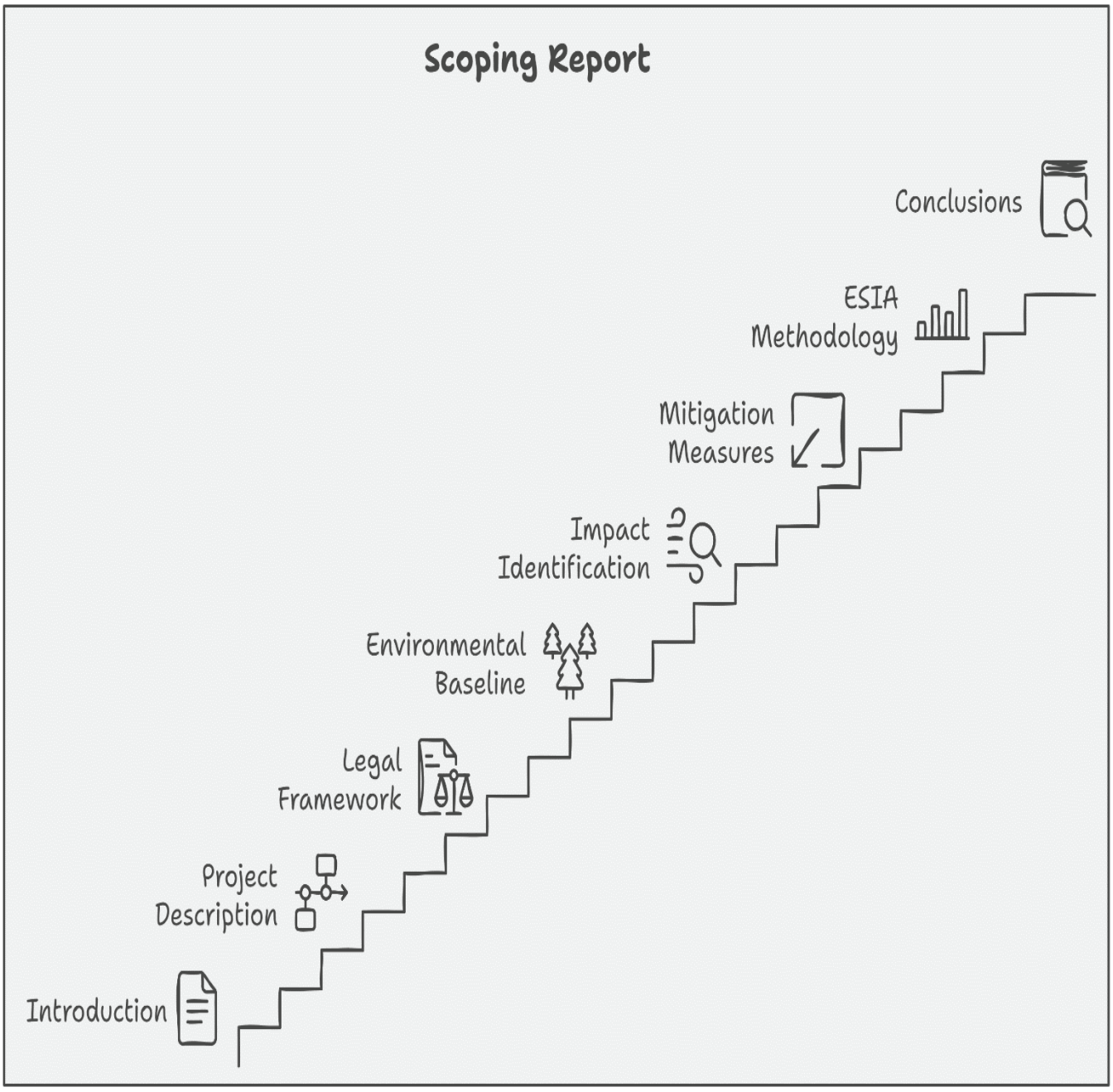
Scoping establishes the content, scope, and methodology for the environmental information that must be submitted to OPAZ for projects prior to the ESIA.

This scoping study must be conducted by the developer's environmental consultants. OPAZ will issue a scoping comment or approval to the developer regarding the scoping report, which will then serve as the terms of reference(TOR) for the ESIA.

The scoping report should primarily focus on identifying the impacts to be assessed and determining their relative importance. Additionally, it should address the following elements:

- Identification of impacts to be assessed and their relative importance;
- Criteria for evaluating the significance of these impacts;
- Methods to be used in the ESIA to predict the magnitude of environmental impacts;
- Types of mitigation measures to be considered;
- Required baseline studies to characterize the existing environment, including any specific requirements for the geographical scope or timing of these studies (e.g., to account for seasonal variations in flora and fauna);
- Consultations to be undertaken during the environmental studies;
- Structure and content of the ESIA report;
- Project details and timeline;
- The level of detail necessary for investigations

The table of contents for the scoping report is outlined in 1 to 5



FIGURE(2) SCOPING REPORT CONTAINS

CHAPTER 1—INTRODUCTION:

Provide a concise overview of the key findings, focusing on main conclusions and potential options to guide decision-making. This summary should capture the essence of the scoping report in a straightforward, high-level format, making it accessible for stakeholders and decision-makers.

Contact Information: Clearly list the names and contact details of the Project Proponent and the Environmental Consultant. This section should be limited to a single page to maintain clarity and ease of reference for anyone needing to reach out for further information or clarification.

CHAPTER 2—DESCRIPTION OF PROJECT:

Provide a brief overview of the development, detailing its purpose, scale, design, construction and implementation timeline, required raw materials, utilities, manpower, anticipated products and by-products from project phases, and include a site plan indicating the development boundary along with any land needed temporarily during construction.

CHAPTER 3—LEGAL FRAMEWORK AND STANDERS:

This chapter should clearly outline the legislative requirements for the project, including a comprehensive list of relevant Omani laws, standards, and guidelines, as well as applicable regional or international legislation when local guidelines are absent, all organized in a table format detailing required laws, regulations, permits, and licenses.

CHAPTER 4—DESCRIPTION OF THE ENVIRONMENT (BASELINE), RELEASES, IMPACTS, MITIGATION, AND MONITORING:

4-1 Environmental Baseline Studies

In the scoping report, environmental consultants are required to present the environmental baseline studies in a concise, structured manner. This section should provide essential insights into existing environmental conditions, forming a foundation for assessing potential impacts and planning mitigation strategies during the Environmental and Social Impact Assessment (ESIA) phase. The baseline studies in the scoping report should cover the following core elements, clearly but briefly:

1. **Baseline Surveys:** An overview of baseline surveys planned for the ESIA phase to capture accurate, current environmental data.
2. **Survey Locations and Monitoring Points:**
    - List specific locations and monitoring sites, and include maps for clear spatial understanding.
3. **Monitoring Methods and Duration:**
    - Summarize monitoring techniques and sampling durations to ensure data reliability and consistency.
4. **Desk-Based Research and Publications:**
    - Mention relevant research data, publications, and secondary sources that support the baseline information.
5. **Modelling and Projections:**
    - Briefly explain any modelling approaches, if used, to enhance baseline data, including environmental condition simulations or predictive analyses.
6. **Justifications for Exclusions:**
    - If certain environmental components are excluded, provide concise justifications for each, clarifying why these elements fall outside the scope of this project

4-2 Environmental Releases, Impact Identification, and Mitigation Measures

In the scoping report, environmental consultants are expected to outline the anticipated environmental releases, potential impacts, and proposed mitigation measures in a concise and structured manner. Each aspect should address the project's various phases and include any uncertainties, data limitations, or assumptions involved. This concise approach ensures clarity and facilitates efficient review by stakeholders. The scoping report should include the following elements:

1. **Impact Identification and Evaluation:**
    - Briefly identify potential impacts on key environmental components using data gathered during the baseline phase.
    - Evaluate the potential effects on elements such as air quality, water resources,soil,and biodiversity.
    - Outline any uncertainties, data gaps, or assumptions that may influence impact predictions.
2. **Data Sources and References:**
    - Document data sources, research studies, and methodologies used in assessing impacts.
    - Provide clear references to facilitate data validation and interpretation by stakeholders.
3. **Mitigation and Compensation Measures:**
    - Describe strategies to minimize or prevent adverse environmental impacts.
    - Summarize any compensatory actions for unavoidable impacts, such as habitat restoration or species relocation.
    - Include an initial outline of these measures in the scoping report, reserving detailed descriptions for the final ESIA report.
4. **Monitoring and Implementation:**
    - Outline arrangements for continuous environmental monitoring throughout the project lifecycle to evaluate the success of mitigation measures.
    - Summarize monitoring timelines, responsible parties, and specific indicators for each environmental component in tabular form where possible.

This concise, tabulated format will make the report more accessible and user-friendly, allowing consultants to prioritize significant environmental components for targeted intervention and continuous monitoring.

4-3 ESIA Methodology:

Provide a concise or tabulated summary of the ESIA approach and methodologies employed to monitor, identify, predict, and assess potential impacts, along with a list of data sources used.
It is important to highlight that after consulting with the relevant OPAZ and operator zones , and upon reviewing the scale of the project, the nature of environmental impacts, associated risks, and the project type, certain requirements of the guideline may be exempted. This exemption must be justified by the consultant and clearly stated in scoping report Study, explaining the reasons for omitting certain items from the Environmental and Social Impact Assessment (ESIA) report.

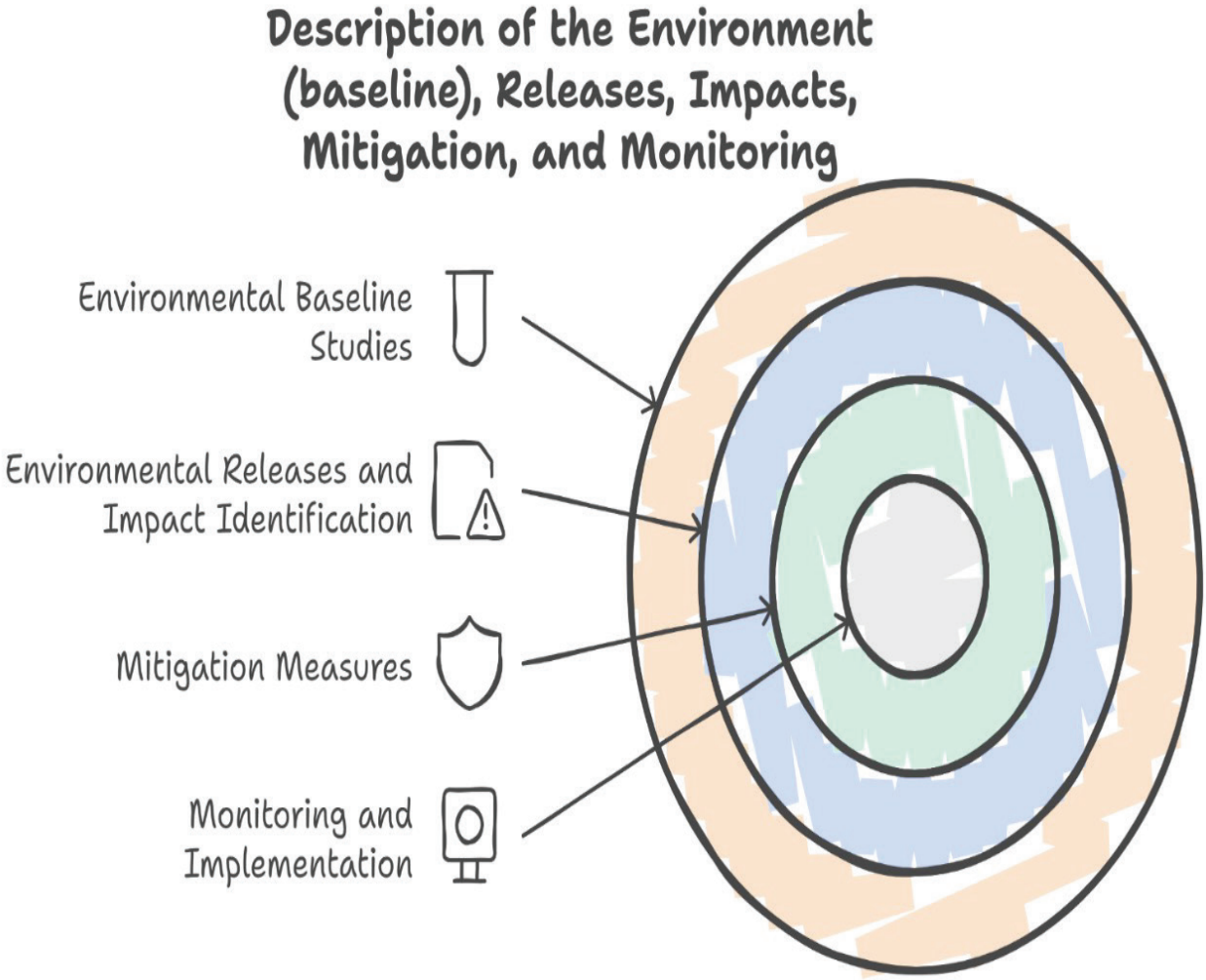


FIGURE (3) DESCRIPTION OF THE ENVIRONMENT (BASELINE), RELEASES, IMPACTS, MITIGATION, AND MONITORING

CHAPTER 5—CONCLUSIONS:

This section should present key conclusions regarding potential environmental impacts, proposed mitigation measures, identified uncertainties, and the recommended methodology for the project.

3- ESIA REPORT :

List of Abbreviations:

Include in this section a table of abbreviations and acronyms used throughout the ESIA report.

Definitions of Terms:

This section should provide a list of terms used in the ESIA report along with their definitions.

List of Tables:

This section should contain a list of all tables included in the main body of the ESIA report, specifying table numbers, titles, and corresponding page numbers.

List of Figures:

This section should provide a list of all figures included in the main body of the ESIA report, detailing figure numbers, titles, and corresponding page numbers.

CHAPTER 1- EXECUTIVE SUMMARY (ARABIC & ENGLISH):

ESIA report should serve as a non-technical summary of the proposed project. This chapter should provide an overview of the environmental components and key features that will be considered in the environmental baseline data and impact assessments. It should also discuss the general mitigation measures and monitoring efforts that will be implemented. The chapter should be presented in both English and Arabic and should include the following sections, as outlined below:

1-1 Project Description:

This section should contain a short description of the proposed project. This description should provide enough information for reviewers to understand the importance and scope of the proposed project.

1-2 Summary of Findings :

This section outlines the environmental impacts of the proposed project, detailing their types and magnitudes, including primary, cumulative, and irreversible impacts that could threaten ecology or sustainable development. It describes the mitigation measures, monitoring programs, and any residual impacts that cannot be mitigated, along with the project's environmental and societal pros and cons, excluding general conclusions or recommendations.

CHAPTER 2-INTRODUCTION:

2-1 Project Title and Project Proponent:

This section should include the name, address, telephone number, and fax number of the proponent's firm; the name and designation of the contact person who is responsible for the project; the project's title; and a listing and brief description of any other projects that the proponent has conducted, is currently conducting, or will conduct on the same site or adjacent to the current proposed project

2-2 ESIA Consultants

This section should be concise and it should include the name, address, telephone number and fax number of the consultant's firm; the names of team members from that consultant firm who prepared the EIA report (and e-mail address for the key contact); and the field(s) of expertise of the consultant firm and the individual team member.

2-3 Project Description and Rationale

This section should provide a detailed description of the proposed project, including its type and key components. It must clearly outline the location of the project, along with the total area it will occupy. Additionally, this section should explain the purpose of the project and provide a justification for its development, whether it is driven by economic, social, or other considerations.

CHAPTER 3- LEGAL FRAMEWORK AND STANDARDS:

This chapter must clearly outline the legislative requirements applicable to the project as detailed in the ESIA report. It should include a comprehensive list of relevant Omani laws, standards, and guidelines that the project must adhere to. In cases where local guidelines are not available, the chapter should reference applicable regional and international legislation. The consultant shall represent this chapter using table to lists all laws and regulations, .

• Omani Laws and Standards:

Provide a detailed overview of all relevant Omani laws, regulations, and standards that govern the project. This includes environmental protection laws, industry-specific regulations, and any other legal requirements that apply to the project. Furthermore, the consultant shall elaborate the all type of the permits and licenses related to laws and regulations.

• Regional and International Legislation or standers:

If Omani laws are unavailable for certain aspects of the project, refer to relevant regional or international legislation and standards. These should be specific to the industry and project type, ensuring compliance with recognized global practices.

CHAPTER 4-PROJECT DESCRIPTION:

4-1 Type of project activity :

In this section, the consultant shall specify the type of project activities in accordance with the ISIC code listed on the Oman Invest platform. If the activity is not identified on the platform, the consultant should coordinate with the zone operator to request the inclusion of the new activity.

4-2 Statement of Need:

This section should comprehensively outline the rationale for the proposed project, emphasizing its alignment with national development priorities and environmental strategies, particularly Oman Vision 2040 and the 2050 Net-Zero Carbon Strategy (Decarbonization). It should identify the target clients and potential customer base, explain the suitability of the chosen location for the project, and highlight the anticipated economic, social, and environmental benefits. Furthermore, it should provide details on the project's investment value and its contribution to the local and national economy.

- **Project Necessity and Strategic Fit:**

Clearly explain why the project is necessary, addressing current demands and future needs. Highlight how the project supports Oman's national development strategies, including contributions to the Oman 2040 Vision and efforts to achieve net zero emissions. This could involve promoting sustainable development, enhancing energy efficiency, or fostering innovation.

- **Target Audience:**

Identify the primary clients or customers who will benefit from the project. Explain how the project will meet their needs and why it is crucial for them.

- **Site Selection Justification:**

Provide a strong rationale for the proposed site's selection, considering factors like environmental suitability, proximity to resources or customers, infrastructure availability, and how the site aligns with regional development goals.

- **Economic and Social Benefits:**

Detail the economic benefits of the project, such as job creation, increased economic activity, and enhanced investment opportunities. Also, discuss the social benefits, including improved quality of life for the local community and potential contributions to social infrastructure.

- **Investment Value and Added Value:**

Discuss the project's potential to attract investment, both domestic and international. Highlight how the project adds value to the economy by creating new opportunities, fostering economic diversification, and enhancing Oman's global competitiveness.

- **Contribution to Net Zero and Oman 2040 Vision:**

Explain how the project will contribute to Oman's goals of reducing carbon emissions and achieving the net zero target. Describe how the project aligns with the broader Oman 2040 Vision, particularly in terms of sustainable development, economic diversification, and environmental stewardship.

4-3 Project Location and Scale:

This section should provide all the necessary information to evaluate the current location and environmental conditions in and around the project area. It should primarily include location maps and other visual materials that clearly illustrate the site. Additionally, a brief description of the site should be provided, highlighting key features and characteristics relevant to the project area.
Key Components to Include:

- **Location Maps:** Detailed maps that show the exact location of the project site within a broader geographic context. These maps should also illustrate the surrounding environment, including nearby landmarks, infrastructure, and natural features.
- **Visual Information:** Include photographs, diagrams, and other visual aids to give a clear representation of the site and its surroundings. Visual materials should help convey the current state of the environment and any significant site features.
- **Brief Site Description:** Provide a concise description of the site, focusing on essential characteristics such as topography, vegetation, water bodies, soil types, and any other pertinent environmental or man-made features that may impact or be impacted by the project.

4-4 Project and Activity Description:

This section should provide comprehensive details about the proposed project, including all associated activities, utilities, facilities and equipment throughout its various phases

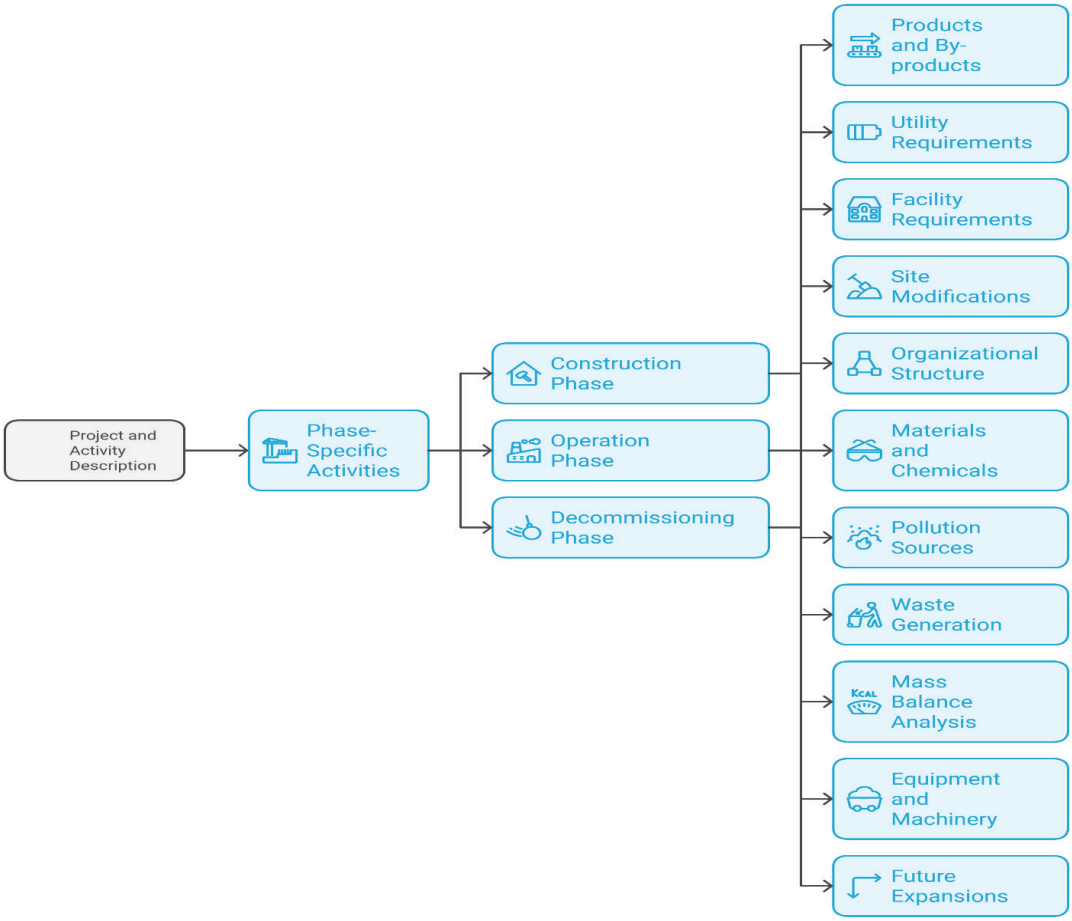


FIGURE (4) FLOW DIAGRAM CONTAINS FOR PROJECT AND ACTIVITY DESCRIPTION

The information presented here should align with the operations described in the project master plan. This section should include:

- **Project Overview:** Provide a detailed description of the proposed project's type, components, and units.
- **Phase-Specific Activities:** Describe all processes and activities associated with each phase of the project, including:
  - » **Construction Phase:** Outline the construction methods, materials, and timeline.
  - » **Operation Phase:** Detail the operational activities, including routine and non-routine operations
  - » **Decommissioning Phase (if applicable):** Explain the plans for dismantling and restoring the site after the project's lifecycle.

- **List Products** and by-products, quantity, storage, handling and transport.
- **List Utility Requirements:** Provide a comprehensive list of all utilities—services essential for the functioning of the project, such as electricity, water supply, sewage systems, natural gas, internet, steam, compressed air, and wastewater treatment. Specify whether these utilities will be supplied on-site or sourced externally. Additionally, include estimates of the quantities required or produced during the project's operation.
- **List Facilities Requirements:** Provide details of the physical assets or infrastructure used within the project, such as processing units, stacks, storage areas, and tanks, which facilitate the project's activities. Include information on the project processing units on site and the capacities of these facilities, such as boilers, furnaces, desalination plants, workshops, laboratories, treatment plants, power plants, pipeline networks, stormwater networks, and drainage networks, as applicable.
- **Site Modifications:** Describe any planned alterations to the project site, such as:
  - Groundwater dewatering
  - Dredging and infilling
  - Excavation and leveling (cut and fill) activities

- **Organizational Structure:** Provide a project organizational chart that includes:
  - Key personnel managing each phase and component of the project
  - Their names, roles, responsibilities, and the number of employees they supervise

- **Materials and Chemicals:** List all raw materials and chemicals, including quantities, that will be used during the construction, operation, and decommissioning phases. Include the purposes and classification of these materials. For hazardous chemicals, include Safety Data Sheets (SDSs) in Annex.

- **Releases and Pollution Sources:** List and describe all sources of Releases and pollution compounds (gases, liquids, solids, noise) resulting from project activities during all phases. This information should be presented in a tabular format, clearly identifying each source and comparing the release against Omani or international standards, as outlined in Section 3. Additionally, include the mitigation release levels, which will be detailed further in Chapter 6.

- **Waste generation:**

List and Describe the types and quantities of waste (hazardous, solid, liquid) generated during each phase of the project. For hazardous materials, SDSs should be included in Annex .

- **Mass Balance Analysis:**

The consultant provides the simulation diagram Include a mass balance analysis for the project. This should:

- Provide a detailed description of the inputs (e.g., raw materials) and outputs (e.g., products, by-products, or waste) of materials and energy across the various stages of the project's processes
- Explain how the mass balance impacts emission rates and the quantity of waste generated. For instance, changes in the mass balance can affect the amount of raw materials required, the emissions produced from chemical reactions, and the waste outputs.
- Identify any environmental components that may be impacted by changes in the mass balance, such as air quality (from emissions rate), water quality (from effluent discharge), and soil contamination (from waste disposal).

It is imperative that the consultant utilizes advanced simulation software, for example, Aspen Plus, Aspen HYSYS, or ProMax.

4-5 Project Status and Schedule:

This section should describe the current status of project implementation, the schedule of the proposed project, and the components and phases therein (if it is a multicomponent or a multiphase project). This section should also include an overview of the approval procedures and steps for the proposed project concise.

CHAPTER 5-PROJECT ALTERNATIVES:

5-1 Project Alternatives

The chapter should discuss the alternative technologies or concepts considered for the project, with a minimum of two alternatives explored in detail, while other options may be presented with less depth. It is not required to develop or present new design, route, or location options. The justification for the selected technology, design, or location should be provided, emphasizing factors such as the application of Best Available Techniques (BAT), cost-effectiveness, and the implementation timeline.

5-2 -BAT Assessment instruction :

In the ESIA's BAT assessment, it is essential to begin by listing the BREF documents referenced in the BAT analysis, ensuring all BREFs are accurately cited. Following this, the project's BAT assessment should be presented in an appropriate format, with tables being preferred. The assessment should cover the following details:

- **Unit/Process:** The unit or process where the technique will be applied.
- **BAT Reference:** The specific BREF documents from which the techniques are drawn, including the section numbers discussing the technique.
- **Applicable Techniques:** The techniques relevant to the project.
- **Reason for Selecting Techniques:** Where specific techniques are chosen, provide a rationale for clarity.

CHAPTER 6 -DESCRIPTION OF THE ENVIRONMENT(BASELINE), RELEASES, IMPACTS, MITIGATION, AND MONITORING AND RISK ASSESSMENT :

Chapter 6 should provide a thorough and detailed overview of the environmental aspects associated with the proposed project. This includes a comprehensive description of the environmental baseline conditions, the methodologies or data sources used to establish these baselines, the potential environmental impacts of the project, and the strategies for mitigation and monitoring to minimize adverse effects. This chapter should address all relevant environmental components present within or near the project area and should encompass all phases of the project lifecycle, including construction, operation, and decommissioning

Sections 6-1 to 6-10 focus on specific environmental components, each with its corresponding section in the Environmental Social Impact Assessment (ESIA) report. The later sections—6-11 (Impacts, Mitigation, and Monitoring Summary), 6-12 (Environmental Risk Assessment), and 6-13 (Environmental Management Plan)—provide a consolidated overview, integrating the discussions on impacts, mitigation measures, monitoring strategies, risk assessment, and the Environmental Management Plan (EMP) for all environmental components.
By structuring the chapter in this manner, the ESIA report ensures a clear and organized presentation of how the project will address environmental concerns throughout its duration

6-1 to 6-10 Environmental Components:

Table(2) present each environmental component alongside its designated section number. If an environmental component is not addressed in Sections 6-1 to 6-9, it should be thoroughly described in Section 6-10, Other Environmental Component(s). Should an environmental component not be present within or near the project area, and consequently not impacted by the proposed project, this must be clearly stated and justified within the relevant section (6-1 to 6-10). Each operational zone is characterized by distinct environmental components, and it is not required for the same components to be applicable across all zones due to their differing environmental conditions. In cases where an operator zone has established specific guidelines or criteria for particular environmental components, such as Terrestrial Ecology or Biodiversity, those zone-specific guidelines should be adhered to.

Section Number	Environmental Component
6-1	Air Quality
6-2	Marine Quality
6-3	Waste Management
6-4	Geology, Seismicity, Soil, and Groundwater
6-5	Ecology(Marine, Terrestrial)
6-6	Noise
6-7	Traffic
6-8	Socio-economic
6-9	Climate Affairs
6-10	Other Environmental Component(s)

Table(2): Organization and Corresponding Sections for Environmental Components in Chapter 6

Subsections for Each Environmental Component (Sections 6-1 to 6-10):
For each environmental component outlined in Sections 6-1 to 6-10, the following subsections must be included:

- **6-x-1: Description of the Environment**

Provide a detailed description of the existing conditions for the environmental component. For example, for Air Quality (Section 6-1), this subsection (6-1-1) would detail current air quality conditions and data sources.

- **6-x-2: Potential Impacts**

Analyze potential impacts of the project on the specific environmental component. For example, Section 6-5-2 (Ecology) would discuss potential disruptions to marine life due to project activities.

- **6-x-3: Mitigation Measures**

Outline the proposed measures to mitigate any identified impacts. For instance, Section 6-7-3 (Traffic) might include traffic management plans to alleviate congestion during construction.

- **6-x-4: Monitoring and Reporting**

Detail the monitoring strategies to ensure the effectiveness of mitigation measures and compliance with environmental standards. For example, Section 6-6-4 (Noise) would describe noise monitoring protocols and reporting requirements.

Note: In these subsections, "x" is replaced with the relevant section number (1–10) based on the environmental component detailed in Table 2. For instance, for the Air Quality component, "Description of the Environment" would be labeled as Section 6-1-1.

6-x-1 Description of the Environment (Baseline):

The baseline section of the Environmental Social Impact Assessment (ESIA) guideline should provide a comprehensive overview of the study area, detailing its location, topography, land use, and natural features, while visually representing key environmental resources such as water bodies, air quality, and biodiversity. It should describe the current status of various environmental components as per table (2) (e.g., air quality, water, noise, soil, and socio-economic factors), with relevant historical trends and seasonal variations. Sampling methodologies must be outlined for each component, including data collection techniques, frequency, and quality control measures, while justifying the criteria for selecting sampling locations based on Omani and international regulations. Data sources should be identified as primary (field-collected) or secondary (existing data), with methodologies for gathering and reviewing this information clearly stated. Baseline data should be presented using maps, tables, and figures for clarity, and the guideline should ensure compliance with applicable regulations to accurately assess potential environmental impacts. Specific information that should be addressed in this section includes the following:

- The assessment of Air Quality and Marine Water components should include an evaluation and description of current levels of nutrients, contaminants, pollutants, and other relevant compounds. All Releases and pollutants mentioned in Section4-4, along with those required by the legal standards outlined in Chapter3, must be addressed in this section.

- This section on Air Quality should report the current concentrations of air pollutants and contaminants in both the project site and areas potentially impacted. The locations of monitoring stations, along with the dates of data collection used to determine baseline conditions, should be clearly described with appropriate maps and supplementary text. Additionally, the climate and meteorological conditions should be considered, where relevant, with a general description of the prevailing climate regime and atmospheric patterns. Long-term data on annual and monthly averages for air temperature, humidity, and precipitation should be included. When applicable, factors such as wind speed and direction, atmospheric stability, and fog frequency should also be addressed.

- An assessment of all relevant pollutants, contaminants, turbidity, and temperature in both the water and sediments is required for the Marine Water component. If applicable, additional data on bathymetry, currents, flow patterns, and the locations of intake and outfall structures within the project site and areas of potential impact should be provided.

- For the Waste Management component, this section shall provide detailed descriptions of the existing waste management facilities and infrastructure that will handle, process, or receive the waste generated by the proposed project, as outlined in Section4-4. These descriptions should exclude any new facilities or processes that will be developed as part of the proposed project. Examples of facilities to be covered include wastewater treatment plants, landfill sites, and hazardous waste treatment or containment facilities. Additionally, if there is any history or evidence of waste disposal activities at the project site, such as old landfill areas or dumping grounds, these conditions must also be documented.

- For the Geology, Seismicity, Soil, and Groundwater component, this section should provide a general description of the topography, as well as the regional and site-specific geology, including superficial deposits, bedrock formations, and fault lines. Where applicable, seismic activity should also be addressed, detailing the sources, frequency of seismic events, and supported by maps or charts illustrating earthquake occurrences.

- For the Soil component, a comprehensive description of the soils in the project area is required, including the type of soil, geotechnical features , and whether the soil is native or consists of reclaimed or fill material. The section should also address pollutant concentrations, existing contamination in both native and reclaimed materials, and any identified sources of contamination. The methods, sampling locations, and regimes used to assess soil quality should be detailed. Additionally, the section must incorporate all pollutants and contaminants outlined in Section 4-4 and adhere to the legal standards provided in Chapter 3.

- This section on Groundwater should describe the aquifer(s) in the project area, including the geological context, aquifer thickness and yield, depth to groundwater, and the groundwater flow patterns. Information on the primary users (e.g., commercial, residential, or industrial) and their withdrawal rates (if available) should also be presented. Additionally, data on groundwater salinity, pollutant levels, existing contamination, and potential contamination sources should be included, along with the methods and monitoring wells used to assess these conditions. Where applicable, a map or diagram indicating the locations of monitoring wells within the project area and areas of potential impact should be provided. All pollutants and contaminants mentioned in Section4-4, as well as those outlined in the relevant legal frameworks in Chapter3, must be included.

- For the Marine and Terrestrial Ecology components, an evaluation of all ecosystems, habitats, and species of flora and fauna that may be impacted by the proposed project is required, with special attention to species and habitats that are endangered, threatened, ecologically sensitive, or of significance at regional or international levels. The assessment must provide information on species abundance at various geographic scales, their habitat needs, home ranges, migration patterns, and any other behavioral traits relevant to the project's potential impacts. Baseline data collection should be designed to account for seasonal and annual changes in species presence and abundance, which may require sampling across multiple seasons or years. The sampling strategy must be explained and justified within the ESIA report, reflecting the ecological conditions of the project area and its potential impact zone.

- For the Socio-economic component, it is essential to assess the present conditions of the populations likely to be affected, both within the project area and the surrounding impact zones. This evaluation should focus on key aspects such as demographic profiles, the types of economic activities in which the population is engaged, and how land in these areas is currently utilized.

- For each environmental component, maps and relevant visual aids should be provided to help reviewers understand the spatial distribution of key features and their proximity to the project site, including both the project area and the potential impact zone. All maps should follow a standardized format, including a title that specifies the content, location, and production date, along with a legend, scale bar, and North arrow.
- For the climate affairs component, the baseline inventory assesses current greenhouse gas emissions from the project site or region and evaluates its contribution to national GHG levels and ozone depletion substance(ODS) .

6-x-2 Environmental Impact prediction and Evaluation:

This section should evaluate the potential and anticipated impacts of the proposed project on environmental components, considering both direct and indirect impacts. The analysis should cover the project area and any surrounding regions that may be affected, drawing from the environmental baseline assessment data and other relevant sources. All project phases, including construction, operation, and decommissioning (if applicable), must be addressed.

The following elements should be included and explained in this section:

1. **Identification of Impacts:**
   - **Sources:** Clearly describe the potential impacts and their respective sources.
   - **Cause-and-effect:** Explain the cause-and-effect relationships between project activities and the resulting environmental impacts.

2. **Impact Location:**
   - Specify where the impacts will occur in relation to project activities and site boundaries.

3. **Significance of Predicted Impacts:**
   - Assess the probable significance of each impact, focusing on the magnitude, extent, and duration of the effect. Include quantitative estimations wherever possible.

4. Permanence and Reversibility:

- Identify whether the impacts are permanent or reversible, and evaluate the likelihood of natural recovery.

5. Methods of Impact Prediction:

- Describe the methods used to predict the impacts, emphasizing quantitative assessments.
- Provide ranges, confidence limits, and any assumptions that affect predictions, including the probability, time scale, and severity of the impact.

6. Use of Models:

If a model is employed to evaluate the impacts, ensure the following:

- A detailed description of the model.
- Justification for selecting the model.
- Data sources and assumptions used in the model.
- Printouts of all inputs, runs, and results.
- Interpretation of results to demonstrate their accuracy and applicability.

These details should be included as an annex to the ESIA report.

7. Cumulative Impacts:

- Evaluate and describe potential cumulative impacts, which result from the combined effect of the proposed project and other existing or planned activities in the area. Consider the cumulative effects across all project phases and resources. Address cumulative impacts related to:
- Off-site adjacent facilities, projects, or activities.
- Other components and processes of the proposed project.
- Additional or future projects at the site.
- New processes planned for the site.
- Cross-resource impacts (e.g., increased traffic affecting air quality, congestion, and noise).

8. Absence of Impacts:

- If no impacts are anticipated on a particular environmental component, state this explicitly and provide a supporting justification .

Information that should be addressed for specific environmental components includes the following:

- For both the Air Quality and Marine Water components, the environmental impacts associated with pollutant and contaminant releases (as referenced in Sections 4-4 6-x-1) must be assessed. If available, estimates of these emissions and discharges should also be provided.

- For the Air Quality component, the potential impacts of the proposed project on air quality must be evaluated and described. Where applicable, suitable models and maps should be employed to estimate and assess these impacts.
- For the Marine Water component, the potential impacts of the proposed project and its activities on sediment quality, water quality, temperature, and currents or flow patterns must be assessed and described. These assessments should be supported by appropriate hydrodynamic models. The locations of facility intakes and outfalls associated with the project should be depicted on maps, along with estimates of water intake and discharge volumes and flow rate.

- For the Waste Management component, all waste streams identified in Section 4-4 must be addressed, with estimates provided for their rates and volumes, including wastewater, solid waste, and hazardous waste. The methods used to develop these estimates should be clearly described. The impacts of each waste stream must be evaluated according to the waste management hierarchy—elimination, reduction, reuse, recycling, treatment, and disposal—to develop mitigation measures (discussed in the next section) that prioritize the highest feasible level within the hierarchy. This means each waste stream should first be assessed for elimination, followed by minimization, reuse, recycling, and so forth. All aspects of waste management, including accumulation, storage, and disposal, should be discussed in terms of both primary impacts (e.g., land, water, and air on-site and off-site) and secondary impacts (e.g., strain on existing or planned waste management infrastructure).

- The Geology, Seismicity, Soil, and Groundwater component requires a detailed description of how the project may affect soil and groundwater, ensuring that all pollutants and contaminants identified in Sections 4 and 6-4 are thoroughly addressed.

- For the Soil component, the potential impacts of the proposed project and its activities on pollutant and contaminant levels in the soil must be described. The analysis should consider land alterations (e.g., excavation, dredging), land-use practices (e.g., fertilizer application, dewatering), and project-related activities (e.g., oil or chemical spills during operations). Maps should be provided to illustrate the locations and extent of these potential impacts.

- For the Groundwater component, the assessment should describe project activities that involve the use and extraction of groundwater, including estimates of withdrawal rates, volumes, and seasonal variations, if applicable. Additionally, the evaluation should address activities that may pose risks of groundwater contamination, such as fertilizer application, discharge of dewatering effluent, or potential oil and chemical spills. Where relevant, the impacts on groundwater should be supported by maps and appropriate groundwater models.

- or the Ecology (Terrestrial Ecology, Marine Ecology)components, the assessment should evaluate and describe the impacts on all habitats, ecosystems, and species of flora and fauna identified in Sections6-5. Particular attention must be given to ecosystems and species that are threatened, endangered, highly sensitive, or hold regional or international significance. Maps should be included to illustrate the locations and extent of these impacts, both within the project area and the broader impact zone.

- For the Noise and Traffic components, the impacts of the proposed project on noise levels and traffic disturbances, both on a daily and seasonal basis (where applicable), must be evaluated and described. The analysis should be supported by appropriate models and maps. Estimates of noise and traffic increases should be provided, along with detailed descriptions of the methods, parameters, and assumptions used to generate these estimates.
- This section should assess the socio-economic impacts of the proposed project on the population in both the project area and the potential impact zone. The evaluation must focus on changes in demographic aspects (e.g., employment opportunities), economic dynamics (e.g., alterations in the demand and supply of goods and services), land-use patterns, and any other relevant factors described in Section 6-8.

- For the climate affairs component, A comprehensive GHG impact assessment requires a quantitative prediction of both direct and indirect emissions from the project, evaluating their impacts at local, regional, and global levels, with a detailed calculation of Scope 1, Scope 2, and Scope 3 emissions. For effective GHG impact assessments in ESIA, various tools and frameworks provide robust methodologies to evaluate emissions and potential environmental effects. The GHG Protocol and IPCC Guidelines serve as key resources for emissions accounting, , and emission factor databases. Using tools enable accurate measurement of GHG emissions across sectors, ensuring compliance with international standards and providing a foundation for evaluating project-specific impacts.

6-x-3 Mitigation measure:

This section should detail the mitigation strategies aimed at minimizing negative impacts on environmental components throughout all phases of the proposed project, including construction, operation, and decommissioning (if applicable). It should encompass the following key elements:

- Selected Mitigation Measures
- Mitigation Strategies for Cumulative Impacts
- Residual Impacts

Each element is discussed in the sections below.

6-x-3-1 Selected Mitigation Measures:

This section should outline the mitigation measures that the project proponent will implement to minimize the environmental impacts of the proposed project across all phases, including construction, operation, and decommissioning (if applicable, based on recommendations from the Environmental consultant, and should consist of practical and cost-effective strategies that effectively mitigate negative environmental effects. Each chosen mitigation measure should be accompanied by a brief description and justification, explaining why it was selected over other alternatives. These measures will form the foundation for establishing the agreed-upon mitigation actions and acceptable environmental conditions (e.g., environmental standards or maximum allowable limits) to be adopted by the project proponent and the zone operator. The section should include the following specific information:
A detailed description of each recommended mitigation measure, including how it will reduce or alleviate the environmental impact and the reasons for its selection over other options (considering cost and effectiveness).
The intended outcomes or targets of the mitigation measures, such as achieving compliance with Omani or/and international standards.
Relevant diagrams and details on the technology, equipment, processes, and facilities that will be utilized as part of the mitigation measures, including information on their effectiveness (e.g., the level of reduction achievable under normal operations).
A description of the implementation process for each mitigation measure, including who will be responsible for carrying out the measures and a schedule that ensures the mitigation actions are in place before project-related impacts occur.

6-x-3-2Mitigation Measures to Address Cumulative Impacts:

This section should outline the mitigation measures or actions to be implemented to avoid, minimize, eliminate, or compensate for the cumulative environmental impacts of the proposed project on various environmental components. It should address all cumulative impacts identified in Sections (6-x-2 Environmental Impact prediction and Evaluation.)

6-x-3-3 Residual Impacts:

This section should clearly identify and describe any residual environmental impacts on the environmental components that cannot or will not be mitigated. It should include all impacts, including cumulative effects, listed in Section (that the project proponent will not address through mitigation.
The following information should be provided:
Justification for the lack of mitigation measures (e.g., economic constraints, technical infeasibility, or minimal environmental impact).
An estimate of the environmental impacts likely to occur without mitigation, including details on the expected duration, extent, and intensity of the impacts

6-x-4 Monitoring program:

This section should outline the monitoring program(s) designed to ensure compliance with the selected mitigation measures, including those aimed at addressing cumulative impacts, and to assess residual impacts (including unmitigated cumulative impacts) of the proposed project on the environmental components. The monitoring program(s) should cover all phases of the project—construction, operation, and decommissioning—and apply to both the project site and the surrounding area of probable impact.

6-x-4-1 Monitoring Program for Compliance with Selected Mitigation Measures

This section should provide a clear and detailed outline of the monitoring program designed to assess the effectiveness and compliance of the selected mitigation measures. The following key aspects should be addressed:

1. **Monitoring Program Overview:**
    - **Objectives:** Define the purpose of each monitoring program and how it relates to specific mitigation measures.
    - **Attributes/Indicators:** List the specific indicators or conditions that will be measured to assess the success of the mitigation efforts.

- **Methodology:** Describe the methodologies that will be employed, including data collection and analysis techniques, and the equipment that will be used.
- **Compliance:** Detail how the program will verify that the standards outlined in Sections (6-x-3-1)are being met.

1. **Responsible Parties:**
   - **Implementation and Accountability:** Identify the individual(s) or agency responsible for implementing, maintaining, and financing the monitoring program.
   - **Documentation Process:** Provide a clear, documented process outlining how the mitigation measures and monitoring activities will be adhered to.

2. **Monitoring Schedule:**
   - **Frequency and Duration:** Specify the frequency of monitoring activities and the number of site visits based on the anticipated duration of impacts and environmental changes.
   - **Documentation:** Explain how the results from site visits will be recorded, including the use of maps, photographs, and other visual aids to document sampling locations and areas when applicable.
3. **Reporting System:**
   - **Reporting Requirements:** Outline the system for periodic reporting, including the frequency of reporting and who will be responsible for preparing and submitting the reports.

4. **Corrective Actions:**
   - **Non-compliance Response:** Describe the actions that will be taken if the mitigation measures are not achieving the desired improvements in environmental conditions.

6-x-4-2Monitoring Program for Cumulative Impacts

This section should outline the monitoring program designed to assess and measure the cumulative impacts associated with the proposed project. It should quantify the extent to which mitigation measures have successfully reduced these cumulative impacts. When applicable, this section should include the same level of detail as described in Section (6-x-4-1)

6-x-4-3 Monitoring Program for Residual Environmental Impacts:

This section should outline a monitoring program designed to assess the residual environmental impacts associated with the proposed project. The program should enable the project proponent to demonstrate that the project is not adversely affecting key environmental conditions beyond defined acceptable levels. These acceptable levels must be clearly established and supported by the relevant limits specified in the legal framework and standard documents referenced in Chapter (3)

6-11 Impact, Mitigation , and Monitoring summary:

This section should provide a comprehensive summary of all identified environmental impacts, associated mitigation measures, and monitoring programs as outlined in Sections (6-1- 6-10). The summary will be organized into two primary subsections:

- Mitigated Impacts
- Residual Impacts

6-11-1 Mitigated Impact:

This subsection should provide a detailed summary of all environmental impacts, including cumulative impacts, and the corresponding mitigation measures and monitoring programs. The information should be presented in a series of three tables, as described below:

The first table shall be General Summary of Impacts, Mitigation Measures, and Monitoring Programs

For each mitigated impact, this table should include:

ENVIRONMENTAL IMPACT	SOURCE OF IMPACT	MITIGATION MEASURE	MONITORING PROGRAM	RESPONSIBLE PERSON
EXAMPLE: AIR QUALITY	VEHICLE EMISSIONS	USE LOW-SULFUR FUEL	CONTINUOUS AIR MONITORING	ENVIRONMENTAL OFFICER

The second table shall be ESIA Matrix (Before Mitigation)

This table should rank the significance of environmental impacts before the implementation of mitigation measures. The matrix should be divided by project phases (construction, operation, and decommissioning) and assessed using the following criteria:

Magnitude of Impact (Geographical Scale): classification is used to determine the spread of environmental impact across geographic areas

- **Limited to the project site:** The impact is confined to the project site only.
- **Local or nearby areas:** The impact extends to neighboring or nearby areas.
- **Regional, national, or international:** The impact reaches a broader area, affecting regions on a regional, national, or even international scale.

Permanence of Impact: The Permanence of Impact classification assesses the duration of an environmental impact:

- **No change:** No noticeable change or impact is expected.
- **Temporary:** The impact is short-term and will eventually dissipate or be mitigated over time.
- **Permanent:** The impact is long-lasting and will not change over time, even with mitigation efforts.

Reversibility of Impact: The Reversibility of Impact rating typically categorizes environmental impacts based on their potential for recovery or restoration

- **Not applicable:** The impact does not apply or is not relevant in the context of reversibility (e.g., situations where no significant impact is present).

- **Reversible:** The impact can be reversed or mitigated over time through natural processes or specific interventions.

- **Irreversible:** The impact cannot be reversed, and the affected environment or resource cannot return to its original state even with significant intervention.

Cumulative Nature of Impact: classification evaluates whether an impact builds up over time or interacts with other impacts

- **Not applicable:** The concept of accumulation does not apply to this impact.
- **Non-cumulative:** The impact is isolated and does not build up over time or interact with other impacts.
- **Cumulative:** The impact compounds over time or interacts with other impacts, leading to a potentially larger, combined effect.

ENVIRONMENTAL IMPACT	Magnitude			Permanence			Reversibility			Cumulative		
	C	O	D	C	O	D	C	O	D	C	O	D
AIR QUALITY—EMISSIONS OF SULFUR OXIDES	2	3	3	2	3	3	2	3	3	3	3	2
TERRESTRIAL AND MARINE ECOLOGY—LOST HABITAT	1	2	1	2	2	2	2	2	2	2	3	3
TERRESTRIAL AND MARINE ECOLOGY—DISTURBANCE OF INCREASED LEVELS OF LIGHT AND NOISE	1	2	1	2	2	2	2	2	2	2	3	3
GROUNDWATER—WITHDRAWAL	2	2	2	2	2	2	2	2	2	2	2	2
WASTE MANAGEMENT—HAZARDOUS WASTES	3	3	3	3	3	3	3	3	3	3	3	3
WASTE MANAGEMENT—SOLID WASTES	1	1	1	1	1	1	1	1	1	1	3	3
WASTE MANAGEMENT—WASTEWATER	1	1	1	1	1	1	1	1	1	1	3	3
NOISE—HIGH LEVELS OF NOISE DURING THE NIGHT	1	1	1	1	1	1	1	1	1	1	3	3
SOCIO-ECONOMIC—HIGHER REGIONAL EMPLOYMENT IN THE SERVICE INDUSTRY	2	2	2	2	2	2	2	2	2	2	3	3

C = construction, O = operation, D = decommissioning phases

Table(3): Example of ESIA Impact Matrix (before mitigation measures are implemented)

Notes: The color-coding of cells indicates the same ranking (e.g., 1 values are green, 2 values are orange, 3 values are red). If the impact is positive, then a "+"should appear before a rank value.

The Third table shall be ESIA Matrix (After Mitigation)

This table should mirror Table 2, but indicate the probable reductions in environmental impacts following the implementation of the selected mitigation measures.

After Table 3, summarize the key trends and conclusions drawn from the matrices, such as how mitigation measures have successfully reduced certain impacts.

6-11-2 Residual Impact:

This subsection should summarize all residual impacts (including non-mitigated cumulative impacts) and associated monitoring programs. The information should be presented in a tabular format:

Source of Impact	Environmental Impact	Reason Impact Could Not Be Mitigated	Monitoring Program	Responsible Person
Example: Groundwater	Contamination risk	Technically infeasible to fully mitigate	Regular groundwater testing	Water Resource Officer

6-12 Environmental Risk Assessment:

This section should examine potential environmental risks that may arise from accidents or system failures throughout the construction, operation, and decommissioning phases of the proposed project. These risks may result from issues such as equipment or material malfunctions, deviations from established procedures, unexpected process disruptions, or operational inefficiencies where systems do not function as intended. Common examples of such incidents include, but are not limited to, spills, leaks, fires, explosions, and process blowdowns. These events pose significant environmental risks that must be carefully evaluated and managed. This section should address accidental environmental impacts through the Hazards Register and response and the Control of Major Accident Hazards (COMAH) reports, if required.

6-12-1 Hazards Register and response:

All accidental environmental impacts of the potential project should be identified and assessed for magnitude of potential risk within an Hazards Register and response

The Hazards Register and response should be organized in a tabular format to ensure clarity, ease of understanding, and efficient communication of key information as showing below Components:

1. Phase:

- specifies the project stage (Construction, Operation, or Decommissioning) when the hazard might occur.

2. Hazard:

- Describes the specific risk or failure (e.g., chemical spill, equipment malfunction).

1. Impact/Effect:

- Outlines the potential environmental consequences (e.g., water contamination, air pollution).

2. Initial Risk Level:

Evaluates and Categorize risks as High, Medium, or Low:

- **High Risk:** Requires significant controls and mitigation (e.g., major spills).
- **Medium Risk:** Manageable with proper controls (e.g., routine flaring)
- **Low Risk:** Minimal impact requiring basic precautions (e.g., dust emissions).

5. Control Measures:

- Define preventive controls to reduce the probability of hazard occurrence:

Examples: Routine maintenance, safety audits, and staff training.

- Establish mitigation measures to minimize environmental impact in case of an incident:

Examples: Emergency shutdown procedures, spill kits, and fire suppression systems.

- Develop recovery plans to restore environmental conditions after an incident:

Examples: Soil remediation, wildlife rehabilitation, and community engagement.

6. Residual Risk Level:

- Assesses the risk that remains after control measures have been implemented.

7. Comments:

- Provides additional information, such as emergency plans, monitoring requirements, or regulatory compliance notes.

If high-risk hazards remain, a Control of Major Accident Hazards (COMAH) Report must be prepared

anaging non-conformances and implementing corrective actions, and the records to be maintained.

6-12-2 Control of Major Accident Hazards Report:

COMAH Report is required if the HER identifies any high-risk hazards. The report must include:

1. Identification of hazards and hazardous events.
2. Definition of major accident scenarios.
3. Quantitative risk assessments demonstrating that risks are As Low As Reasonably Possible (ALARP).
4. Control, mitigation, and recovery plans.
5. Management systems for hazard controls to ensure operational safety.
6. Evidence of independent verification prior to project approval.

6-13 Environmental Management plan:

6-13-1 Environmental Management plan Objectives:

This section is dedicated to outlining the primary objectives of the Environmental Management Plan (EMP), which serves as the cornerstone for implementing the mitigation measures and monitoring programs described in Chapter 6 of the ESIA report. The EMP will be presented for all project phases—construction, operation, and decommissioning—individually, as detailed below:

6-13-2 Roles and Responsibilities

This section should outline the roles and responsibilities of key personnel involved in the implementation and performance of the Environmental Management Plan (EMP). This includes individuals such as the Project Manager, H.S.E Manager, Project Construction Manager, and subcontractors. Each will play a critical role in executing the proposed mitigation measures and overseeing monitoring activities to ensure compliance and effective environmental performance throughout the project.

6-13-3 Environmental Permitting:

This section should detail all required environmental permits and licenses necessary for each phase of the project which refers to chapter 3 .

6-13-4 Training and Competence

This section should detail the methods and procedures that will be implemented to ensure that all management, supervisors, and workers receive the appropriate level of training required to carry out their tasks in alignment with the Environmental Management Plan objectives. These methods should include documentation of the training provided and a process for verifying the competency of key personnel involved.

6-13-5 Communication

This section should outline the methods of internal and external communication that will be utilized to ensure the effective implementation of the Environmental Management Plan (EMP) programs. Communication methods may include EHS (environment, health, and safety) induction training, newsletters, and regular project meetings, such as engineering, construction, and contractor coordination meetings. Topics to be discussed in these meetings should cover the status of EMP activities, progress in implementing the EMP program, and any specific EMP issues identified during project execution.

6-13-6 Monitoring and Reporting:

This section should explain how the project proponent will monitor the implementation of mitigation measures and environmental conditions to verify and document the successful performance of the Environmental Management Plan (EMP). It should also outline the methods and protocols for both internal and external reporting of EMP performance, as necessary to demonstrate compliance with relevant standards and requirements.

6-13-7 Audit and Inspection:

For projects involving multiple stakeholders, proponents, or contractors, an audit and inspection program should be established to ensure compliance with all requirements and commitments of the Environmental Management Plan (EMP), including relevant legal standards and Codes of Practice. This program should facilitate oversight and coordination of EMP objectives across all project participants. This section should outline the types of audits or inspections planned, covering audit criteria, scope, frequency, and methodologies. Additionally, it should specify, at a minimum, the roles responsible for planning and conducting audits and inspections, the reporting process for audit and inspection results, procedures for managing non-conformances and implementing corrective actions, and the records to be maintained.

CHAPTER 7- BENCHMARK:

The benchmarking chapter begins by outlining the purpose and scope of benchmarking within the ESIA study, highlighting its role in improving environmental performance and ensuring regulatory compliance.

It defines objectives such as comparing emissions levels and resource efficiency, while detailing the criteria used to select relevant benchmarks, including project scale, geographical similarity, regulatory context, and technological parity. The chapter explains the data collection methods, such as site visits and literature reviews, and assesses the quality and reliability of the gathered information. The results compare the project's environmental performance to selected benchmarks, identifying best practices and areas for improvement. Additionally, it evaluates regulatory compliance against both local and international standards and incorporates case studies showcasing successful environmental practices. The chapter concludes with recommendations for adopting best practices, setting performance targets, and implementing a continuous improvement framework. References and annexures provide supporting data and methodological details.

CHAPTER 8-STATEMENT OF COMMITMENTS:

In this chapter, the investor / proponent and environmental consultant must commit that all data mentioned in the Environmental and Social Impact Assessment (ESIA) report is accurate. In the event of any misleading information, the investor /proponent and the consultant will bear the legal consequences. Additionally, the environmental consultant is required to prepare recommendations for technical Environmental conditions derived from the findings of the Environmental and Social Impact Assessment.

CHAPTER 9-CONCLUSION:

In conclusion, the ESIA process has demonstrated the project's necessity by addressing current and future demands while aligning with Oman's national development strategies, including the Oman 2040 Vision and net-zero emissions goals. The management plan ensures that the project meets stakeholder needs, justifies the site selection, and maximizes economic and social benefits such as job creation and quality of life improvements. It also enhances investment opportunities by fostering economic diversification and global competitiveness. Additionally, the plan contributes to Oman's sustainability objectives through effective mitigation of environmental impacts, support for net-zero carbon goals, and addressing public concerns through adaptive management and ongoing stakeholder engagement.

الهيئة العامة للمناطق الاقتصادية الخاصة والمناطق الحرة
Public Authority for Special Economic Zones and Free Zones
Sultanate of Oman
سلطنة عمان