Environmental & Social Impact Assessment
Hajr Two Independent Power Plant

المركز الوطني
للرقابة على الالتزام البيئي
National Center for Environmental Compliance
المملكة العربية السعودية

رؤيــــة VISION
2030
المملكة العربية السعودية
KINGDOM OF SAUDI ARABIA

مكتب الدكتور
عيسى الحرتاني
للاستشارات البيئية
AL-HARTANY
ENVIRONMENTAL CONSULTANCY

شركة هجر الثانية للكهرباء
Hajar Two Electricity Co.

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DOCUMENT CONTROL

Version	Version Date	Description	Author	Reviewer	Approver
1.0	03/03/2025	DRAFT ESIA Report – submitted to ACWA for Reviwe	VZ, NM	LBG	
2.0	27/03/2025	ESIA Report – Addressing ACWA's Comments	LBG	MKB	KW
3.0	03/07/2025	ESIA Report – marine Survey and marine modelling updates	VZ, LBG	MKB	KW
4.0	24/07/2025	ESIA Report – flood risk and CHA screening updates	SF, LBG	MKB	KW

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
AC	Alternating Current
AVR	Automatic Voltage Regulator
BAT	Best Available Techniques
BOO	Build Own and Operate
BRD	European Bank for Reconstruction and Development
BSDG	Black start diesel generators
CCGT	Combined Cycle Gas Turbine
CEDI	Continuous electro-deionisation
CEMS	Continuous Emission Monitoring System
CESMP	Construction Environmental and Social Management Plan
CIA	Cumulative Impact Assessment
CRPD	Convention on the Rights of Persons with Disabilities
CT	Current Transformers
DC	Direct Current
DMF	Dual Media Filtration
EC	Environmental Classification
ECA	Export Credit Agencies
EDG	Emergency Diesel Generators
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EP	Equator Principles
EPC	Engineering, Procurement and Construction
EPFI	Equator Principles Financial Institutions
ESF	Electrical Special Facilities
ESIA	Environmental & Social Impact Assessment
ESMS	Environmental and Social Management System
FCF	Fuel Connection Facilities
GAMEP	General Authority of Meteorology and Environmental Protection
GAStat	General Authority of Statistics Saudi Arabia
GCC	Gulf Cooperation Council
GER	General Environmental Regulations
GHG	Greenhouse Gas Emissions
GIIP	Good International Industry Practice
GT	Gas Turbines
GW	Gigawatt
HP	High Pressure

Abbreviation	Meaning
HRSG	Heat Recovery Steam Generators
HVAC	Heating Ventilation and Air Conditioning
IBA	Important Bird Area
ICOD	Initial Commercial Operation Date
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IEX	Ion exchange
IFC	International Finance Corporation
ILO	International Labour Organisation
IPP	Independent Power Plant
KSA	Kingdom of Saudi Arabia
Leq (A)	A-weighted Equivalent Continuous Sound Level
LP	Low Pressure
LV	Low Voltage
MEWA	Ministry of Environment, Water and Agriculture
MV	Medium Voltage
MW	Mega Watt
MWAN	National Centre for Waste Management
NCEC	National Centre of Environmental Compliance
NCM	National Centre for Meteorology
NCVC	The National Centre for the Development of Vegetation Cover and Combating Desertification
NCW	National Centre for Wildlife
NDC	Nationally Determined Contribution
NOMAC	National Operation & Maintenance Company
O&M	Operation and Maintenance
ODS	Ozone Depleting Substances
OECD	Organization for Economic Co-operation and Development
OESMP	Operational Environmental and Social Management Plan
OHTL	Over Head Transmission Line
PCOD	Project Commercial Operation Date
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PRDS	Pressure Reducing & DeSuperheating Station
PSs	Performance Standards
PV	Photovoltaic
RfP	Request for Proposal
RO	Reverse Osmosis

Abbreviation	Meaning
SA	Saudi Aramco
SASE	Saudi Aramco Standards for Engineering
SEC	Saudi Electric Company
SIO	Saudi Irrigation Organisation
SPPC	Saudi Power Procurement Company
STG	Steam Turbine Generator
SUA	Site Use Agreement
SWA	Saudi Wildlife Authority
TSS	Total Suspended Solids
UN	United Nations
UNCLOS	United National Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UTRCC	Unit Trial Run Command Centre
VT	Voltage Transformers
WBG	World Bank Group
WHO	World Health Organisation

Executive Summary

Introduction

Acwa Power plans to develop the proposed Hajr Two Combined Cycle Gas Turbine (CCGT) Independent Power Project (IPP), hereafter referred to as the “project”. The proposed development is an independent natural gas-fired combined cycle power plant with 3,010 MW capacity. The development of the project is in line with the KSA Vision 2030 which aims to diversify the national energy mix used in electricity production, increase the share of natural gas (and renewable energy sources) to approximately 50% while reducing the use of liquid fuel.

The Project is located in Qurayyah, in the Eastern Province of the Kingdom of Saudi Arabia (KSA), on the Arabian Gulf. The project site is located approximately 100 km to the South of the city of Damman.

The Project will be developed by a joint venture between ACWA Power and the Saudi Electric Company (SEC), who have created a special purpose vehicle ”Project Company” called Hajr Two Electricity Company. The plant will operate on natural gas as the main fuel and back-up diesel fuel for emergency situations.

The Project seeks finance from international lenders who are understood to be signatories of the Equator Principles (EP) or lenders that have investment policies aligned with the International Finance Corporation (IFC) Performance Standards (PS). As a result, the Project’s construction and operations must align with the requirements of the EP’s and IFC PSs.

Al-Hartany Environmental Consulting Office has been engaged by ACWA Power to undertake the independent assessment of potential environmental and social impacts, as well as certain other environmental & social related scope.

Institutional and Organisational Framework

The Project will be required to comply with all applicable environmental and social laws, regulations, policies, standards, and guidelines that form KSA’s regulatory framework. In doing so, the process of environmental and social impact identification and evaluation will need to demonstrate that the Project can comply with such criteria during both the construction and operational phases. The Project will adopt and comply with the following regulations and standards:

- National regulations and standards.
- International and Regional Treaties ratified by the KSA, and
- International guidelines and standards adopted by anticipated Project lenders. including EP IV (2020), IFC Performance Standards (2012) and WBG/IFC EHS Guidelines (2007).

Projects within KSA with potential to cause environmental impacts are subject to an ESIA as part of the planning and permitting process in accordance with the National Environmental Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH and as described in the Executive Regulations on Environmental Permits for the Construction and Operation of Activities of the Ministry of Environment, Water & Agriculture (MEWA).

The Environmental Classification Form (EC Form) for the Project was initially submitted to NCEC under EPAC-2025000635 and the Project was classified Category 2. Accordingly, this ESIA Report for the Project was prepared. Following a subsequent review by the reglulator, the Project was recategorised as Category 3. As a result, a revised application was submitted under the new reference EPC3-2025-000558.

Project Information

The Project is approximately 100 km to the south of the City of Dammam. As shown on the following figure, the site is within the Qurrayah industrial complex, located between existing Steam Plant and Combined cycle power plant in the north and a new combined cycle plant in the south within a fenced-off site and situated along an existing main road running parallel to the coastline.

Location of the Hajr Two CCGT Components

The Hajr CCGT Plant will comprise of a natural gas fired combined cycle power plant with a total net capacity of 3,010 MW. The power generation requirements for the Project are shown in the table below.

Power Generation Requirements

Milestone	Target Date	Power Export MW
ICOD 1 (Simple Cycle)	31 July 2026	670 MW
ICOD 2 (Simple Cycle)	31 May 2027	1,840 MW
PCOD	31 May 2028	3,010 MW

The primary fuel will be natural gas which will be delivered to the project site by ARAMCO interface point at plant boundary. Back-up fuel shall only be used when the gas supply is disturbed or completely interrupted to which the plant will utilize liquid fuel which will be transported to site via trucks, within the necessary storage tanks and unloading bays to be installed at the Site by the Project Company.

The footprint of the Project assets are summarised below.

Summary of the Project Assets and their Areas

Asset	Area
Temporary Construction Facility • Laydown Area 1 • Laydown Area 2 • Batching Plant Area	 • 20.2 Ha • 22.5 Ha • 3.7 Ha
Hajr Two CCGT Boundary	35.6 Ha
ESF Boundary	16.0 Ha
Proposed FCF Expansion	4.1 Ha
Future Carbon Capture Facility Proposed Plot	10.4 Ha
Proposed Evaporation Pond Options: • Option 1 • Option 2	• 7.49 Ha • 2.64 Ha

The scope of the ESIA relates to the design, construction, and operation of the CCGT which includes the following elements:

- Five (5) Gas turbine (GT) generators
- Five (5) Heat recovery steam generators (HRSG)
- Two (2) Steam turbine (ST) generators and auxiliaries
- Condenser
- Cooling Tower
- Set of associated Balance of Plant (BOP) systems
- Marine Intake and Outfall Structures
- Proposed Future Carbon Capture infrastructure (space allocation only)

The Project will include considerable civil works. The main civil works required for the construction phase will consist of the following:

- Site development,
- Flood protection and embankments, as required,
- Road design and construction,
- Plant buildings,
- Support structures for equipment and other facilities,
- Service water, sewage, drainage, storm water and wastewater systems; basic design of evaporation pond,
- Boundary fences; and
- Water treatment systems etc.

The laydown areas will be located within the temporary site installation area within the Project boundaries and will include:

- Offices.

- Storage area and warehouse;
- Workshop and fabrication yard;

The construction phase will also include the provision of temporary site fencing including gates, first aid, site safety and security system, temporary roads and site drainage including water and sanitary drainage etc.

The contractor anticipates that in addition to the owner policy for Saudization, most of the subcontracted foreign labour (manual workforce) shall come from the Middle East mainly Egypt, Asia and the Far East, mainly India, Pakistan, Bangladesh, Nepal, and Philippines. At this stage it is understood that about 4,500 personnel are expected to be present on site during peak periods. The EPC Contractor will rent existing labour camps in a nearby town outside the Qurrayah Complex. Workers will be accommodated in these camps and transported by busses to site. The anticipated construction period for the project is 40 months, it is intended that construction workforce will be transported to and from the site.

Pre-commissioning activities ensure that construction is completed, systems are integrated, and components such as turbines, generators, and cooling systems are ready. This includes hydraulic testing of the marine intake and outfall system to check for leaks and flow rates, as well as flushing the cooling system to remove debris. Individual components like gas turbines and heat recovery steam generators are started up and tested for performance.

Integrated system testing follows, where the cooling system is monitored for flow, temperature, and pressure to ensure its efficiency and environmental compliance. The entire plant undergoes performance testing to verify that all systems, including the marine intake and outfall, meet regulatory standards for discharge quality and water temperature. Continuous environmental monitoring is conducted to ensure compliance with regulations. After all systems are successfully tested, optimized, and certified, the project is formally commissioned and handed over for commercial operation.

The design lifetime of the Project will be 25-years and the day-to-day operation of the Plant (O&M) will be the responsibility of the O&M and the Project Company. Operations and maintenance of the plant will be by the ‘First National Operation & Maintenance Company’ (NOMAC), a wholly owned subsidiary of ACWA Power and SEC. This will include the provision of all services including all routine operation, maintenance, overhaul, specialist repair services to the plant etc. NOMAC and SEC will also provide Power Availability guarantee and fuel consumption guarantee for the facility.

The requirements for the operational phase workforce are expected to be more than 100 personnel. Further details on the staff will be provided within the ESIA where available. It is noted that the O&M is obliged to employ qualified Saudi Arabia citizens to the maximum extent possible and in accordance with Saudization law.

ALTERNATIVES

In accordance with good practice methodologies for ESIA, the evaluation of various project design and activity alternatives should be considered, in order to ensure that the objectives of the proposed project have accounted for social, environmental, economic and technological options. The following project alternatives were considered:

No Project Alternative

The no project alternative would result in future demand for electricity in KSA exceeding the available supply and result to a deficit. The lack of a secure and reliable electricity generation and supply system would have significant social and economic development implications including the realisation of the KSA vision 2030. In addition, the no project alternative would hinder KSA's efforts of the climate strategy to transition from liquid-based fossil fuels to natural gas power generation. As such, the "no project alternative" option is not considered a viable option and it would not align with KSA's development goals.

Site Location

Locating the Project close to existing infrastructure prevents other E&S impacts relating to the development of new associated facilities.

Using the current proposed site located near similar facilities, also prevents the need to disturb any critical habitats since the Project site has already been cleared for previous use as laydown area and has limited flora and fauna species that are common in KSA.

Project Layout

The current Project layout was negotiated with and agreed by SPPC. The Project layout is adopted based on the available land and as per plant operation and maintenance requirements.

Intake and Outfall Layout

The originally proposed intake and outfall locations for the Project are illustrated in the following figure. Initial modelling indicated that the proposed alignment did not provide adequate dilution of the brine and thermal plumes, as well as potential recirculation and interaction between the two.

Preliminary Intake and Outfall Pipelines' Alignment

As a result, the intake and outfall alignment, along with the diffuser design, were revised and optimised to enhance plume dispersion, ensure compliance with discharge standards, and minimise the risk of recirculation. The final, selected layout is presented in the following figure.

Optimised Intake and Outfall Pipelines' Alignment

LAND OWNERSHIP

The land selected for this project is the Qurrayah industrial area under the ownership of SEC. Several other plants are already under operation. SEC is the shareholder in this Project and has allocated the land for this project.

SITE CONDITIONS AND LAND USE

The Qurrayah complex was initially developed to meet Saudi Arabia's growing power generation needs, featuring infrastructure centered around gas turbines and combined cycle power generation, taking advantage of the Kingdom's natural gas resources. As projects expanded, large areas of the complex including the project site were dedicated to temporary accommodation facilities to support EPC contractors and project staff. These accommodations included housing, amenities, and landscaped areas to create a functional environment for workers. Recently, the temporary accommodation facilities were fully decommissioned and cleared, freeing up the site for the Hajr Project.

Satellite imagery of the Project area reveals its gradual transformation over time. In 2010, a small section of the site served as temporary facilities for the development of the Qurrayah Power Plant to the south, while the rest of the area remained sandy and devoid of vegetation. By 2017, the site and surrounding areas had been repurposed as an accommodation area for the EPC Contractor supporting the development of the Qurrayah IPP, located along the northern boundary. This accommodation area was landscaped with ornamental trees.

Between 2019 and 2023, the accommodation facilities were gradually decommissioned and dismantled, leaving the site with only remnants. Presently, the site includes remaining landscape trees, low-lying shrubs, grass, compacted soil areas, compacted roads, concrete foundation slabs, and scattered construction and demolition waste.

OVERVIEW OF BASELINE, PROJECT IMPACTS & MAIN PROPOSED MITIGATION

Air Quality

Continuous ambient air monitoring was conducted at one location for a period of seven days by the air quality monitoring station (AQMS). The air quality monitoring was undertaken from 19 December to 26 December 2024. Data was logged every 15 seconds and stored every 1 minute. The ambient air quality standards used to identify pollution include the national standards set out in the Implementing Regulations for Air Quality of the Environmental Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH. The monitoring survey measures ambient air quality for Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Ozone (O^3), PM10, PM2.5.

The results obtained from the monitoring station demonstrate that concentration of all parameters are well below applicable standards stipulated in the executive regulations for air quality standards and the WHO targets and guidelines. No exceedences of NCEC daily standards were observed.

The construction activities associated with the project and its facilities may contribute to changes in air quality due to dust, gaseous emissions, odour, and volatile organic compounds (VOCs).

Dust Emissions: Generated from site preparation, earthworks, vehicle movements, and the operation of a temporary batching plant. The closest receptor (Qurrayah IPP) is 100m from the site, indicating potential dust impacts. However, dust from vehicle movements is unlikely to affect receptors, as none are located within 50m of construction routes.

Gaseous Emissions: Equipment and plant operations will produce pollutants such as NOx, CO, SO_2, VOCs, and PM. Given the transient nature of construction and the nearest receptor being 100m away, the impact is considered minor.

Odour Emissions: Potential sources include sewage storage and biodegradable waste. With no residential receptors within 100m, odour nuisance impacts are deemed negligible.

VOC Emissions: Small quantities of fuels, paints, and solvents will be stored securely. Any potential impacts will be temporary and limited to the project site, with negligible magnitude.

Overall, while some air quality impacts are expected during construction, they are largely localized and can be mitigated through proper management practices.

A detailed air quality dispersion modelling assessment has been undertaken to determine impacts associated with the operation of the proposed Hajr Two IPP Project. Dispersion modelling has been carried out using the United States (US) Environmental Protection Agency (EPA) Breeze AERMOD 13.1 dispersion model, five years of meteorological data from King Fahd International Airport (Dammam Airport) (2020 to 2024). The key pollutants considered in this assessment are nitrogen dioxide (NO_2) and carbon monoxide (CO) as these are the key pollutants emitted from the plant when operating on natural gas. Emissions of ammonia (NH_3) associated with the operation of the Selective Catalytic Reduction equipment when operating in combined cycle mode are also considered. Emissions of sulphur dioxide (SO_2) and particulate matter (PM_{10} and $PM_{2.5}$) are also anticipated when operating on the back-up fuel oil. Predicted concentrations have been compared with relevant standards and guidelines incorporated into applicable KSA law and also the WBG/IFC EHS Guidelines that reference the WHO ambient standards. The predicted modelling results present the worst-case meteorological conditions recorded during the 5 years of data.

Nitrogen Dioxide (NO2): The maximum predicted annual mean concentrations, comply with KSA air quality standards and the WHO interim targets. Emissions contribute to less than 25% of these standards, indicating no significant impact. The predicted 24-hour mean concentrations align with WHO guidelines and remain below 25% of the applicable standards, confirming no significant air quality impacts. The highest predicted 1-hour mean concentrations comply with national and WHO guidelines and contribute less than 25% of the respective standards, making the impacts insignificant.

Carbon Monoxide (CO): The 99th percentile of 24-hour mean, 8-hour mean, 1-hour mean, and 15-minute mean CO concentrations remain within compliance at all receptor locations under all operational scenarios, with contributions below 25% of the relevant standards, resulting in an insignificant impact.

Ammonia (NH_3): Since there are no national or WHO guidelines, UK Environmental Assessment Levels were used for comparison. The predicted ammonia concentrations comply with these standards, with process contributions below 1%, making the impact insignificant.

Sulfur Dioxide (SO_2): Under scenarios 3 & 4, the process contributions to the 24-hour mean are compliant with the standards but exceed 25% of national standards and WHO Interim Target 1 at some receptors. However, since backup fuel use is limited to a maximum of 30 days per year, and actual sulfur content may be lower than assumed, the overall impact remains minimal.

For hourly mean, no exceedances of national standards were predicted, but contributions exceeded IFC's 25% threshold at some receptors. Given the limited operation of the plant in back-up fuel, the impact is considered insignificant.

Particulate Matter (PM10 & PM2.5): Predicted 24-hour mean concentrations comply with both national standards and WHO guidelines at all sensitive receptors under all scenarios, with process contributions remaining below 25% of the applicable standards. No significant impacts are expected.

Therefore, the residual impact assessed as Negligible with regular monitoring and maintenance and the implementation of mitigation and management measures.

Climate Change

The estimated quantity of fuel required during the construction phase is 52,000 L/month. Using the Greenhouse Gas Protocol calculation tool for GHG Emissions from Stationary Combustion (World Resources Institute, 2015), the GHG emissions during construction were calculated.

The monthly GHG emissions, during the Project construction phase is estimated to be 139.63 tonnes of carbon dioxide equivalent (tCO2e). The annual estimate of GHG emissions during construction is 1,675.6 tCO2e. This will be less much less than the IFC threshold value of significance of 25,000 tCO2e per year. The construction period is expected to be over a period of 30 months, totalling around **50,266.8** tCO2e during the Construction period.

The project may face climate-related physical risks, including extreme heat, dust storms, and flash floods.

Rising temperatures in KSA may impact worker safety, causing heat exhaustion, dehydration, and reduced productivity. These risks are addressed under occupational health and safety (OHS) measures. Construction workers may be exposed to harsh conditions during dust storms without proper shelter or mitigation. Relevant OHS measures are in place.

A project-specific flood risk study has been undertaken to characterise flow paths that contribute to the AoI. To determine the flood risk and ensure the required design considerations are implemented at an early stage of the Project, a hydrology and flood risk study was carried out (**Appendix M**). The risks and the required mitigations are summarised in section 6.2.4.1.

Overall, while climate risks exist, mitigation measures will be implemented to ensure worker safety and site resilience.

The operation of the project is estimated to produce ±6.6MtCO_2/year. When this is compared to KSA's total emissions of 712Mt in 2020[1], the project represents ~0.57% of the national total. When compared to the country's energy sector emissions (~562 MtCO_2e in 2020) the Project represents ~0.73% of the country's energy sector processes and product use emissions. The annual emissions of ±6.6MtCO2e/year significantly exceed the IFC threshold for GHG quantification (25,000tCO_2/year), for emissions that are within direct control of the facility within the study period.

The powerplant will be self-sufficient and therefore, power grid supply is not expected to be required under normal conditions, therefore, Scope 2 emissions (electricity use) is not assessed during operation. GHG emissions are not expected from the operation of the assotiated facilities and have therefore not been considered in the assessment.

The stationary combustion emission may result from the operation of backup diesel generators in emergency cases which are considered infrequent. The estimated quantity of fuel required during the operation phase for EDG and BSDG are 1,300 kg/h and 7,400 kg/h, respectively. The emissions will depend on the actual emergency situations where the operation of the diesel generator will be required.

The project's estimated annual emissions (~6.6 MtCO2e) exceed the Equator Principles IV threshold of 100,000 tCO2e, requiring consideration of climate transition risks under TCFD guidelines.

KSA's Climate Commitments:

- Ratified the Paris Agreement (2016), aiming to limit global temperature rise below 2°C.
- Vision 2030 targets a 50% renewable energy share in electricity generation by 2030.
- Saudi Green Initiative (SGI) promotes emissions reduction, clean energy, and sustainability programs.
- Updated NDC (2021) emphasizes emission reduction, climate adaptation, and energy diversification, including increased reliance on natural gas.

Project Alignment with Climate Goals:

- Utilizes modern, efficient combined-cycle natural gas technology instead of coal or fuel oil.
- Aligns with KSA's NDC commitments by supporting lower-carbon energy generation.
- No reputational risks linked to high-carbon power generation.
- Considers Carbon Capture Readiness (land plot allocation) for up to 95% CO2 capture to address potential future emissions regulations.

[1] https://www.climatewatchdata.org/countries/SAU?end_year=2020&start_year=1990

Given these factors, the project does not pose significant short-term climate transition risks and is in line with KSA's national energy and sustainability goals.

Noise & Vibration

In order to confirm baseline conditions prior to construction work, a noise monitoring survey was undertaken. The noise monitoring was carried out by Bander Said Allehiany (BSA), an accredited laboratory in KSA. Noise monitoring was conducted at four (4) locations, for a 24- hour period; both day and night for each monitoring location within the period of 19 – 25 December 2024. The monitoring results at all monitoring stations are well within the applicable daytime and nighttime standards when compared to the WBG guidelines. In addition, monitoring results at all monitoring stations are well within the applicable daytime and night-time standards when compared to the standards stipulated in the executive regulations for noise as per the national standards.

Noise will be generated by construction and propagated from the project site and the associated facilities to the surrounding areas via a range of processes. Pertinent construction activities at the project site in relation to noise are likely to include:

- Site preparation (e.g. earthworks, compaction);
- Civil works including trenching;
- Construction, mechanical and electrical installation; and
- Road compacting;
- Vehicles movement.

Construction noise is inevitable but will have a localised extent, contained within the project footprint. The duration of the impact will be short considering individual noise emission events relative to the duration of the construction activities. The frequency of occurrence is high as noise emissions will likely occur daily, but noise emissions are reversible once the activity ceases.

The operation of the plant will typically result in a continuous low-level humming noise due constant and relatively stable operational processes such as rotating equipment, air intake, emissions release and water treatment. As such, impacts are likely to be discernible at the receptor locations in proximity to the site, especially the nearby industrial facilities. The main source of noise is anticipated to be emitted from the gas turbines, HRSG's, steam turbines, stack emissions, fans, water pumps, ventilation units, switchgear equipment, etc. Noise levels may increase during transient (start-up) operation. Noise modelling was conducted as part of the operational noise impacts assessment to predict the potential noise egress from the proposed Hajr Two IPP Project and the potential effect on the receptors. The results indicate that all the receptors comply with the IFC/KSA day and night-time limits except for the Qurrayah IPP which slightly exceeds the national standards at night. As the Qurrayah IPP is operational at night and generate noise levels that are most likely above 65 dBA within the plant and is affected by other nearby industrial sites, noise levels from the Hajr 2 IPP site are unlikely to be perceptible for the site workers at the Qurrayah IPP industrial site during night-time operations and therefore the impact is considered to be minor.

Regular scheduled maintenance activities will be undertaken to ensure that equipment is operating in its most effective manner, so that the initially designed performance and noise levels can be maintained. Ensure good design of the noise control within the plant and the noise generating components to ensure noise levels are reduced to the extent possible and ensure compliance with noise standards at the nearby facilities and existing receptors.

Soils, Geology & Groundwater

The construction phase will involve excavation, backfilling, and grading, which may lead to soil erosion, compaction, and loss of fertility. However, most excavated soil will be reused on-site, and proper stockpiling will help maintain soil conditions. Since the site lacks steep slopes, the impact is expected to be minor and localized.

There is also a risk of soil and groundwater contamination from fuel, chemicals, and construction waste if not properly stored and handled. Accidental spills and hazardous waste, such as concrete washout and used oils, could lead to environmental damage. Effective waste management will be essential to mitigate these risks.

Dewatering may be necessary for deep excavations but will be temporary. The extracted water is conveyed via a network of flexible hoses to a sedimentation pond or tank, where suspended solids are allowed to settle before the water is discharged into the marine environment through a shoreline pipe. While the use of pumps is essential for dewatering, improper management could lead to oil spills and potential contamination of groundwater. The risk of groundwater contamination is low due to the absence of principal aquifers and groundwater abstraction in the area. A Dewatering Management Plan will be implemented to ensure environmental compliance.

During the operational phase, the potential for soil and groundwater contamination is low, as the project will be static and not directly interact with these environmental parameters. However, risks could arise from improper management and storage of hazardous materials, chemicals, fuels, and wastewater. Key contamination sources include bulk diesel storage, waste oils, solvents, and storm-water runoff. Accidental spills, extreme rainfall, or fires could exacerbate these risks.

To mitigate these impacts, the plant will be designed with paved areas to limit seepage, dedicated storage for contaminants, and drainage systems with collection sumps to prevent environmental pollution. The evaporation pond utilised for the collection of non-compliant treated wastewater (if any) will be lined with acid-resistant geomembrane and equipped with leak detection pits, ensuring minimal risk of contamination. When utilised, regular monitoring will be carried out to ensure the pond doesn’t overflow. With these measures in place, the impact is expected to be negligible.

Water, Hydrology and Flood Risk

During construction, water will be sourced from municipality-approved suppliers, with an estimated usage of 350m^3/day for various purposes, including washing, cleaning, and sanitary needs. An additional 25,500m^3 will be required for concrete, plus 1m^3 per 1m^3 of concrete for washing and cleaning equipment. To mitigate risks related to local water shortages, the EPC Contractor must engage licensed suppliers, obtain relevant permits, and ensure that water demand does not affect local communities.

The site is subject to flood risks, including rainfall accumulation and potential sea-level rise. A flood risk study has been conducted to determine the appropriate design measures to mitigate these risks, accounting for sea-level rise and climate change projections.

The baseline flood modeling identifies flood risks from sabkha flooding, direct rainfall, and water accumulation in depressions. Key mitigation and design recommendations are:

- Minimum Finished Ground Level (FGL): A minimum FGL of +3.5 m MSL is recommended for critical infrastructure, including the Hajr 2 CCGT Plant, ESF, Laydown Area 1, and Evaporation Pond North, to reduce flood risks.

- Hajr 2 CCGT Plant: Flooding depths up to 0.2 m observed; to be minimized through grading and onsite drainage. Access road to be raised and graded to 3.5 m.
- ESF: Located in sabkha; flood depths <0.1 m with FGL at +3.5 m. A nearby depression causes flood depths up to 8 m, but low velocities mean minimal risk to the ESF.
- Future Carbon Capture Plot: Not at risk under current baseline; no mitigation needed.
- HV Cable Corridor: Localized flood depths up to 1.2 m; recommend exclusion zones or backfilling and grading of ESF boundaries.
- Laydown Area 1: Should be raised to +3.5 m FGL or designated as an exclusion zone if unsuitable.
- Laydown Area 2: Flood depths up to 1.3 m in localized depressions; recommend exclusion zones.
- Batching Plant: No flooding observed; no action needed.
- Internal Roads: Should be graded to align with surrounding topography.
- Evaporation Pond North: Max flood depth of 2.7 m; platform level should be +3.5 m MSL. Existing coastal protection appears adequate.
- Evaporation Pond South: No direct rainfall flooding; coastal interaction effects noted—design review recommended.
- Coastal Flood Risk: Coastal water height peaks at ~2.0 m MSL. Including freeboard and surge (up to 2.96 m MSL), the +3.5 m FGL provides adequate protection. Effectiveness of existing coastal defenses should be further assessed.
- Storm Surge: Modelling using the “Extreme High Sea Level” scenario (1.73 m) confirms that current mitigation measures are sufficient to protect against storm surge impacts.
- Sea Level Rise: Medium-term (2041–2060), Projected rise of 0.3 m aligns with the project’s 25-year design life and is accounted for in current measures. Long-term (2081–2100), Projected rise of 0.8 m, which is 0.5 m higher than current modelling. With the additional 0.5 m sea level rise, a platform level of +3.5 m MSL would no longer adequately protect Laydown Area 1, Evaporation Pond North and South, and the Plant area from flooding. These areas will require further design consideration for long-term resilience.

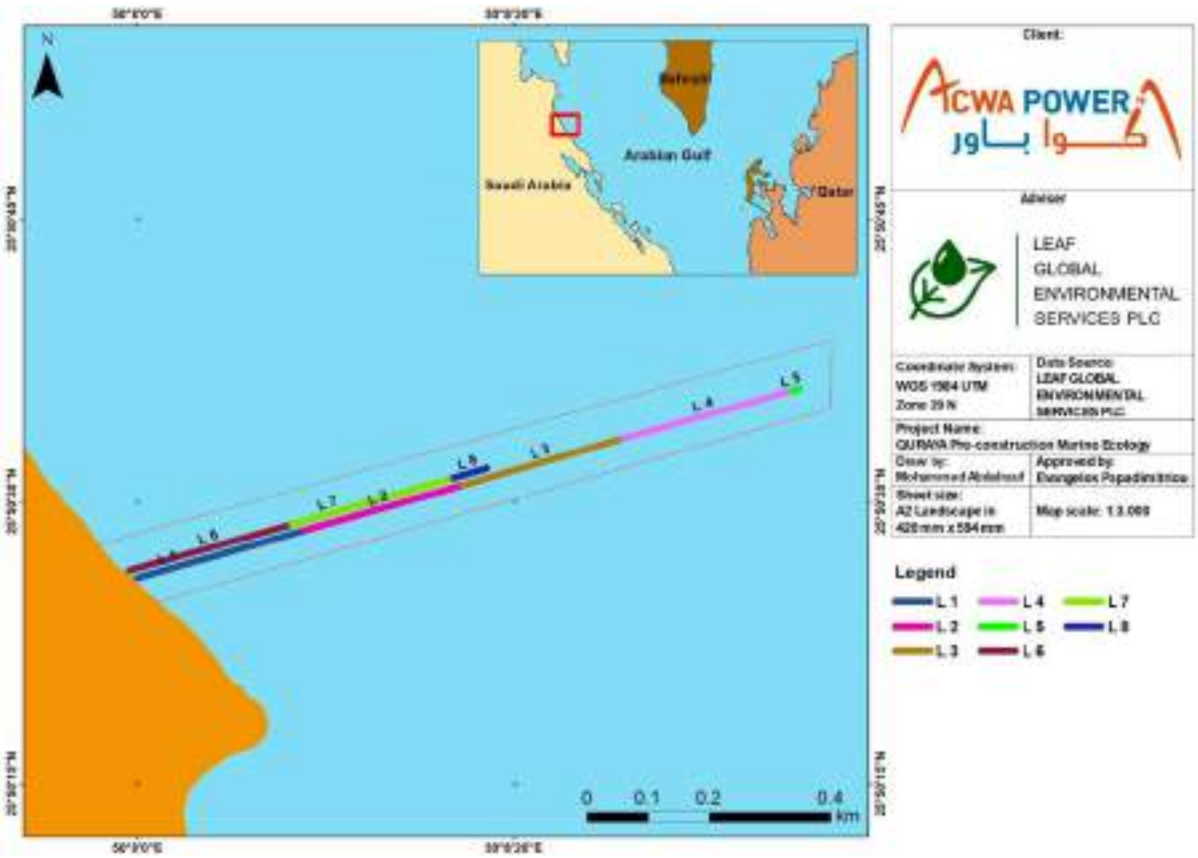
During operation, the water concept will be to reduce effluent emissions and to recover as much as possible the water in the Power Plant. There will be several treatment plants with the objective to treat and recycle effluents.

The reused water will be as follows:

- HRSG: blowdown water as well as other drains from steam-water cycle such as steam condensate, will be collected and treated in the boiler blowdown treatment plant. After the treatment, water will be reused in the desalinated water tank for the production of demineralised and service water.
- Non-seawater effluents such as evaporative cooler blowdown and Water Treatment Plant clean drains, will be collected and treated in a dedicated wastewater treatment plant. Following the pre-treatment,, the treated water will be sent to the raw water tank, which will be used for the production of demineralised and service water.

Marine Ecology

A marine survey was conducted by LGES from 29th May to 7th May 2025. The survey methodology and outcomes are summarised in the following sections and provided in detail in **Appendix J**.

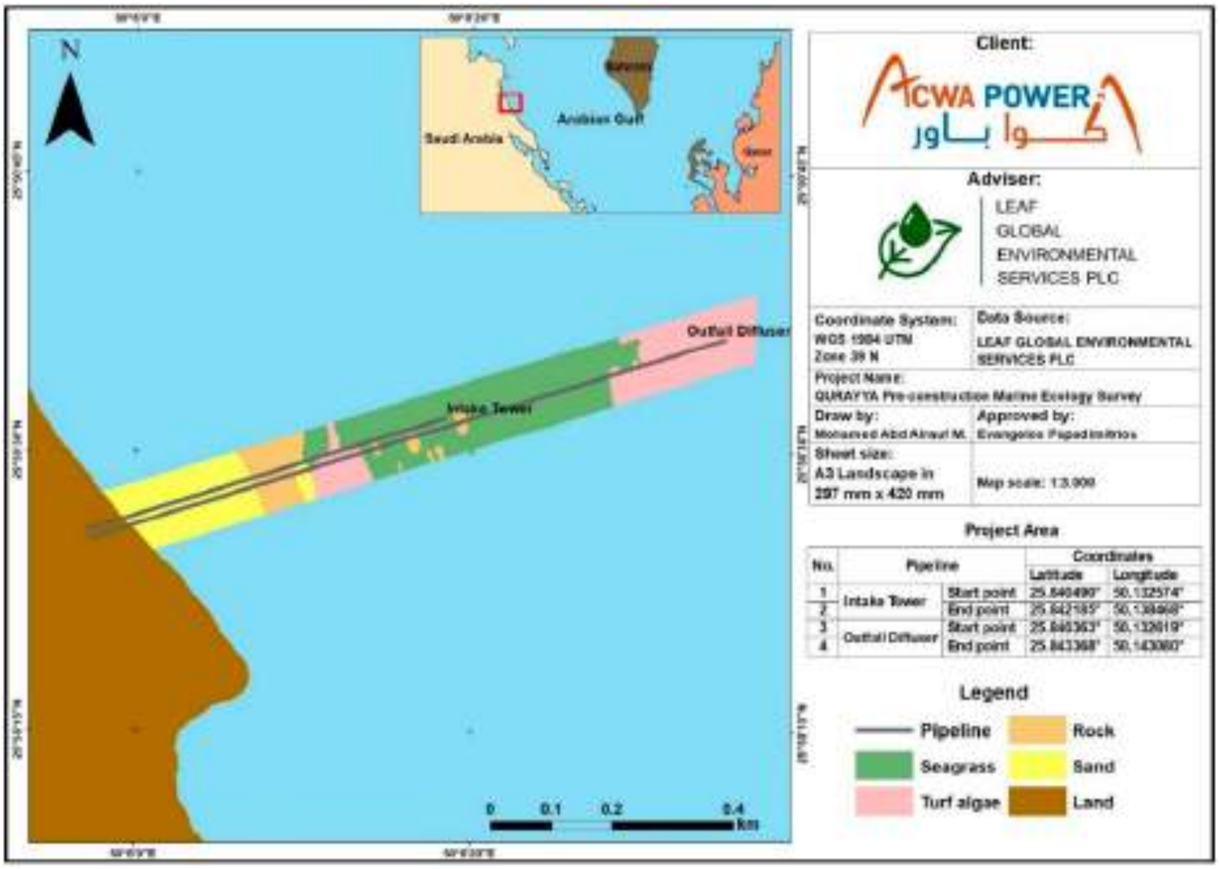


Location	Start point		End point		Length
	Latitude	Longitude	Latitude	Longitude	
L 1	50.1333160	25.8405395	50.1357126	25.8412206	250 m
L 2	50.1357126	25.8412206	50.1381260	25.8419065	250 m
L 3	50.1381260	25.8419065	50.1405045	25.8426018	250 m
L 4	50.1405045	25.8426018	50.1429176	25.8432845	250 m
L 5	50.1429176	25.8432845	50.1430930	25.8433333	19 m
L 6	50.1331971	25.8406457	50.1356119	25.8413287	250 m
L 7	50.1356119	25.8413287	50.1379991	25.8420163	250 m
L 8	50.1379991	25.8420163	50.1384821	25.8421567	61 m

Transects Locations and Coordinates

The benthic habitat assessment conducted along the proposed intake and outfall pipelines revealed a clear gradient in both substrate composition and bathymetric features across the surveyed marine corridor. At Location 1, the nearshore area was primarily composed of sandy substrates, with depths ranging from approximately 0.3 m to 2.13 m. Consolidated rock outcrops were also present at shallower points (less than 0.7 m), interspersed within the sandy matrix. This area lacked vegetative cover such as seagrass or turf algae and exhibited low habitat complexity. At Location 2, a notable shift in benthic structure was observed, with seagrass meadows becoming predominant across depths of 2.76 m to 4.59 m. These were interspersed with rocky substrates and localized turf algae. The seagrass beds were primarily composed of *Halophila stipulacea* and *Cymodocea serrulata*, which are categorised as Least Concern on the national and IUCN red list. Both species are typical of soft-bottom environments and are known to contribute to sediment stabilization. Turf algae were noted at specific points around 2.78–2.81 m depth in association with hard substrates, enhancing the structural heterogeneity of the habitat. At Location 3, the benthos was dominated exclusively by continuous seagrass coverage, extending from 5.87 m to 9.81 m depth. No other substrate types or vegetation forms were recorded in this section. Location 4 continued this pattern, with seagrass meadows recorded throughout the surveyed depth range of 6.65 m to 12.87 m. The assemblage remained consistent in species composition and structural characteristics, with no other dominant benthic types observed. At Location 5, the benthic environment transitioned to being predominantly covered by turf algae, particularly at greater depths between 12.25 m and 15.38 m. Seagrass was still present but more sporadic, recorded between 12.36 m and 14.6 m, typically in co-occurrence with patches of turf algae. No live or dead coral structures were recorded throughout the entire survey area, and no coral taxa were observed.

The habitat map of Benthic habitats is shown on the figure below indicating ht elocations of seagrass along the intake and outfall.



Habitat Mapping of the Survey Area (LGES, 2025)

The reef fish census conducted across the five surveyed locations recorded variable species presence and abundance. Fish species observed during the survey included *Pomacanthus maculosus, Caranx melampygus* (bluefin trevally), *Scomberoides lysan, Stegostoma fasciatum* (zebra shark), *Ostracion cubicus* (boxfish), Gobiodon spp. (goby), and *Blenniidae* spp. (blenny). All identified species are categorised as least concern on the International Union for Conservation of Nature (IUCN) red list except for the Endangered zebra sharks (*Stegostoma fasciatum*). No marine megafauna were observed during the survey.

During construction, direct disturbances to marine habitats will result from trench excavation and side casting for the intake and outfall pipelines. These activities will lead to a localized loss of seagrass, estimated at approximately 0.59ha, primarily consisting of *Halophila stipulacea* and *Cymodocea serrulata*. Both species are classified as Low Concern on the IUCN Red List and are known for their resilience and regional abundance, therefore resulting in minor broader ecological impact.

While marine construction may temporarily increase suspended solids and reduce water clarity, the coarse-grained nature of the sediments within the project area limits the dispersion of fine particles. As such, turbidity increases are expected to be localized and short-lived, with limited risk of smothering adjacent seagrass beds. Natural recovery of seagrass is anticipated post-construction. Mitigation measures, including the use of silt curtains and controlled excavation techniques, are recommended to reduce impacts further.Vessel anchoring during construction may also impact the marine environment, particularly in areas where seagrass is present. To minimize this, divers will be deployed to microsite and avoid direct contact with seagrass wherever possible. The absence of large marine mammals in the project area suggests that the risk of vessel strikes is negligible.

Underwater noise from vessel movement, excavation, and pipeline installation could affect marine mammals and fish, potentially leading to temporary displacement. However, given the industrial nature of the area, the temporary duration of construction activities, and the lack of megafauna sightings, these impacts are unlikely to be significant.

Accidental spills of diesel or oil pose a risk to marine organisms, but the effects of small spills are typically short-lived in open waters. Spill response and mitigation measures will be detailed in the construction management plans developed by the EPC Contractor to minimize environmental risks.

The introduction of invasive species through ballast water discharge presents a potential ecological threat. To prevent this, vessels will adhere to international ballast water management regulations, including anti-fouling measures and pest control, with compliance monitored through port and vessel-level enforcement.

The discharge of brine and thermal water into the marine environment has the potential to alter salinity and temperature levels, potentially affecting marine biodiversity and ecosystem balance. However, marine modelling for the project indicates that these impacts will be minimal. Seagrass beds are located approximately 150 meters inshore of the diffuser, and the modelling predicts that excess salinity at this location will be around 1 g/L, which is less than 2% above natural background levels. Similarly, thermal dispersion patterns from the new outfalls are expected to mirror existing conditions, with no significant increase in near-bed temperature (ΔT) at the seagrass zone. Given these findings, the impact of brine and thermal discharges on seagrass and surrounding marine life is assessed as negligible, and no significant ecological disruption is expected as a result of operational discharges from the Project.

Routine maintenance of the intake pipelines is necessary due to the accumulation of fouling species like oysters, mussels, and barnacles, which can affect the pipeline's performance. While discharges of organic material during cleaning may cause localized impacts, the effects are generally low in significance due to the organic nature of the material and the limited area of impact.

The intake system also poses a risk of entrainment and impingement of small marine organisms, such as plankton, fish eggs, and larvae, as they may be drawn into the intake. To minimize this risk, the intake system is being designed with an intake velocity of 0.15m/s, which is within the thresholds recommended by the IFC EHS Guidelines and the US EPA. Additionally, bar and mesh screens will be installed to further mitigate impingement impacts. The fauna that is entrained into the plant will be monitored during the first 2 years to assess whether any species greater than least concern had been drawn into the plant. If they have then a review process will be undertaken to identify suitable mitigation measures to minimise this impact.

Marine Water and Sediment Quality

Marine water and sedimet quality samples were collected and sent for analysis by LGES as part of the marine survey. The methodology and outcomes are summarised in the following sections and provided in detail in **Appendix J.**

The water exhibited a pH of 8.1, well within the NCEC acceptable range (6.5–9), indicating stable buffering capacity. Temperature was measured at 24.7 °C, consistent with expected ambient levels for late spring in the Arabian Gulf. Turbidity was low and significantly below the 3 NTU threshold, thus suggesting minimal suspended particulate matter in the water column. Salinity was high at 49.78 PSU however, this is typical for the Gulf as it reflects strong evaporation and limited freshwater inflow. TDS (Total Dissolved Solids) was elevated, a typical characteristic of hypersaline environments in the region. Sulfate concentrations reached 3,400 mg/L likely due to seawater ionic composition and evaporation effects. Dissolved Oxygen was 7.2 mg/L, well above the minimum requirement (5 mg/L), indicating good oxygenation and limited organic pollution. Nutrient-related parameters such as ammonia, nitrate and nitrite remained within expected background concentrations. These parameters are typical for the Arabian Gulf, with no signs of stratification or water quality degradation.

Key physicochemical and nutrient parameters including chloride, sulfate, total phosphorus, total nitrogen, and total organic carbon, were well below regulatory thresholds. Heavy metals such as lead, cadmium, mercury, chromium, and copper were either not detected or present in trace concentrations far below levels of concern. Microbiological parameters, including total coliforms and E. coli, were undetectable across all sites. Sediment analysis confirmed a predominance of carbonate-rich sand and low levels of contaminants. Total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), and heavy metals were either absent or detected at minimal levels across all locations, reflecting the absence of historical or ongoing anthropogenic pollution.

Grain size analysis showed a predominance of coarse particles, with 100% of sediment passing the 9.5 mm sieve and a significant portion retained above 2 mm, particularly at Location 3, where 90.1% passed the 2 mm sieve. Finer fractions (<0.075 mm) ranged from 5.0% (Location 3) to 8.1% (Location 5), indicating overall coarse-grained sediments.

The macro-benthic infauna from five samples had a population with an average of 74 individuals per sample. The total population recorded in all five samples is 370 individuals. The macro-benthic community from the Project Area consisted of two phyla. Mollusca (99.2%) followed by Retaria (0.8%) were the major phyla of macro-benthic infauna from the Project area. A total of 28 species of macro-benthic infauna were recorded from all the samples. Cerithium sp. (57.3%), Timoclea sp. (8.9%), Veneridae sp. (4.6%), Trochidae sp. (4.3%) and Phasianellidae (3.5%) were the major species of the macro-benthic infauna from the Project area.

The trenching and installation of intake and outfall pipelines may impact water quality by increasing suspended sediment and reducing water clarity. To assess these potential effects, a sediment dispersion study was conducted by HR Wallingford in 2025, evaluating the impacts of dredging and construction activities on water quality and nearby infrastructure. The seabed composition along the pipeline routes is not yet confirmed, but estimates suggest a largely sandy bed with 10% fine material, based on limited geotechnical surveys from sites further north. The study assumes that trenching will be performed using a small-to-medium backhoe, with trenches being dredged and backfilled after pipe installation.

Sediment dispersion was modeled using representative release points along the pipeline routes, simulating sediment loss under different current conditions over a 7-day period. The modeling assumed a fine sediment release rate of 1 kg/s, focusing on particles smaller than 63 µm, as coarser materials settle quickly near the dredging site.

Modelling of suspended sediment dispersion during trenching indicates that increases in sediment concentrations will generally remain within 5 mg/L above background levels and will dissipate within a few hundred metres of the trench. These levels are within the national turbidity standard of 5 NTU (~5 mg/L) for industrial waters and are therefore not expected to cause significant environmental concern. At the nearby QIPP intake, sediment concentrations may temporarily rise by approximately 6 mg/L above background during trenching activities. This short-term exceedance is comparable to levels that might naturally occur during storm events and is expected to last only for a few days. No notable increases in fine sediment concentrations are predicted at other nearby intake locations. Overall, the impact of suspended sediment on water quality is expected to be localized, temporary, and within acceptable environmental limits.

The trenching and installation of intake and outfall pipelines may release suspended sediments, potentially altering sediment quality through increased fine material deposition. However, the marine survey (**Appendix J**) indicated that the intake and outfall alignement is composed mostly of flat sediments with shell fragments and flat sedimentary rocks rather than fine silt. The sediment across the surveyed area is predominantly coarse-grained and carbonate-rich, with a low proportion of fine particles (silt and clay), such coarse sediments are less prone to resuspension and typically settle quickly after disturbance. Although dredging in these conditions is less likely to create long-lasting turbidity plumes, impacts are anticipated to be short-term and localized. Accordingly, taking into consideration the size of the trench and the type of sediments, the impact on sediment quality is not expected to be significant.

Additionally, accidental spills, discharges, and runoff from construction activities pose a risk of water contamination. This includes leaks from terrestrial and marine equipment, as well as altered drainage patterns due to site leveling. The presence of fuel and chemical storage areas increases the risk of pollution, particularly during heavy rainfall, which could transport surface pollutants into the sea or groundwater. To mitigate these risks, appropriate control measures will be implemented through relevant management plans.

Dewatering during excavation may pose a minor risk to marine water quality if non-compliant effluent is discharged; however, this risk is minimal under normal conditions and regular monitoring. To mitigate potential impacts, the EPC Contractor will develop a Dewatering Management Plan outlining treatment, monitoring, and discharge procedures. A discharge permit will be obtained from NCEC. Water quality will be monitored daily before discharge using handheld meters, and discharge will occur at a shoreline point away from sensitive habitats. In addition, a contingency plan will be in place to manage non-compliant effluent.

Thermal dispersion modelling indicates that existing operational plants generate large surface thermal plumes extending along the shallow coastal waters, with areas exceeding the environmental temperature limit of +4°C covering approximately 17 km² (95th percentile). The addition of the new Al Hajr and Qurayyah Expansion plants is not predicted to increase heat discharge at the new outfalls; instead, their flows may slightly alter the shape of existing plumes, though the overall thermal patterns and exceedance areas remain largely unchanged. Brine dispersion modelling shows that the new discharges form dense, seabed-hugging plumes due to their high salinity. However, the diffuser design is expected to achieve sufficient dilution, ensuring salinity remains within the NCEC limit of +1.8 g/L (95th percentile). In the broader area, salinity concentrations fall below 0.5 ppt within approximately 3 km from the outfalls.

Therefore, the intake and outfall design for the Hajr Two CCGT Project has been optimized to ensure compliance with national standards. Adverse impacts from the brine and thermal discharge of the project are not anticipated.

To prevent chlorine leaks, double-wall chlorination pipes will be installed externally along the intake, with leak detection measures such as diver inspections, chlorine pressure monitoring, and frequent water testing at the pumping station. The study is ongoing, with design adjustments being evaluated for environmental compliance.

Chemical and de-oiled wastewater will be treated and discharged to the sea with brine and cooling tower blowdown only after meeting quality standards. In case of unplanned major malfunctions, wastewater will either be stored for offsite treatment, recirculated for re-treatment, or diverted to a lined evaporation pond. While potential impacts on marine water quality could occur due to accidental discharge, pond overflow, or flooding (considering the proximity of the ponds to the marine environment), these are unlikely under normal conditions. These are unlikely due to planned monitoring and engineering controls as well as the pond being the last option to be considerd shall other alternatives fail. To mitigate risks, the wastewater treatment plant will be properly maintained and equipped with automated dosing and alarms, water quality will be monitored prior to discharge, and any exceedances will trigger system checks and corrective actions. If the evaporation pond option is selected, it will include HDPE lining, leak detection, flood protection, and perimeter security, with contingency and emergency response plans in place to manage unexpected events.

Terrestrial Ecology

The project is located within Khalij Salwa[2] which was proposed as a protected area in Saudi Arabia in 1990 under the IUCN Management Category IV (habitat or species management area). However, it remains a proposed designation with limited available information on the ecological significance of the area are not published and no reported management plans to date.

The project is also located around 8km from the Gulf of Salwah. The Gulf of Salwah, a shallow, hypersaline bay between Saudi Arabia and Qatar, is ecologically significant for the presence of seagrass, diverse breeding and wintering seabird species, including the vulnerable Socotra cormorant, and marine mammals like the dugong. It has been designated as a Key Biodiversity Areas (KBA) and Important Bird Areas (IBA) by BirdLife International[3]. The remaining protected areas are more than 30km away from the project site.

The presence of construction equipment, workers, temporary facilities and environmental externalities resulting from construction processes (i.e., noise, vibration, waste and wastewater) have the potential to impact upon terrestrial ecology during the construction phase. Such impacts may include the partial or direct loss of habitat and flora species as well as disturbance to fauna.

A site visit was undertaken in November 2024 and observations indicated the Project site is a typical desert habitat with sparse natural and native vegetation, primarily small shrubs as well as large ornamental and landscape trees. No fauna species were identified during the site visit.

2 UNEP-WCMC (2025). Protected Area Profile for Khalij Salwa from the World Database on Protected Areas, May 2025. Available at: https://www.protectedplanet.net/11995

3 BirdLife International (2025) Site factsheet: Gulf of Salwah. Downloaded from https://datazone.birdlife.org/site/factsheet/gulf-of-salwah?utm on 18/05/2025

All flora species observed during the site visit were recorded and identified. All species recorded are common for the region, and none are listed on the KSA high priority list. Four specie are Least Concern on the IUCN list while the remaining species are not evaluated.

Given that the majority of the site has sparse, limited vegetation and given the absence of flora of conservation value suggests that the site does not host rare or endangered species or contribute significantly to biodiversity. Therefore, the development of the project is unlikely to have significant impacts due to habitat loss. Although the site is of a disturbed habitat due to industrialisation, mitigation management will be required and implemented to reduce further or prolonged impacts to the development area including but not limited to reducing the construction footprint to designated spaces, avoid vegetation loss, and create habitat corridors for wildlife movement. Store and reuse topsoil for re-vegetation, use native species for landscaping, and prevent the spread of invasive plants. Inspect and clean machinery to prevent invasive species, restrict off-road driving, and ensure all activities stay within defined boundaries.

Solid Waste and Wastewater

The construction phase can often be the most environmentally damaging phase of a project, particularly in regard to the volumes of waste that are generated, if not properly managed. Construction activities such as site preparation, civil works, electrical and mechanical works, materials delivery, operation of labour camps will generate construction, domestic and hazardous waste streams in both solid and liquid form.

The surge in waste due to construction Projects can strain existing waste management facilities and systems due to increased load or limited capacity. The EPC Contractor will make arrangements for the establishment of waste management facilities for the Project's construction phase.

The construction site will be equipped with on-site temporary sanitation facilities to cater to the needs of construction workers. These facilities are expected to include toilets, basins, and ablution facilities. These facilities will require regular maintenance, including emptying and removal of wastewater from the Project site. This should be carried out by licensed contractors who will ensure the proper transport and disposal of the wastewater at a wastewater treatment plant.

The operation of the Project will generate small amounts of non-hazardous domestic waste from the the administration facilities and from activities of the employees. The operation of the Project may also result in the generation of small quantities of hazardous waste streams including used chemical containers and drums, used oil, miscellaneous wastes such as batteries, waste cables, oily rags, etc.; and general clean-up materials and solvents from general maintenance of on-site plant and machinery.

During the operational phase, the project will have a sewage treatment facility and the treated effluent will be reused for irrigation onsite.

Chemical and de-oiled wastewater will be treated in a wastewater treatment plant and discharged with brine from RO plant and cooling tower blowdown through the outfall to the sea only after confirming compliance with applicable quality standards which is the wastewater treatment plant design basis. In case of extreme conditions like malfunctioning of wastewater treatment plant for both working and standby equipment, one of the following alternatives will be applied as per finalised design during detailed engineering.,

i. Wastewater flow during the extreme conditions where the quality of the wastewater does not meet applicable standards will be sent to intermittent storage tank for collection by tankers (authorised third party) if decided to be treated outside of the plant or sent back to the wastewater treatment plant if the extreme conditions are short term and wastewater treatment plant is back to operation and discharged with brine from RO plant and cooling tower blowdown through the outfall to the sea only after confirming compliance with applicable quality standards.

ii. The effluent will be diverted to a lined evaporation pond for safe containment.

While potential impacts on marine water quality could occur due to accidental discharge, pond overflow, or flooding as per selected methodology indicated above, these are unlikely under normal conditions due to planned monitoring and engineering controls. To mitigate risks, the wastewater treatment plant will be properly maintained and equipped with automated dosing and alarms, water quality will be monitored prior to discharge, and any exceedances will trigger system checks and corrective actions. If the evaporation pond option is selected, it will include HDPE lining, leak detection, flood protection, and perimeter security, with contingency and emergency response plans in place to manage unexpected events.

The accumulating sludge in the evaporation pond and the sewage treatement plant will regularly be collected by licensed companies and disposed.

<u>Landscape and Visual Amenity</u>

Construction will cause minor, adverse changes to the landscape, primarily through site leveling and building construction. The site, being an undeveloped industrial area, has low sensitivity to these changes.

Construction activities may cause temporary visual disturbances due to heavy machinery, dust, and lighting at night. These impacts will be most noticeable to nearby workers, road users, and residents, but are considered minor due to the site's location within an industrial complex.

The visual and landscape impacts are expected to be temporary, with minimal long-term effects on surrounding receptors. The project’s proximity to existing industrial facilities reduces the sensitivity of the area to these changes.

Receptors affected by the visual impacts during the project operation will be those that have direct (and partial) views across the existing site. It is inevitable that the plant, once completed will contribute to the existing landscape and visual setting which is mostly an industrial landscape. The proposed Hajr Two IPP CCGT plant is located within the Qurrayah industrial area which comprises of existing and operational plants, it is thus deduced that the development of the proposed Hajr Two IPP will result in minor and insignificant impacts to the visual landscape of the AoI and development region.

Lighting will be required for security around the site perimeter, lighting within the plant itself and that site entrances or along access roads. Impacts due to lighting may result in considerable changes to the night-time views of the site. This will be minimised through implementing the applicable measures to avoid unnecessary sky glow glare or light spill into dark areas.

Considering the existing landscape value of the project area, the impacts are likely to have negligible magnitude and significance on the surrounding receptors.

<u>Traffic and Transportation</u>

Construction will result in additional vehicles on main highways and roads and temporary construction roads on-site. The number of vehicles will vary due to the phasing of works and the timing of vehicular movements.

Construction vehicles will include a variety of vehicle classifications, e.g., HGV's, LDV's, trucks, pick-up trucks, excavators and other heavy/light equipment. The works will also require numerous vehicles to be mobilised to transport workers, components and equipment.

Heavy construction vehicles can cause accelerated wear and tear on road infrastructure, leading to potholes, cracks, and road degradation. This can result in nuisance to road users and the local communities, increase accidents risk and require more frequent maintenance. In addition, increase in the number of vehicles along the access road as a result of the Project's development has the potential to result in road traffic accidents affecting humans and livestock.

The local community may not be used to increased traffic including HGVs along the local roads traditionally and therefore, the magnitude of potential impacts to road infrastructure is considered minor and the magnitude of road safety incidents is assessed to be moderate.

Transportation impacts during operations are not expected to be significant, as the operation of the Project will not require continuous delivery of materials, or other equipment to operate. There will be operational staff daily commute and occasional deliveries and waste removals from the site, which will not result in a significant amount of traffic on the main roads in the area. Therefore, the traffic and transportation impact assessment during operation has been scoped out.

Archaeology and Cultural Heritage

Based on the desk review, there are no international or national sites of cultural heritage significance listed in connection with the Project site. The historic port of Al Uqair, situated approximately 22 km south of the project site, is the only noted historical site in the area. The project site itself is located within an industrial area between two existing power plants, with no known archaeologically sensitive sites closer than Al Uqair. Therefore, potential impacts on this heritage site are unlikely.

There is no evidence to suggest that the project site contains significant archaeological or cultural features, and observations from the site visit revealed no findings of concern. The site has also been modified, excavated and compacted, having previously served as temporary construction facility during the construction of the adjacent power plants. As such, impacts on any buried artifacts are considered unlikely. Therefore, archaeology and cultural heritage has been scoped out and is not discussed further in this report.

Nonetheless, an archaeological 'Chance Find Procedure' will be developed prior to the start of site earthworks. This will include protocols and procedures to stop work and methods to preserve potential finds, as well as reporting requirements and coordination with the Authorities.

Socio-Economic

The construction phase will generate employment, benefiting workers and stimulating the local economy through the multiplier effect. However, a large portion of the workforce may be expatriates, potentially reducing the local economic benefit from wage expenditure.

Spending on local and international goods and services will benefit the local economy, with some construction materials sourced locally. However, specialized materials will likely be imported.

The influx of workers may drive up demand for basic commodities, leading to price inflation, potential shortages, and social inequalities. However, the provision of accommodation and transportation for workers will help manage some of these impacts.

Community Health, Safety & Security

All construction Projects have potential risks relating to public safety that could arise, particularly regarding the use, for example, of equipment, construction plant and vehicles and deep excavations, which could result in potential hazards on or near the site and on the surrounding roads. It is important therefore to protect the local community from risks which could occur due to traffic accident or emergency situations of fire, flood or pollution incidents. However, the site is fenced and secure, therefore there is negligible potential that the Project could be accessed by the public in the vicinity of the Project area.

Specific management plans during the construction phase, in addition to the CESMP, will include a Pollution Prevention and Control Plan, Traffic Management Plan and an Emergency Preparedness and Response Plan. A Stakeholder Engagement Plan will also provide the basis for consultation with communities including a grievance mechanism. Similar plans will also be prepared by the O&M company prior to operations. Security arrangements will be in provided for the Project.

Labour and Working Conditions

KSA labour law includes clear guidelines for timely payment of salaries, working hours, breaks, rest days, paid leave, sick leave and end of service benefits. Salaries are protected by the Wage Protection System (WPS) in KSA, and all workers shall receive their salaries in local currency and bank accounts as per the Law. In addition, the IFC PS2 and ILO conventions provide clear requirements related to the working conditions.

However, contractors may violate the laws and regulations and workers potentially accept the unjust conditions they experience as they are not aware of their legal rights or afraid of the adverse outcomes expressing their concern may result in.

Discrimination based on gender, nationality, religion or as a result of different social status or work position is widespread within the construction industry.

Labour exploitation on construction sites, unfortunately, has become a reality in some parts of the world with history of contractors and recruitment agency exploitation of workers despite existing Labour Law articles that forbid such practices.

Workers are also at risk (especially migrant workers) as they face the risk of debt bondage through unscrupulous recruitment agencies in their home countries. Even though the EPC Contractors will be responsible for covering the required expenses as per the Labour Law, there still remains a risk of engaging uncertified recruitment agencies who have human rights violations.

Illegal recruitment of minors may be observed in the absence of regular monitoring of the contractors' human rights practices and auditing the sites and the management systems in place. However, the recruitment process in the KSA such as obtaining a work permit from the relevant government departments ensures that children are not exploited.

During the construction phase, workers will be vulnerable to various forms of harassment, exploitation and abuse, aggravated by traditionally male working environment. GBVH is likely to be committed by co-workers or construction supervisors and can be attributed to gender stereotypes.

Common activities undertaken during construction such as the movement of heavy machinery, excavation, handling of chemicals, etc. can all introduce significant risk to the health and safety for the associated work force.

In addition, the close interaction and mixing of workers on construction sites and in labour accommodations can facilitate the spread of such diseases, which may also impact the surrounding communities.

Residual Impacts

The significance of the residual impacts are shown in below.

Topic	Beneficial	No change	Negligible	Minor	Moderate	Major	Total
Construction Phase							
Air Quality			5	1			6
Climate Change			2				2
Noise			7	2			9
Soil and Groundwater			3				3
Hydrology, Surface Water Drainage and Flood Risk			1	1			2
Solid Waste and Wastewater				1			1
Marine Ecology			9	1			10
Marine Water Quality			3				3
Landscape and Visual Amenity			2				2
Traffic and Transportation			2				2
Terrestrial Ecology			3				3
Archaeology and Cultural Heritage			1				1
Socio-economic	4		1				5
Community Health, Safety & Security			5				5
Labour & Working Conditions			4	3			7
Total	**4**	**0**	**43**	**8**	**0**	**0**	**55**
Operation Phase							
Air Quality			3				3
Climate Change			2		1		3
Noise			2	2			4
Soil and Groundwater			1				1
Marine Ecology			3	1			4
Marine Water Quality			3				3
Solid Waste and Wastewater			1				1
Landscape and Visual Amenity			1				1
Socio-economic	2						2
Community Health, Safety & Security			2				2
Labour & Working Conditions			2	3			5
Total	**2**	**0**	**20**	**6**	**1**	**0**	**29**

Cumulative Impacts

The ongoing and planned developments included in the cumulative impacts assessment consist of the Hajr Two IPP and the SEC CCGT Project, which will be developed simultaneously adjacent to our project. Additionally, existing and operational plants considered in the assessment include the Qurrayah Power Plant 2, Qurrayah IPP, Qurrayah Power Station and the Qurrayah Sea Water Plant. A qualitative assessment of the potential and relevant operational cumulative impacts have been undertaken considering the project information available and assuming the future SEC CCGT and the nearby existing facilities have very similar activities to the Project. Quantitative assessments were carried out for operational noise and air emmissions by conducting modelling studies.

- Cumulative dust generation and gaseous emissions from construction activities with the potential to impact surrounding receptors, workers & visitors. To determine the operational phase impacts, a quantitative cumulative modelling was carried out and it provided in **Appendix H.** The modeling shows that the predicted environmental concentrations (PEC) for Nitrogen Dioxide (NO2), Carbon Monoxide (CO), Ammonia (NH_3), and Particulate Matter (PM2.5) comply with national and WHO guidelines, indicating no significant impact.

  For sulfur dioxide (SO_2), exceedances of WHO standards may occur in worst-case scenarios. However, the plant will operate primarily on natural gas, the backup fuel will only be used in the event of an interruption to the supply of natural gas. It is estimated that the plant will only operate for 30 days per year on the back up fuel. The concentrations presented in the table above represent the worst-case concentration over a five-year period i.e. under the worst-case meteorological conditions experienced in the five years considered. The plant is only likely to operate for a maximum of 30 days per year with the backup fuel if gas is not available. It will be therefore an infrequent event and it is unlikely that this would coincide with the worst-case meteorological conditions. It should also be noted that at the time of the assessment, the actual sulphur content of the backup fuel was not known. The emissions of SO2 were therefore calculated from the limit value (0.015% by volume at 15%O2, dry), which is likely to be higher than the actual sulphur content. The actual concentrations experienced during a period of use of the backup fuel are therefore likely to be significantly lower than the values presented.

  Particulate Matter (PM10) may exceed WHO Interim Targets at some receptors. But this is based on worst-case assumptions for the purposes of modelling particulates within this assessment. The emission limit used for particulates is provided as total particulates, for the purposes of assessing PM10 concentrations it has been assumed that all particulates emitted from the stacks are PM10. The concentrations presented above are therefore likely to be over estimations.

  The cumulative impact of emissions is assessed as minor, and the residual significance is considered negligible due to the infrequent use of backup fuel and the implementation of mitigation measures.

  The potential impacts will be further reduced through the implementation of mitigation measures and a robust grievance mechanism.
- The development of Hajr Two IPP and the SEC CCGT will run parallel. Therefore, cumulative impacts of GHG emissions from construction activities are anticipated to be minor. The operation of Hajr Two IPP and SEC CCGT will run parallel together with the operation of nearby existing facilities. Therefore, cumulative impact of GHG emissions from is anticipated to be Moderate. The Hajr Two IPP Project is required to be designed with a Carbon Capture system to reduce the GHG emissions. With the implementation and proper operation of this system, the cumulative impacts significance will be reduced to minor when operated.
- The construction of the Project will coincide with the operation of the planned SEC CCGT. Therefore, cumulative impact on noise from construction activities is anticipated to be Moderate. Noise modelling was conducted as part of the operational noise impacts assessment to predict the potential noise egress from the Hajr Two CCGT and the proposed SEC CCGT Project and the potential effect on the receptors. The results indicate that all the receptors comply with the IFC/KSA day and night-time limits except for the Qurrayah IPP and Qurrayah Power Plant 2 which slightly exceed the national standards at night. As the Qurrayah IPP and Qurrayah Power Plant 2 are operational at night and generate noise levels that are most likely above 65 dBA within the plant and are affected by other nearby industrial sites, noise levels from the Hajr 2 IPP and the SEC CCGT sites are unlikely to be perceptible for the site workers at the Qurrayah IPP and Qurrayah Power Plant 2 industrial sites during night-time operations. Therefore, the cumulative impact is considered to be minor.
- Considering the proximity of both Projects, the potential exists for cumulative impacts to develop due to increased risk of contamination of downstream areas due to runoff as well as impacts to water resources and services due to water consumption for construction activities and workers

accommodation. Therefore, cumulative impact on hydrology and water resources from construction activities is anticipated to be Minor. However, the impact will be reduced with the adoption of mitigation measures.

- The construction of the intakes and outfalls of the Hajr Two and The SEC CCGT Projects will result in adverse cumulative impacts on the Project area. However, considering the nature of the area and the absence of sensitive habitats apart from certain locations of seagrass (categorised least concern on the IUCN red list), cumulative impact from construction activities is anticipated to be Minor.

  The design and route for the intakes and outfalls of both the Hajr Two CCGT and the SEC CCGT Plant has been optimised to ensure discharge from the proposed outfall complies with national standards, which require excess salinity (ΔS) to remain below 3% of background salinity and excess temperature (ΔT) to remain within +5°C at the edge of the defined mixing zone. Therefore, significant impacts are not anticipated. Cumulative impacts from enstrainment and non routine discharges may also adversly impact the marine ecology if not mitigated.

- Sufficient waste management infrastructure is lacking in the Region. The construction of multiple developments and projects will result in a strain on existing waste management facilities in the area due to volumes of waste. The cumulative impacts are expected to be moderate.

  The Projects' EPC contractors will identify waste and wastewater management companies including recycling companies in Ash Sharqiyah or nearest towns in order to promote the recycling of waste especially packaging materials, wood, metal waste & hazardous materials. Coordination will also be required with the local government authorities (e.g., municipalities) with regards to licensed and appropriate waste management facilities fit to accommodate project waste types and quantities.

  The Projects' O&M Companies will identify waste and wastewater management companies including recycling companies the nearest towns in order to promote the recycling of waste and management of sludge. Coordination will also be required with the local government authorities (e.g., municipalities) with regards to licensed and appropriate waste management facilities fit to accommodate project waste types and quantities.

- Both Projects are expected to utilize the same roads to reach the Project area. considering construction activities will run parallel, the increase in traffic is expected to result in cumulative impacts of moderate significance.

  The implementation of traffic management plans and mitigation actions will reduce the impact significance. The residual significance of cumulative impacts is Minor.

- All flora species observed during the site visit were recorded and identified. All species recorded are common for the region, and none are listed on the KSA high priority list. Four specie are Least Concern on the IUCN list while the remaining species are not evaluated.

  Given that the project construction will coincide with the construction of SEC CCGT cumulative impacts to terrestrial ecology are anticipated to be Minor.

  However, the impact will be reduced with the adoption of mitigation measures.

- The development of the Hajr Two CCGT Project within the heavy industrial area of Qurrayah will contribute to the permanently alteration of the landscape character of the Project area which is predominantly already consists of industrial plants in the area.

- Impacts in relation to archaeology and cultural heritage would mainly be those related to the excavation, earthworks and clearance of the Project asset site and the potential for encountering unknown buried archaeological, however, this is unexpected. A Chance Find Procedure will ensure that any unexpected finds are not damaged and reported to the authorities.

- Positive impacts in terms of cumulative increase in local employment and dissemination of skills. This can be enhanced further by prioritising local recruitment where possible. A grievance mechanism shall be developed and implemented to manage the impacts of worker influx in the development region and impacts to community and nearby facilities safety. Positive cumulative impacts are expected during operation, as the project will contribute to regional service provision, help alleviate power shortages, and support meeting energy demand.

- Project related impacts would mainly be those associated with construction: influx of workers, public trespassing, security concerns, strain to public social services as well as incidents (accidents) from the presence of vehicles, heavy plant and machinery. The Project is located within the Qurrayah Complex which is a gated area that requires a special site access pass to allow visitors in. therefore, trespassing or direct interactions with the communities are not anticipated.

Impacts related to operations will be mainly due to emergency situations (unplanned events) such as fire, explosion and release toxic materials as well as incidents (accidents) from equipment operation and the Project vehicles and public trespassing.

The Project is expected to be fenced and with security guards to ensure that there is no unauthorised access into the site nor the Qurrayah Complex.

Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan' and via appropriate training of staff.

- Impacts associated with poor working conditions, gender-based violence and harassment, health and safety hazards etc. are Project-specific and therefore cumulative impacts are not expected.

  Cumulative impacts may occur if the workers for Hajr Two and SEC CCGT are accommodated in the same facilities; however, this is not confirmed.

  The cumulative impacts can be managed by ensuring the labour camp is in compliance with the IFC/EBRD Worker Accommodation Guidelines.

The cumulative impacts can be managed by the implementation of an environmental and social management system (ESMS), and the required mitigation measures identified as part of the ESIA.

FRAMEWORK FOR ENVIRONMENTAL &SOCIAL MANAGEMENT & MONITORING

The Framework Environmental and Social Management Plan (ESMP) provides a framework for the effective implementation of the mitigation and monitoring measures outlined in Chapters 6.2 and 7.2 of this Report. This framework ensures alignment with applicable elements of the established ACWA Power corporate level E&S Policy and ESMS Implementation Manual.

The framework ESMP will provide a framework for the development of both CESMP and OESMP by the EPC Contractor and O&M Company respectively. The intention is that the Framework ESMP will be used by both the EPC Contractor and O&M Company for the development of specific environmental and social management plans, based on the specific findings and recommendations of the ESIA. The following sections outline the Framework ESMP as required by NCEC for the environmental permitting of the Project.

The production and implementation of a Framework ESMP provides the mechanism by which to implement the findings of the ESIA. This Framework ESMP sets out specific objectives and targets defining a 'framework' for the way in which the ESIA and its recommended mitigation and monitoring measures should be addressed in the next stages of the Project development.

This Framework ESMP is intended to be adopted by the EPC Contractor who will develop and author their own detailed CESMP with supporting activity and topic specific management plans and method statements to cover the construction of the Project. A future OESMP will be developed by the O&M Company which will closely align with the FESMP in terms of structure but will provide operations specific detail.

This Framework ESMP will also contribute to the development and implementation of the ESMS. The Project ESMS will align with applicable elements of the established ACWA Power corporate level E&S Policy and ESMS Implementation Manual.

CONCLUSION

The development of the Hajr Two IPP is in line with the KSA Vision 2030 which aims to diversify the national energy mix used in electricity production, increase the share of natural gas (and renewable energy sources) to approximately 50% while reducing the use of liquid fuel. In addition, the power industry is a strategic industry in the KSA which has ensured its continued economic development and industrial diversification. The Project also aligns with KSA climate change strategy which includes transition from liquid-based fossil fuels to natural gas power generation. The Project will help increase the stability of electricity supply and further ensure the efficient use of scarce natural resources.

The main impact of the Project will be the GHG emissions that significantly exceed the IFC threshold for GHG quantification (25,000tCO_2/year). The Project will be decarbonisation-ready with measures implemented to allow for the addition of carbon capture and sequestration technology at a later date without major modifications to the Plant. If this is implemented and operated, the impact from GHG emissions will be reduced to acceptable levels.

Additionally, the air quality and noise modelling indicated that the Project will not result in significant impacts. The Project will result in other E&S impacts that will require proper mitigation and monitoring. The implementation of the ESIA mitigation measures and a robust ESMS by the EPC Contractor and the O&M Company that aligns with ACWA Power Corporate E&S Policy and ESMS Implementation Manual and the continuous monitoring, reporting and supervision will ensure that adverse impacts of the Project are minimised to acceptable levels.

84 environmental and social impacts associated with the development and operation of the Project. During the construction phase of those assets, 56 impacts have been identified, of which four (4) are positive and 52 are negative. During construction one (1) impact was assessed to be of major significance, ten (10) as moderate significance while the rest are minor or negligible. There are a total of 29 operational phase impacts, of which two (2) are positive and 27 are adverse. During operation, one (1) impact is major significance and eight (8) are of moderate significance impacts while the rest are minor or negligble. The major impacts are related to labour major injury or fatality where key risks are not suitably managed, while this is unlikely to happen, the significance of this occuring would be major.

Through the application of the appropriate mitigation and management measures, the significant impacts that were identified (i.e. major or moderate) have been reduced/improved to an acceptable level of significance or magnitude. The only remaining moderate impact would be the impact of GHG emissions. These emissions are inevitable and the reduction of the significance of this impact will be through the proper implementation and operation of the decarbonisation system. While the Project will be decarbonisation-ready with measures implemented to allow for the addition of carbon capture and sequestration technology, the operation date of this system has not been confirmed yet and therefore GHG emissios will remain significant until its operation.

1 Introduction

1.1 General Information about the Study

Acwa Power plans to develop the proposed Hajr Two Combined Cycle Gas Turbine (CCGT) Independent Power Project (IPP), hereafter referred to as the “project”. The proposed development is an independent natural gas-fired combined cycle power plant with 3,010 MW capacity. The development of the project is in line with the KSA Vision 2030 which aims to diversify the national energy mix used in electricity production, increase the share of natural gas (and renewable energy sources) to approximately 50% while reducing the use of liquid fuel.

The Project is located in Qurayyah, in the Eastern Province of the Kingdom of Saudi Arabia (KSA), on the Arabian Gulf. The project site is located approximately 100 km to the South of the city of Damman.

The Project will be developed by a joint venture between ACWA Power and the Saudi Electric Company (SEC), who have created a special purpose vehicle ”Project Company” called Hajr Two Electricity Company. The plant will operate on natural gas as the main fuel and back-up diesel fuel for emergency situations.

The Project seeks finance from international lenders who are understood to be signatories of the Equator Principles (EP) or lenders that have investment policies aligned with the International Finance Corporation (IFC) Performance Standards (PS). As a result, the Project’s construction and operations must align with the requirements of the EP’s and IFC PSs.

Al-Hartany Environmental Consulting Office has been engaged by ACWA Power to undertake the independent assessment of potential environmental and social impacts, as well as certain other environmental & social related scope.

The term ESIA will be used throughout the Report and is considered to be inclusive of the EIA requirements of NCEC as well as the ESIA requirements of the lenders. As such, references to the impact assessment of environmental and social parameters are termed as ESIA, unless there is specific reference to the EIA requirements of NCEC.

The following figures show the location of the Hajr Two CCGT IPP.

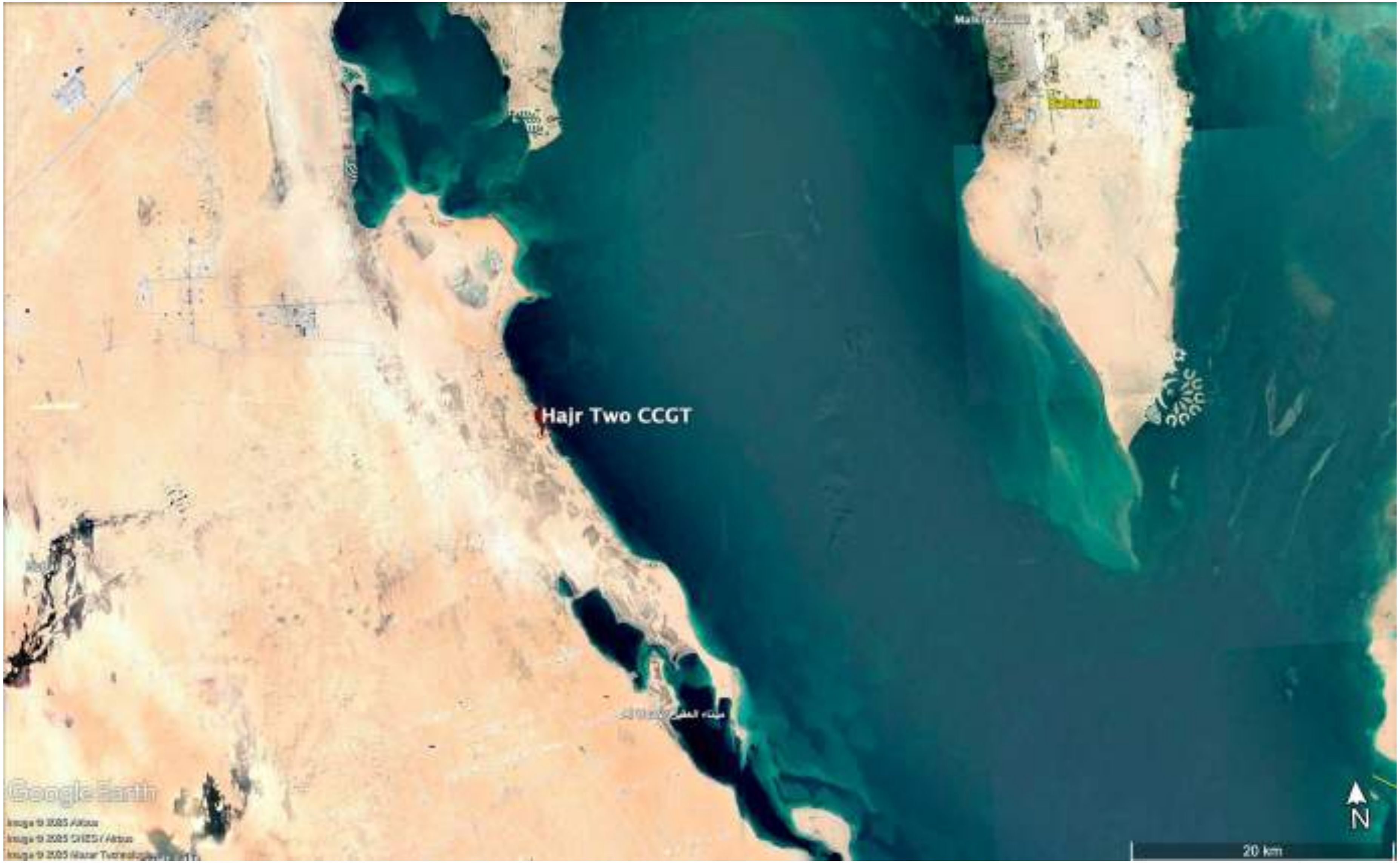


Figure 1-1 Location of Hajr Two CCGT IPP Project

Figure 1-2 Hajr Two CCGT IPP Project Components

1.2 Justifications for Preparing the Study, its Objectives, and Scope of Work

1.2.1 Requirement for ESIA Report

An Environmental Impact Assessment (EIA) is required by the NCEC for all activities that have environmental impacts and are classified as second and third category projects as promulgated by the Executive Regulations for 'Environmental Permits for the Construction and Operation of Activities' of the Environment Law issued by the Royal Decree No. (M/165) as of 19/11/1441 AH.

An ESIA is required to also meet the environmental and social requirements of the anticipated Project lenders as set out in Equator Principles (EP), International Finance Corporation (IFC) Performance Standards (PSs) (2012) and the applicable World Bank Group (WBG) Environmental Health and Safety (EHS) Guidelines (2007).

It should be noted that for the purpose of this document the term 'ESIA' is inclusive of the EIA requirements of the NCEC as well as the ESIA requirements of the potential project lenders.

This Report has been informed by the ESIA Scoping Report prepared in accordance with Ministry of Environment, Water & Agriculture (MEWA) Executive Regulations, the environmental and social requirements of the anticipated Project lenders.

The Environmental Classification Form (EC Form) for the Project was initially submitted to NCEC under EPAC-2025000635 and the Project was classified Category 2. Accordingly, this ESIA Report for the Project was prepared. Following a subsequent review by the reglulator, the Project was recategorised as Category 3. As a result, a revised application was submitted under the new reference EPC3-2025-000558.

1.2.2 Objectives of the ESIA

The ESIA aims to ensure that the key environmental and social impacts associated with the Project are identified and accordingly the necessary mitigation and management measures are incorporated as far as possible into the design, construction and operation of the Project. In addition, the objectives of this report are as follows:

- Provide an overview of the Project.
- Review of the regulatory and legislative framework, including KSA laws, applicable international regulations and standards and international lender requirements;
- Assess the existing environmental baseline conditions prior to the development of the Project through a review of available existing data and the undertaking of environmental baseline surveys;
- Assess the Project's environmental and social impacts for the construction and operational phases including residual and cumulative impacts;
- Determine applicable mitigation and management measures to be implemented in order to avoid or minimise potential adverse impacts and enhance beneficial impacts;
- Consider alternatives that can be used for the Project leading to greater social and environmental gains; and
- Prepare a framework for which the construction and operational phase management systems and plans can be developed and implemented.

1.2.3 Scope of the ESIA

The scope of the ESIA relates to the design, construction, and operation of the CCGT which includes the following elements:

- Five (5) Gas turbine (GT) generators
- Five (5) Heat recovery steam generators (HRSG)
- Two (2) Steam turbine (ST) generators and auxiliaries
- Condenser
- Cooling Tower
- Set of associated Balance of Plant (BOP) systems
- Marine Intake and Outfall Structures
- Future Carbon Capture infrastructure (space allocation only)

1.3 Structure of the ESIA Report

To comply with the requirements of organisational and legal framework (Section 2.1 of the ESIA) and considering the Project is "Category 3", the structure of this ESIA Report is in line with Appendix 4 of *The Implementing Regulations for Environmental Permits for the Construction and Operation Activities of the Environmental Law issues by Royal Decree No.(M/165) as of 19/11/1441 AH.* Therefore, this ESIA report is structured as follows:

- **Executive Summary:** provides a non-technical summary of the Report, including the main outcomes and conclusions;
- **Chapter 1- Introduction:** provides a brief overview and description of the Project and describes the ESIA and approvals process for the Project as well as outlining the ESIA and environmental permitting team;
- **Chapter 2 – Institutional and Organisational Framework:** describes the national, regional, and international legislative framework and requirements for the ESIA;
- **Chapter 3 – Project Information**: provides a description of the scope of the Project, including detail on the Project site, asset technologies, planned construction and operation activities and delivery programme;
- **Chapter 4 – Analysis of Alternatives**: provides a description of the Project alternatives that were considered during the Project's development;
- **Chapter 5 – Baseline Environment:** provides a description of the existing baseline conditions for the environmental and social aspects included in the scope of the ESIA. This chapters also outlines the scope, methodologies, and results of all baseline survey efforts;
- **Chapter 6 – Impact Identification, Analysis and Assessment:** provides a description of the ESIA methodology adopted to assesses the environmental and social impacts of the Project. The chapter presents the technical assessments of the environmental and social topics that have been identified as being relevant and applicable to the Project. The significance of these impacts prior to the implementation mitigation and management measures are presented.
- **Chapter 7 – Environmental and Social Mitigation and Management:** describes the environmental and social mitigation and management opportunities for the impacts identified in Chapter 6 to determine the residual significance of the impacts. The recommended monitoring and

management plans are also set out as well as the framework Construction Environmental and Social Management Plan (CESMP).

- **Chapter 8 – Key Findings and Conclusions:** summarises the key findings and conclusions of the ESIA Report.
- **Chapter 9:** includes the relevant technical appendices.

1.4 Information on the Permit Applicant

The Project will be developed by a joint venture between the Saudi Listed Joint Stock Company, ACWA Power and the Saudi Electric Company (SEC), who have created a special purpose vehicle "Project Company" called Hajr Two Electricity Company.

1.4.1 ACWA Power

ACWA Power is a developer, investor, co-owner, and operator of a portfolio of power generation and desalinated water plants, with 75 assets currently in operation, construction, or advanced development across twelve (12) countries, including KSA. Formed in 2004, ACWA Power is registered and headquartered in KSA and employs approximately 4,000 staff.

1.4.2 Saudi Electricity Company (SEC)

Saudi Electricity Company (SEC) is the primary electricity source in Saudi Arabia, generating and distributing power across the nation. It caters to individuals, businesses, and government sectors, playing a vital role in Saudi Arabia's growth. SEC generates over 54 GW of sustainable energy, making it a leading energy producer in the Middle East and North Africa. Committed to environmental preservation and the Kingdom's Vision 2030, SEC focuses on efficient fuel consumption to reduce carbon emissions. Their vision is to be a leading and competitive benchmark for local content and localization of industry in the Kingdom of Saudi Arabia and abroad, while their mission involves promoting the local economy and workforce development and establishing a flexible supply chain in the Kingdom of Saudi Arabia that contributes to the local economy and promotes workforce development by expanding core partnerships and investment programs.

1.5 Information on the Service Provider who Prepared the Study

Al-Hartany Environmental Consultancy has been appointed to prepare the ESIA study for the Hajr Two IPP.

The multi-disciplinary ESIA project team responsible for the production and delivery of this ESIA and the environmental permit applications for the Hajr Two CCGT IPP are summarised in the following table.

Table 1-1 ESIA Project Team

Company	Role
Al-Hartany Environmental Consultancy	Al-Hartany is leading the environmental and social consultancy with regards to this Project. Al-Hartany's work includes the preparation of ESIA documentation to support the environmental permit application to NCEC.
Entran	Entran is a specialist air, noise and transport company in the UK with >15 years' experience of modelling emissions and odour. Entran was appointed to undertake the air dispersion and noise modelling to inform the Project.
Bander Said Allehiany (BSA)	BSA is an accredited laboratory in KSA. BSA was appointed to analyse the soil samples taken from the Project site to determine soil quality/contamination and carry out the baseline ambient air quality and noise for the Project.
Leaf Global Environmental Services (LGES)	LGES is an is an interdisciplinary science, engineering, and Technology Company that was established in 2018. LGES was appointed to carry out the marine survey for the Project.
HR Wallingford	HR Wallingford is a specialist marine modelling company in the UK with >50 years' experience. HR Wallingford was appointed to undertake the brine, temperature and silt and sediment dispersion modelling to inform the Project.

1.5.1 Key Project Information

Table 1-2 Key Project Information

Project Title	Hajr Two Independent Power Plant
Location	Ash Sharqiyah, Kingdom of Saudi Arabia (KSA)
Project Developer	ACWA Power
Project Company	Hajr Two Electricity Company
EPC Contractor	Tecnicas Reunidas & Orascom Construction
O&M Company	Joint Venture between First National Operation and Maintenance Co. Ltd (NOMAC) and Saudi Electricity Company (SEC)
NCEC Registered Environmental Consultant	Al-Hartany Environmental Consultancy is a Class A NCEC environmental consultant with Registration No. ELESL-2024- 000283 (**Appendix D**). Address: 7041Jeddah Ruwais District Fayd Alsama Street

2 Institutional and Organisational Framework

The following chapters present the regulatory requirements for conducting an ESIA in accordance with national and lender regulations and standards.

2.1 Institutional Framework

The Project will be required to comply with all applicable environmental and social laws, regulations, policies, standards, and guidelines that form KSA's regulatory framework. In doing so, the process of environmental and social impact identification and evaluation will need to demonstrate that the Project can comply with such criteria during both the construction and operational phases. The Project will adopt and comply with the following regulations and standards:

- National regulations and standards.
- International and Regional Treaties ratified by the KSA, and
- International guidelines and standards adopted by anticipated Project lenders. including EP IV (2020), IFC Performance Standards (2012) and WBG/IFC EHS Guidelines (2007).

The stakeholders involved in the implementation of the institutional framework for the Project include MEWA and the new National Environmental Centres that fall under MEWA's remit which include NCEC. The following: ACWA Power and SEC, Project Company, the Engineering, Procurement and Construction (EPC) Contractor(s) and Operation and Maintenance (O&M) Company are also responsible for ensuring adherence to and implementation of the institutional framework.

2.1.1 Ministry of Environment, Water and Agriculture

MEWA is a government ministry in KSA responsible for overseeing environmental protection, water resources management, and agricultural development in the country. MEWA is responsible for developing and implementing policies and regulations to protect the environment, conserve biodiversity, and mitigate the impact of human activities on ecosystems. The ministry works towards preventing pollution, managing waste, and promoting sustainable practices in various sectors, including industry, agriculture, and transportation.

2.1.2 National Centre for Environmental Compliance

The NCEC has been the environmental regulator in KSA since 1st January 2021. NCEC is responsible for the issuing and renewal of environmental licenses for Category 1, 2 and 3 projects in accordance with the KSA Environmental Law and applicable MEWA Executive Regulations. NCEC review the environmental studies to determine the potential environmental impacts of proposed projects and provide recommendations or conditions for approval to ensure that environmental concerns are addressed. NCEC also monitors various industries, activities, and projects to ensure they comply with environmental regulations and standards.

2.1.3 National Environmental Centres

In addition to the NCEC which has superseded GAMEP as the Environmental Regulator in KSA, the following National Centres have also been established and have their own policies and standards which need to be followed where applicable.

- **National Centre for Meteorology (NCM).** This monitors weather and climate conditions, prepares forecasts, provides airports, ports and other bodies with data and weather forecasts, and operates regional weather monitoring stations;
- **National Centre for Wildlife (NCW);** This will supervise programmes related to the protection and development of wildlife and biological diversity, as well as planning and managing protected areas and managing centres for the breeding and resettlement of endangered animals;
- **The National Centre for the Development of Vegetation Cover and Combating Desertification (NCVC).** This will develop and manage national parks, develop and rehabilitate vegetation cover in forests, protect local endangered plant species, combat desertification and conducting studies and supporting research related to vegetation; and
- **National Centre for Waste Management (MWAN):** organizes the waste management sector to improve the quality of services, enhances the level of capabilities and competencies, enhances the economic sustainability of the sector by stimulating investment and maximizing the participation of the private sector, and reduces waste disposal in landfills by stimulating the use of best practices in resource recovery.

2.1.4 Lenders & Financial Institutions

The Project is seeking project finance from international lenders understood to require compliance with the EPs, IFC PSs and the applicable WBG EHS Guidelines.

These Financial Institutions require projects to conduct an environmental and social assessment to address the relevant environmental and social risks and impacts of the proposed Project. Therefore, an Environmental and Social Impact Assessment (ESIA) study has been prepared for these institutions.

2.2 Organisational Framework

2.2.1 National Laws, Regulations, Standards and Requirements

2.2.1.1 Basic Law of Governance 1992

The Basic Law of Governance (Royal Decree No. A/90 dated 27/08/1412H) is commonly referred to as the Constitution of Saudi Arabia. Article 32 of the Basic Law states: '*The State shall preserve, protect and improve the environment and prevent its pollution*'.

2.2.1.2 National Environmental Law 2020

The previous national KSA legislation, the General Environmental Regulations (GER) (2001) has been superseded by the National Environmental Law (July 2020) and Executive Implementing Regulations (January 2021).

2.2.1.3 MEWA Executive Regulations

The new Environmental Law issued under Royal Decree M/165 of 19th Dhul Qada 1441 Hejra in July 2020 will be supported by new Executive Regulations which became law in June 2022. The law consolidates and supersedes much of the existing national legislation including the GER and conservation legislation into one law. These include:

- The Executive Regulations for Environmental Permits for the Construction and Operation of Activities;

- The Executive Regulations for Environmental Inspection and Auditing;
- The Executive Regulations for Air Quality;
- The Executive Regulations for Noise;
- The Executive Regulations for Preventing and Treating Soil Contamination;
- The Executive Regulations for Protecting the Aquatic Media from Pollution;
- The Executive Regulations for Sustainable Management of the Marine and Coastal Environment;
- The Executive Regulations for Ozone Depleting Substances (ODS) and Hydrofluorocarbons (HFCs);
- The Executive Regulations for Environmental Rehabilitation of Degraded Sites and Treatment of Contaminated Sites;
- The Executive Regulations for Controls and Procedures Pertaining to Financial Dues for Environmental Licenses, Permits, and Services;
- The Executive Regulations for Hunting Terrestrial Wildlife Species;
- The Executive Regulations for Logging;
- The Executive Regulations for Development of Vegetation Cover Development and Combating Desertification;
- The Executive Regulations for Apprehension of Violations and Imposing Penalties.
- The Executive Regulations for Preparing and Implementing Preparedness and Response Plans for Emergencies and Environmental Disasters.

2.2.1.4 Waste management system

The waste management system issued pursuant to Royal Decree No. (M/3) dated 1/5/1443 AH/August 2021 and Council of Ministers Resolution No. (11) dated 1/2/1443 AH. The system aims to regulate waste collection, transportation, sorting, storage, import, export, treatment and safe disposal activities, including aftercare of waste disposal sites. Everyone who practices in an activity related to waste management must provide the best environmental and economic results, according to the following priorities: recycling, resource recovery, and safe disposal.

The waste management system is supported by the executive regulations for waste management issued by Ministerial Resolution No. 332291/1, dated 10/18/1443 AH, which aims to clarify the executive frameworks of the system, such as provisions for licenses and permits, waste generator responsibility, and other waste management standards that must be applied.

2.2.1.5 Environmental Standards

The applicable environmental standards for the Project as per the national regulations and lender guidelines are outlined in **Appendix C**. These standards require project compliance. Where there is contradiction in limits between national standards and lender guidelines, the most stringent will apply.

In accordance with lender requirements, where specific national standards do not exist, a good practice standard should be applied.

2.2.1.6 National ESIA Requirements and Approval

Projects within KSA with potential to cause environmental impacts are subject to an ESIA as part of the planning and permitting process in accordance with the National Environmental Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH and as described in the Executive Regulations on Environmental Permits for the Construction and Operation of Activities of the Ministry of Environment, Water & Agriculture (MEWA).

Whilst all major development projects are required to pass through the ESIA process, the level of reporting and detail required is subject to classifying the project into three (3) individual classes based upon their predicted impacts. The table below provides further detail on these classes as described in the relevant Environmental Regulations.

The Executive Regulation on Environmental Permits for the Construction and Operation of Activities refer to NCEC as the Competent Authority, who is responsible for ensuring the environmental protection of KSA and implementing legislation as required. The Competent Authority is able to delegate responsibility of issuing approvals to other government authorities.

Table 2-1 ESIA Classes as per the Executive Regulation on Environmental Permits for the Construction and Operation of Activities

Class	Details
C1	Projects with Limited Environmental Impacts Covers projects that are not expected to have tangible adverse environmental and social impacts. Require submission of an Environmental Management Plan and Environmental Rehabilitation Plan to NCEC.
C2	Projects with Significant Environmental Impacts Covers projects that are likely to have some adverse environmental and social impacts which can be substantially mitigated and will not significantly impact areas beyond the site boundary. Require submission of an ESIA to NCEC as per Article 7 of this executive regulation.
C3	Projects with Serious Environmental Impacts Covers projects that are likely to have significant adverse environmental and social impacts, which cannot be fully mitigated, and likely affect areas beyond the site boundary. Require submission of an ESIA to NCEC as per Article 8 of this executive regulation.

Based on the table above, and the nature of the Project, which is Thermal Power Plant, the Project is considered a Class 3 "*Projects with Serious Environmental Impacts*" which will require the submission of a scoping and an ESIA to NCEC.

2.2.1.7 NCEC Permitting and Approvals Process

Under the National Environmental Law 2020 and as described in the Implementing Regulations on Environmental Permits for the Construction and Operation of Activities, the environmental permitting and approval process for Class 3 Projects includes the following key stages:

- **Stage 1**: Applicant to identify relevant category of the development and to complete the related Environmental Classification Form;
- **Stage 2**: Submission of Environmental Classification Form to NCEC by Applicant;
- **Stage 3**: NCEC review of Environmental Classification Form (ECF) and confirmation of activity classification to Applicant within 10 working days;

- **Stage 4**: Class 2 activity, applicant prepares ESIA Report in line with the suggested structure and content outlined in Appendix 2 and submits the ESIA Report to NCEC;
- **Stage 5**: NCEC review and approval of ESIA Report and issuance Environmental Permit for the construction of the Project within a maximum of 30 working days. Re-submission may be required if information provided is deemed insufficient by NCEC. The Environmental Permit to commence construction works is valid for three (3) years, construction activities must commence within this time to avoid the requirement for a new permit;
- **Stage 6**: Applicant commences construction, ensuring all commitments, i.e., environmental reporting, are met and reported as required to NCEC throughout works; and
- **Stage 7**: EPC Contractor appointed by the applicant completes construction and applies for an Environmental Permit for operation activities. Prior to the issuance of the Environmental Permit for operation, NCEC will review the conditions of the construction Environmental Permit to ensure all requirements have been met and may undertake a site inspection. If all information is satisfactory, NCEC will issue the Environmental Permit for operation. The duration of the operational permit will depend on the activity but will be no less than three (3) years and no more than six (6) years.

The timeframe to complete all stages detailed above will differ between developments, indicative timeframes for NCEC approval is provided in the Implementing Regulations.

Throughout all stages of the environmental permitting and approval process, liaison and consultation with MEWA, NCEC and other relevant National Centres should be undertaken by the NCEC registered environmental consultancy.

For this Project, the EISA liaison and submission of report will be undertaken by 'Al-Hartany Environmental Consultancy.

2.2.2 Regional Laws, Regulations, Standards and Requirements

KSA is signatory to several regional agreements related to the environmental and social aspects. Table 2-2 below lists those relevant to the Project.

Table 2-2 Regional Conventions and Protocols

Conventions, Agreements and Protocols	Date Signed	Summary	Applicability to the Project
Agreement for the Establishment for Arab Centre for the Studies of Dry and Barren Land	03/09/1968	The Centre was established to conduct regional studies on barren areas in Arab countries, including e.g. studies of soils, studies on the degree of soil erosion and studies on the geological and geomorphological aspects of the different areas.	The Project will implement the necessary mitigation to avoid soil erosion and contamination
The Convention of Conservation of Wildlife and its Natural Habitat in the Gulf Cooperation Council (GCC) Countries	30/12/2001	Legal agreement binding all GCC states to coordinate their activities towards the conservation of wildlife and natural habitats.	The Project will implement the necessary mitigation and monitoring to avoid where possible and reduce impact to terrestrial ecology.

2.2.3 International Laws, Regulations, Standards and Requirements

The Project will be seeking financing from one of more financial institutions who:

- Have their own internal E&S investment guidelines that align with or are similar to the IFC Performance Standards

- Are Export Credit Agencies and require compliance with the OECD Common Approaches; or
- Are members of the collective environmental and social agreements such as the Equator Principles.

It is noted that ACWA Power implements the E&S requirements of IFC on all its projects as such the Hajr Two IPP must comply with the IFC Performance Standards and IFC EHS Guidelines as part of ACWA Power Internal E&S requirements.

The Equator Principles necessitate Project compliance with the IFC Performance Standards and EHS Guidelines. The key E&S requirements for financial institutions are summarised below.

2.2.3.1 Equator Principles

The Equator Principles (EPs) are voluntary set of guidelines for assessing and managing environmental and social risks in project financing and have become the project finance industry standards for addressing environmental and social issues in global project financing. The latest iteration of the EPs, EPIV, was released in October 2020.

In accordance with the EPs, for projects located in Non-Designated Countries (which includes KSA), the assessment process evaluates compliance with the applicable IFC Performance Standards and the EHS Guidelines.

The Equator Principles consist of the following 10 Principles, which must be applied by the lenders providing finance:

- Principle 1 - Review and Categorisation
- Principle 2 - Environmental and Social Assessment
- Principle 3 - Applicable Environmental and Social Standards
- Principle 4 - Environmental and Social Management System and Equator Principles Action Plan
- Principle 5 - Stakeholder Engagement
- Principle 6 - Grievance Mechanism
- Principle 7 - Independent Review
- Principle 8 - Covenants
- Principle 9 - Independent Monitoring and Reporting
- Principle 10 - Reporting and Transparency

2.2.3.2 IFC Performance Standards

The IFC Performance Standards (PSs) are a key component of the IFC's Sustainability Framework and directed towards clients (i.e., the party responsible for implementing and operating the project that is being financed), providing guidance on how to identify risks and impacts. The IFC Performance Standards are designed to help avoid, mitigate and manage risks and impacts throughout the life of a project. The IFC Performance Standards aim to initiate sustainable business which includes stakeholder engagement and disclosure obligations of the client at a project-level.

The 2006 version of the IFC Performance Standard was reviewed and made applicable to all new projects from 1st January 2012. The updated IFC Performance Standard reflect IFC's stronger commitment to climate change, business and human rights, corporate governance and gender equality as well as strengthening the due diligence process for IFIs. Such updates include comparable labour terms for migrant and non-migrant workers, clarification of levels of stakeholder engagement, monitoring of supply chains and an enhanced focus on energy efficiency.

The following lists the IFC Performance Standards (2012):

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Performance Standard 2: Labour and Working Conditions
- Performance Standard 3: Resource Efficiency and Pollution Prevention
- Performance Standard 4: Community Health, Safety, and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

Of the IFC Performance Standards listed above, all are applicable to the Project, with the exception of IFC Performance Standards 5 and 7.

2.2.3.3 WBG/IFC EHS Guidelines

The EHS Guidelines have been set out by the IFC and the World Bank Group to provide general guidelines for its members when involved in a project or when providing financial support to a project. The EHS Guidelines serve as technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The following EHS Guidelines relevant to this Project include:

- General EHS Guidelines, Environmental:
  - Air Emissions and Ambient Air Quality;
  - Energy Conservation;
  - Wastewater and Ambient Water Quality;
  - Water Conservation;
  - Hazardous Materials Management;
  - Waste Management;
  - Noise; and,
  - Contaminated Land.
- General EHS Guidelines, Occupational Health & Safety:
  - General Facility Design and Operation;
  - Communication and Training;
  - Physical Hazards;
  - Chemical Hazards;
  - Biological Hazards;
  - Radiological Hazards;
  - Personal Protective Equipment (PPE);
  - Special Hazard Environment; and,
  - Monitoring.
- Community Health & Safety:
  - Water Quality and Availability;

- o Structural Safety of Project Infrastructure;
- o Life and Fire Safety;
- o Traffic Safety;
- o Transport of Hazardous Materials;
- o Disease prevention; and
- o Emergency Preparedness and Response.

- Construction and Decommissioning;
  - o Environment;
  - o Occupational Health and Safety; and
  - o Community Health and Safety.
- Industry Sector Guidelines:
  - o EHS Guidelines for Thermal Power Plants;
  - o EHS Guidelines for Electric Power Transmission and Distribution;
  - o Environmental, Health, and Safety Guidelines for Gas Distribution Systems.

2.2.4 International and Regional Conventions / Protocols

KSA is signatory to several international and regional agreements related to the environment and social. The table below lists those relevant to the Project.

Table 2-3 International and Regional Conventions and Protocols

Conventions, Agreements and Protocols	Date Signed / Ratified	Summary
Convention Concerning the Protection of the World Cultural and Natural Heritage	23/11/1972	Established to protect and enhance cultural and natural heritage, whilst there has been a focus on United Nations Educational Scientific and Cultural Organisation (UNESCO) designated sites the convention requires member states to protect all relevant resources and specifically states. that because a resource is not listed it should not be implied that the resource has no value.
Convention on International Trade in Endangered Species of Wild Fauna and Flora and Subsequent Amendments	03/03/1973	Established to identify species at risk and control trade in endangered species
Convention of the Conservation of Migratory Species of Wild Animals and all Amendments (Bonn Convention)	23/06/1979	An international agreement that aims to conserve migratory species throughout their ranges. This covers a wide range of species, including birds, marine mammals, sea turtles and bats. Requires member states to preserve and protect species and habitats which occur regularly in their area.
International Plant Protection Convention (1979 Revised Text)	28/11/1979	A convention established to protect the genetic resources of native plant species for agricultural and biological conservation purposes.
Protocol Concerning Regional Cooperation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency	14/02/1982	Contracting Parties undertake to cooperate in combatting pollution by oil and other harmful substances and maintain and promote contingency plans.
United National Convention on the Law of the Sea (UNCLOS)	10/12/1982	An international agreement that establishes a legal framework for all marine and maritime activities for all signatories.
Vienna Convention for the Protection of the Ozone Layer	22/03/1985	A multilateral environmental agreement that provided frameworks for international reductions in the production of chlorofluorocarbons due to their contribution to the destruction of the ozone layer, resulting in an increased threat of skin cancer.
Rotterdam Convention on the Prior Informed Consent Procedure for	10/09/1998	The Rotterdam Convention is an international treaty designed to facilitate informed decision-making by countries with regard to trade in hazardous chemicals.

Conventions, Agreements and Protocols	Date Signed / Ratified	Summary
Certain Hazardous Chemicals and Pesticides in International Trade		
Montreal Protocol on Substances that Deplete the Ozone Layer and All Amendments	16/09/1987	Established to reduce emissions of chemicals harmful to the upper ozone layer.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	22/03/1989	The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. Includes restrictions on exporting of wastes but also includes requirements on member states to minimise production of hazardous waste and manage appropriately regardless of disposal location.
Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC)	12/03/2016	UNFCCC is the main convention addressing the impacts and causes of climate change and aimed at returning global temperatures to a level which will not cause irreversible significant harm to ecosystem functioning.
United Nations Convention on Biological Diversity	05/06/1992	An international legally binding treaty with three (3) main objectives: conservation of biodiversity, sustainable use of biodiversity, fair and equitable sharing of the benefits arising from the use of genetic resource. The overall goal is to encourage actions which protect wildlife and ecosystems and lead to a sustainable future.
Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa	17/06/1994	Aims to conduct research and prevent/reverse desertification of natural habitats.
Convention for the Protection of the World Cultural and Natural Heritage	23/11/1972	Established to protect and enhance cultural and natural heritage, whilst there has been a focus on UNESCO designated sites the convention requires member states to protect all relevant resources and specifically states that because a resource is not listed it should not be implied that the resource has no value.
Kyoto Protocol to the (united Nations) UN Framework Convention on Climate Change	11/12/1997	Annex I parties of the framework agreed to commitments with a view to reducing their overall emission of six (6) greenhouse gases by at least 5% below 1990 levels between 2008 and 2012. Established emissions trading and a clean development mechanism.
Cartagena Protocol on Biosafety to the Convention on Biological Diversity	29/01/2000	Relates to the transfer and use of living modified organisms and may apply to any hybrid species which are imported for planting if genetically modified.
Stockholm Convention on Persistent Organic Pollutants (POPs)	25/06/2012	A global treaty to protect human health and the environment from persistent organic pollutants (POPs). Requires member states to eliminate use of Persistent Organic Pollutants, mainly focused on herbicides but now extended to other substances.
Convention on the Rights of Persons with Disabilities (CRPD) and its Optional Protocols	13/12/2006	International human rights treaty intended to protect the rights and dignity of persons with disabilities.

2.2.4.1 ILO Conventions

KSA is signatory to six of ten fundamental conventions under the International Labour Organization (ILO), namely:

- Forced Labour Convention (C029 of 1930 ratified in June 1978);
- Equal Remuneration Convention (C100 of 1951 ratified in June 1978);
- Abolition of Forced Labour Convention (C105 of 1957 ratified in June 1978);

- Discrimination (Employment and Occupation) Convention (C111 of 1960 ratified in June 1978);
- Minimum Age Convention (C138 of 1973 ratified in April 2014); and
- Worst Forms of Child Labour Convention (C182 of 1999 ratified in October 2001).

The four fundamental ILO conventions that Saudi Arabia is not signatory to include[4]:

- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize of 1948.
- ILO Convention 98 on the Right to Organize and Collective Bargaining of 1949.
- ILO Convention 155 on Occupational Safety and Health of 1981.
- ILO Convention 187 on Promotional Framework for Occupational Safety and Health of 2006.

KSA is signatory of one of four priority Governance Conventions, the Labour Inspection Convention C081 of 1947 ratified in June 1978 and 11 of 178 technical conventions.

[4] Retrieved from: https://www.ilo.org/dyn/normlex/en/f?p=1000:11210:0::NO:11210:P11210_COUNTRY_ID:103208

3 Activity Description

3.1 Activity Objectives and Need

The development of the Hajr Two CCGT IPP is in line with the KSA Vision 2030 which aims to diversify the national energy mix used in electricity production, increase the share of natural gas (and renewable energy sources) to approximately 50% while reducing the use of liquid fuel. In addition, the power industry is a strategic industry in the KSA which has ensured its continued economic development and industrial diversification. The Project also aligns with KSA climate change strategy which includes transition from liquid-based fossil fuels to natural gas power generation.

Additionally, the Project will be decarbonisation-ready with measures implemented to allow for the addition of carbon capture technology at a later date without major modifications to the Plant.

The Hajr CCGT development site is located within the Qurayyah complex which consists of an existing Steam Plant to the North, a new Combined Cycle Plant South of the site and adjacent to the boundary of Qurrayah IPP which was initially developed to meet Saudi Arabia’s growing power generation needs. Power demand is projected to significantly increase in the region, and this project will play a crucial role in alleviating the deficit that will directly contribute to mitigating the region’s power shortfall.

As such, the Project is of national importance in its contribution to the continued economic growth in KSA.

3.2 Project Location

The Project is approximately 100 km to the south of the City of Dammam. As shown on the following figure, the site is within the Qurrayah industrial complex, located between existing Steam Plant and Combined cycle power plant in the north and a new combined cycle plant in the south within a fenced-off site and situated along an existing main road running parallel to the coastline.

Figure 3-1 Location of the Hajr Two CCGT Components

3.3 Activities During the Project Phases

3.3.1 General Description of the Plant

The Hajr CCGT Plant will comprise of a natural gas fired combined cycle power plant with a total net capacity of 3,010 MW. The power generation requirements for the Project are shown in the table below.

Table 3-1 Power Generation Requirements

Milestone	Target Date	Power Export MW
ICOD 1 (Simple Cycle)	31 July 2026	670 MW
ICOD 2 (Simple Cycle)	31 May 2027	1,840 MW
PCOD	31 May 2028	3,010 MW

The primary fuel will be natural gas which will be delivered to the project site by ARAMCO interface point at plant boundary. Back-up fuel shall only be used when the gas supply is disturbed or completely interrupted to which the plant will utilize liquid fuel which will be transported to site via trucks, within the necessary storage tanks and unloading bays to be installed at the Site by the Project Company. See the following figure.

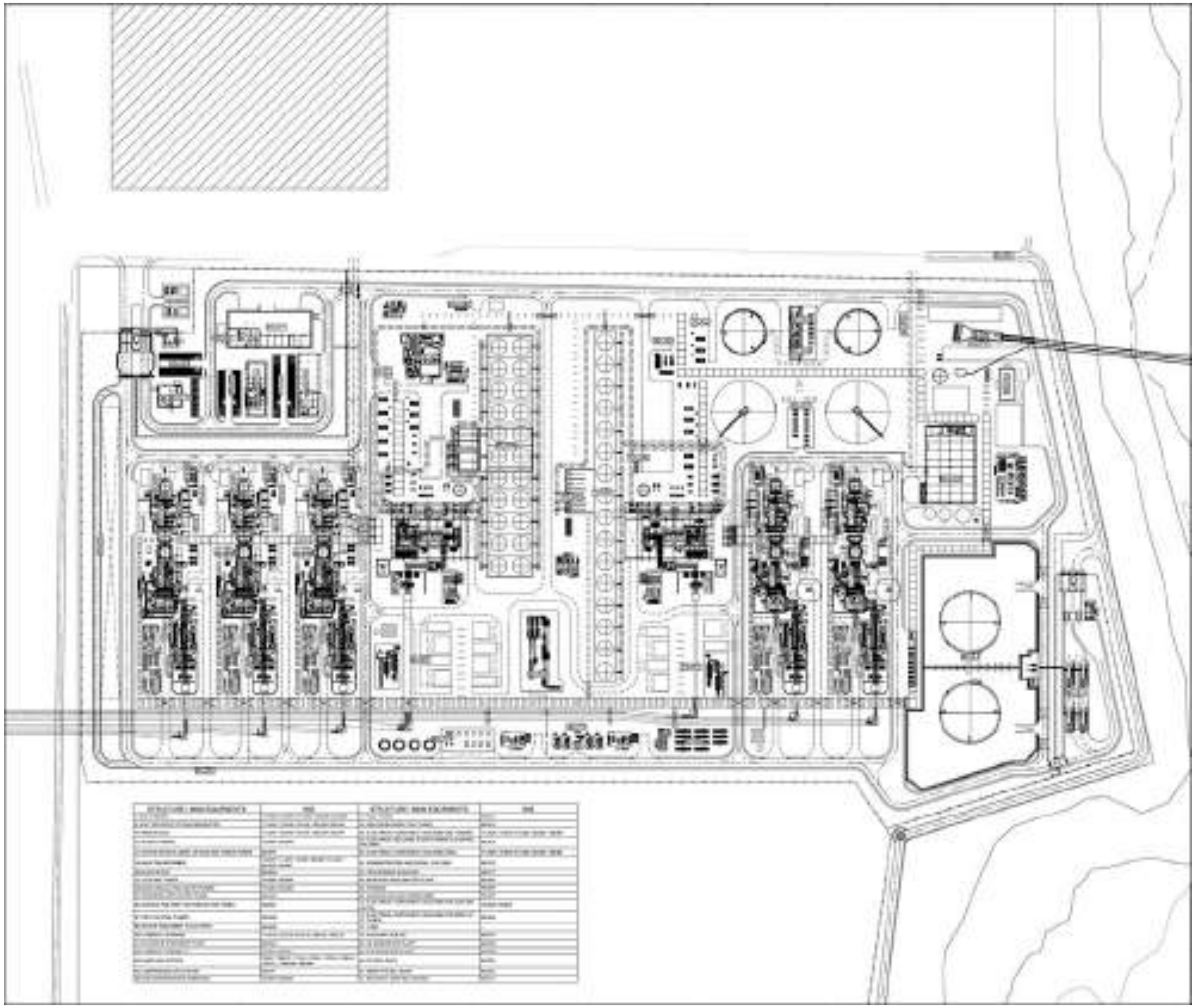


Figure 3-2 CCGT Plant Layout

3.3.2 Gas Turbine Systems

3.3.2.1 Gas Turbine

The 7HA gas turbine has a single shaft, bolted rotor with the generator connected to the gas turbine through a solid coupling at the compressor or “cold” end. This configuration improves alignment control and provides an axial exhaust-optimal for combined cycle or waste heat recovery applications. The major features of the 7HA gas turbine are described below.

3.3.2.2 Compressor

The axial flow compressor has 14 stages with one stage of modulating inlet guide vanes and three stages of variable stator vanes. Interstage air extraction is used for cooling and sealing air for turbine nozzles, wheel spaces, and bearings, and for surge control during start up.

3.3.2.3 Turbine

In the four-stage turbine section, energy from hot pressurized gas produced by the compressor and combustion section is converted to mechanical energy. The turbine section is comprised of the bladed turbine rotor, turbine shell, exhaust frame, exhaust diffuser, nozzles and diaphragms, stationary shrouds and aft (number 2) bearing assembly.

3.3.2.4 Bearings

The gas turbine contains two journal bearings to support the turbine rotor, and one dual direction thrust bearing to maintain the rotor-to-stator axial position. The bearings are located in two (2) housings detailed as follows:

- One at the inlet and
- One at the center of the exhaust frame.

All bearings are pressure lubricated by oil supplied from the main lubrication oil system. The number 1 bearing (journal and thrust) is accessed by removing the top half of the compressor inlet casing. The number 2 bearing is readily accessible through the tunnel along the centerline of the exhaust diffuser. (Removal of the turbine casing is not required for bearing maintenance.) Bearing protection includes vibration sensors and drain oil temperature thermocouples.

3.3.2.5 Combustion System

The combustion system uses a reverse flow, multi-chamber (can annular) design in which combustion chambers are arranged around the periphery of the compressor discharge casing. Combustion chambers are connected to adjacent chambers by crossfire tubes.

Each chamber contains fuel nozzles and a combustion hot module. Specific chambers may also contain spark plugs. The hot module combines the combustion liner and transition piece and connects to the turbine nozzles. Each fuel nozzle and hot module may be individually replaced if needed for maintenance.

The Dry Low NOx (DLN) 2.6+AFS combustor is an axially staged, multi-mode combustor capable of operation with either gas or liquid fuel.

The inner surface of the hot module and face of the cap form the first burning zone of the DLN combustor. Combustion air is introduced through annular passages (premix chambers) surrounding each of five (5) circumferentially arranged fuel nozzles.

3.3.2.6 Gas Fuel Operation

The fuel nozzles of the Dry Low NOx system have multiple gas injection locations. These locations are used alone and in combination to optimize performance over the wide range of fuel/air ratios required to operate the gas turbine from ignition to full load.

Premix gas is initially injected in the head end of the combustor during start-up and low load. Then part of the gas is diverted to the second stage of fuel nozzles which provides NOx and turndown benefit.

3.3.2.7 Liquid Fuel Operation

As liquid fuel injection occurs at the tip of the fuel nozzle only, operation on liquid fuel is always in diffusion mode. To provide NOx abatement, liquid fuel is fed into the combustor as an emulsion with water.

3.3.3 Heat Recovery Steam Generator (HRGS)

The HRSG is a natural circulation boiler design. Boiler circulation is maintained by the natural Buoyant forces of the steam. Buoyant force is greatest in tubes where the heat flux is highest; water flow is strongest in areas where it is most needed. A circulation pump and the corresponding controls are not required so electric power is conserved and maintenance costs are lowered.

A specified HRSG start-up rate in terms of °C/ min in the steam drum will be calculated to meet the intended service life of the unit. The start-up is controlled by the rate of pressurization in the HP drum by start-up venting system or HP by-pass system or by limiting the GT startup rate until the steam turbine is on line. Provisions have been supplied to reduce the near field noise levels to guarantee values at 1m from the HRSG and 1.5 m above grade. The HP outlet steam temperature is controlled by an interstage desuperheater. The RH Outlet temperature is controlled by a steam side interstage desuperheater.

An outlet desuperheater could be included to control the outlet steam temperature during the start up; the outlet desuperheater will only operate when the outlet temperature of the interstage desuperheater is approaching the saturation temperature.

It is recommended that the inlet feedwater temperature be above the sulfuric acid dewpoint of the exhaust gas to prevent corrosion of the heating surface due to the presence of sulfur in the exhaust gas. The sulfuric acid dewpoint of combustion turbine fuels can be estimated based upon the H_2O/SO_3 concentration in the exhaust gas.

3.3.4 Steam Turbine Generator

The steam turbine generator will be a condensing steam turbine with a reheat, tandem-compound four (4) casings unit. It will consist of single flow high pressure (HP) section, double flow intermediate pressure (IP) section, two (2) double flow exhaust low pressure (LP) section.

3.3.4.1 High Pressure Turbine Casing

The HP casing will have a horizontally split design with two shells. The main steam will enter into the HP inner casing via two inlet connections. The HP steam flows in the direction towards the HP front pedestal. The inlet connections will be sealed in the inlet section of the HP nozzle adaptor with special sealing rings.

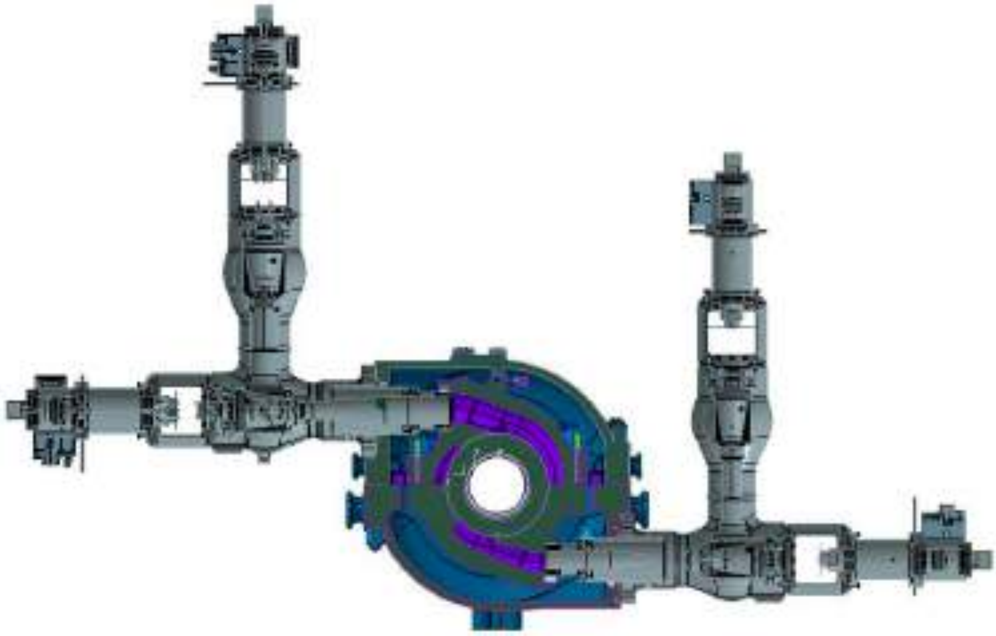


Figure 3-3 Typical HP Inlet Section View (for reference only)

The turbine casings will be divided by a horizontal plane into the upper and lower halves. The outer casing will be mounted over lugs in the horizontal plane on the bearing pedestals. Mounting in the horizontal plane ensures that any expansion due to thermal effects has a neutral effect and rotor and stator alignment in the hot and cold conditions remain the same. The inner casing will be mounted in the horizontal plane of the outer casing on the lugs.

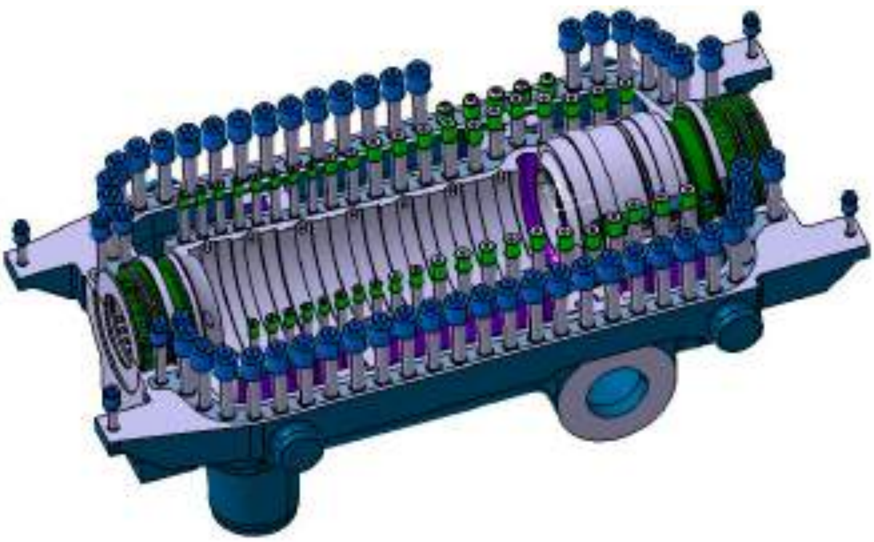


Figure 3-4 Typical Horizontal Stud Bolt Arrangement (for reference only)

3.3.4.2 Intermediate Pressure (IP) Casing

The IP casing will have a horizontally split design with two shells in the inlet part. The reheat steam enters into the IP inner casing vial four inlet connections. The steam entering into the IP inner casing will be conducted into the IP nozzle adaptor, which is casted in the inner casing. The inlet connections will be sealed in the inlet section of the IP nozzle adaptor with special rings.

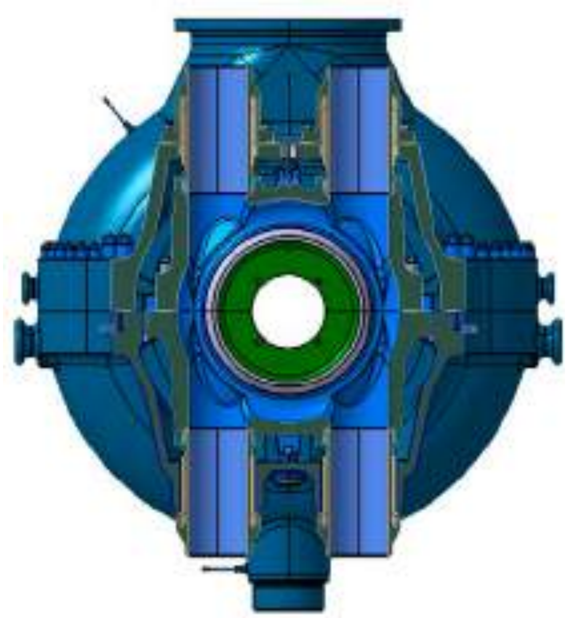


Figure 3-5 Typical IP Inlet Section View (for reference only)

3.3.4.3 Low Pressure Turbine Casing

The low-pressure turbine will have an inner and outer casing. The outer casing prevents air from entering the turbine exhaust and condenser and directs the steam from the turbine exhaust to the condenser and so is under a partial vacuum on operation. The turbine is applied side exhaust steam, and the inner casing is installed inside the outer casing and mounted on a separate bridge.

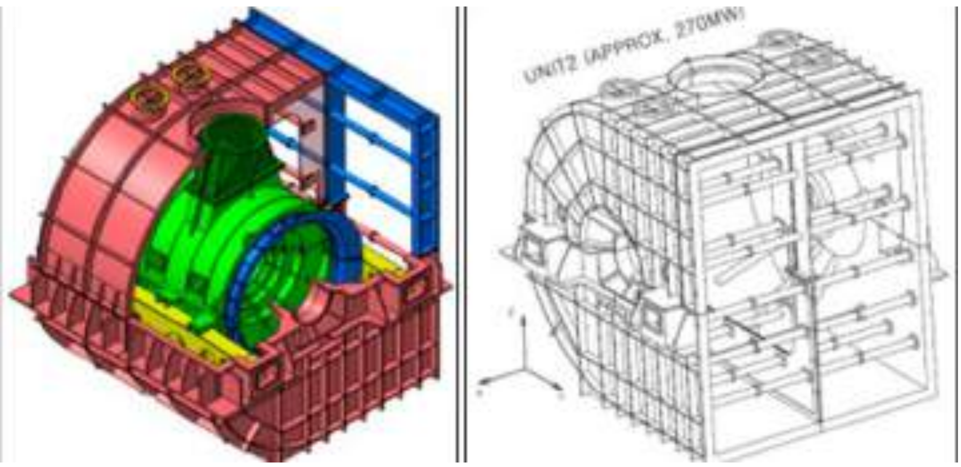


Figure 3-6 Typical LP Casing Assembly for reference only)

3.3.5 Fuel System

Dual Fuel System

The dual fuel system allows the gas turbine to operate on either gas or distillate fuel. Transfers from one fuel to the other may be initiated by the operator prior to start up or at any time after completion of the starting sequence. Transfers between distillate and gas may be required to be made within a load range which results in completing the fuel transfer without staging from one gas fuel combustion mode to another.

Since gas is typically the primary fuel and distillate the backup fuel, transfers from gas to distillate are automatically initiated on low gas supply pressure, provided that liquid fuel is available. Transfer back to the primary fuel is by operator initiation only in order to ensure the integrity of the fuel supply and to prevent oscillatory operation if the gas supply pressure is marginal at the transfer initiation pressure. The transfer sequence is divided into three parts: a line pre-filling period, a pilot fuel stage, and a main fuel stage. During the first period, the incoming fuel command increases to a level that will allow prefilling of the system in about thirty seconds. After the pilot pre-filling period, the incoming liquid fuel is ramped up as gas fuel is decreased. After the pilot fuel stage, the main liquid fuel stage is started and ramped up, while decreasing gas fuel to maintain constant load. The total energy to the gas turbine is held reasonably constant.

The gas and liquid fuel systems components are described in the sections that follow.

Gas Fuel System

The gas fuel system modulates the gas fuel flow to the turbine. Proper operation of the gas fuel system requires that the gas be supplied to the gas fuel control system at the proper pressure and temperature.

The pressure is required to maintain proper flow control. The fuel gas temperature must ensure that the required hydrocarbon superheat is maintained. For discussion of fuel gas supply requirements refer to the fuel gas specifications in the Reference Documents section of this proposal.

Liquid Fuel System

The liquid fuel system delivers the fuel oil from the fuel pumping system through filtration module and a control module (shared with water injection system) to the gas turbine combustion chambers. The pilot fuel circuit provides a lower amount of fuel for ignition, acceleration to full speed, and part load.

3.3.6 Power Substation

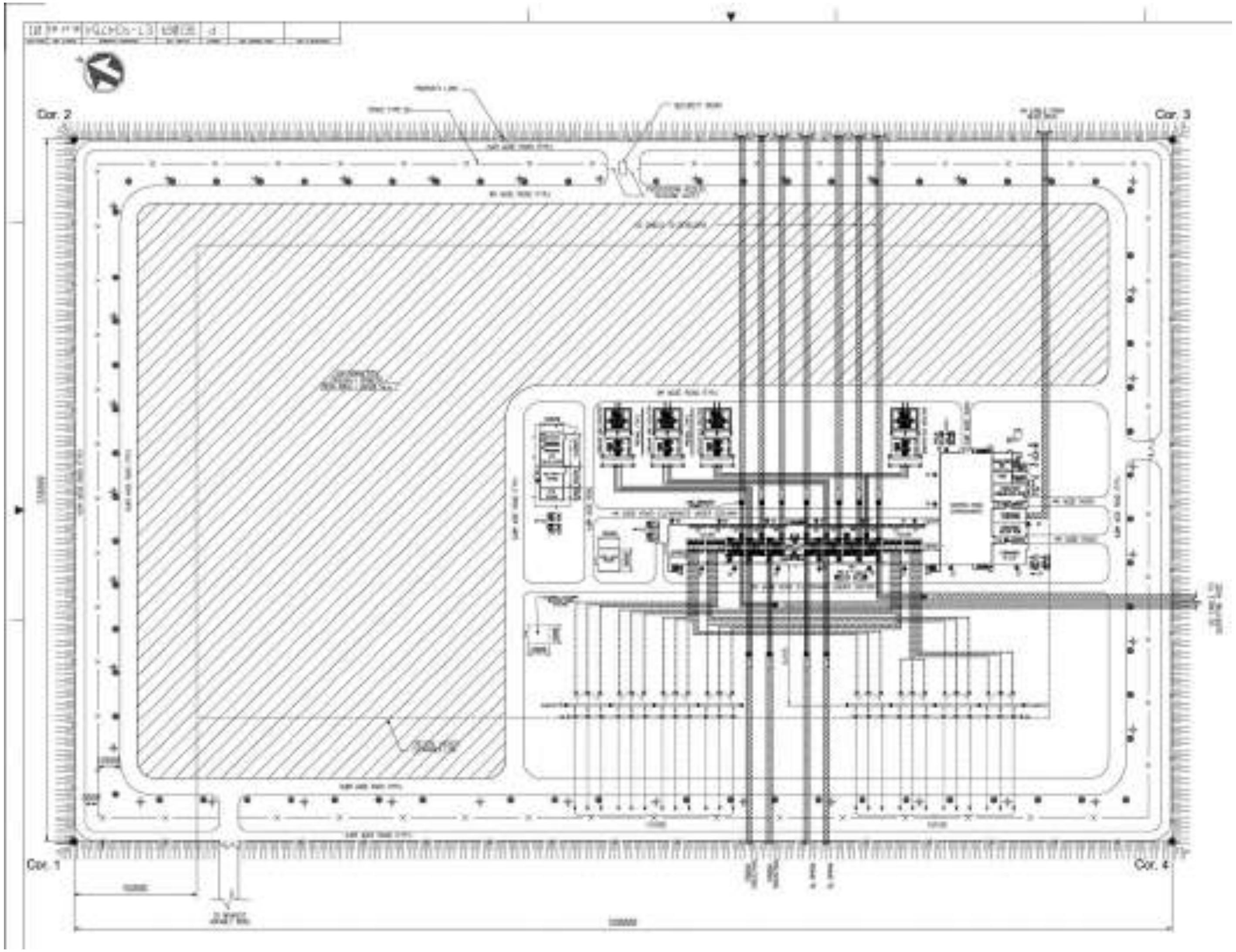
As part of the Project development, a new Electrical Special Facility (ESF), a 380 kV Bulk Supply Point substation, will be constructed to support the integration of power generation into the grid. The substation will include the following components:

- 380 kV Gas Insulated Switchgear (GIS)
- 380 kV Hybrid Gas Insulated Switchgear (HGIS)
- 380 kV Bus Reactor
- 380 kV Line Reactor
- 13.8 kV Switchgear

The substation will be fully equipped with an AC & DC system, protection and metering equipment, control and communication systems, and a Supervisory Control and Data Acquisition (SCADA) system. It will be integrated into the Substation Automation System (SAS) and remotely operated from the Energy Control Center (ECC) via a dedicated communication gateway.

A ±700 m underground 380 kV high voltage power line will be developed to connect the substation to the CCGT Power plant. the location of this underground line is indicated on **Error! Reference source not found.**.

All work and services will be performed in full compliance with the applicable specifications, ensuring the reliable and efficient operation of the substation. The substation layout is shown on the following figure.



U/G WST UNDERGROUND WATER STORAGE TANK
WTPC WATER TRANSFER PUMP CHAMBER
CDP CONDENSATE DRAIN PIT
ST SEPTIC TANK
SEP SEEPAGE PIT
SMH SEWER MANHOLE
MSC MUNICIPALITY SEWER CONNECTION
MWSC MUNICIPALITY WATER SUPPLY CONNECTION
LIGHTING POLE
CCTV CAMERA
EXHAUST FAN
SUPPLY FAN

HAJER-2 380kV IPP		
CORNER	EASTING	NORTHING
Cor. 1	411693.2800	2858085.6561
Cor. 2	411977.3768	2858232.9281
Cor. 3	412204.3387	2857787.4078
Cor. 4	411920.2420	2857640.1359

Figure 3-7 Hajr Two ESF Layout

3.3.7 Water Treatment Plants (WTP) & Systems

The water system in this plant aims to reduce effluent emissions and to recover as much as possible the water in the Power Plant. There will be several treatment plants with the objective to treat and recycle effluents.

The reused water will be as follows:

- HRSG blowdown water as well as other drains from steam-water cycle such as steam condensate, will be collected and treated in the boiler blowdown treatment plant. After the treatment, water will be reused in the desalinated water tank.
- Non-seawater effluents such as evaporative cooler blowdown and Water Treatment Plant clean drains, will be collected and treated in a dedicated wastewater treatment plant. Following the pre-treatment,, the treated water will be sent to the raw water tank, which will be used for the production of demineralised and service water.
- Treated sanitary wastewater will be reused for irrigation purpose within the plant.

For the development of this project, the Water Treatment Plant has the objective to produce demineralised and service water. The composition is outlined as follows; Pre-treatment system based on Ultrafiltration - Ultrafiltered water tank.

- Reverse Osmosis with two passes.
- First pass reject water is sent to the outfall.
- Second pass reject is recycled in Ultrafiltered Water Tank.
- Desalinated Water tank
- Remineralization system for service water production,
- Demineralization system (EDI or Mixed Beds)
- Chemical dosing systems
- Seawater filtration backwash collection basin with sludge extraction.

The capacity of the different treatments are:

- Demineralised water production. Design capacity 3x70 m^3/h
- Service water production. Design capacity 3x70 m^3/h
- Potable water production. Design capacity 2x1.5 m^3/h
- Desalinated water production. Design capacity 3x135 m^3/h
- Pretreated (Ultra filtered) water production. Design capacity 3x397 m^3/h

3.3.7.1 Potabilization System

The potable water will be taken from second pass permeate and will consist of:

- One buffer tank,
- Feeding pumps,
- Remineralization system vessels,
- Chemical injection.

3.3.8 Intake and Outfall

The intake system consists of two intake pipelines (620) running parallel in a trench, ending in reinforced concrete intake towers. The expected intake flow rate is 11,050 m^3/h. The intake towers include removable screens, a manhole for maintenance, and underwater concrete fill for stability. Screens have 110x110mm spacing to limit clogging, and additive supply pipes reduce biofouling.

The outfall system consists of a single outfall pipeline (1,100m), discharging through a 40m diffuser section. the diffuser will have 6 risers, each with two outlet ports, discharging at a 60° angle to enhance mixing and dispersion.

The expected flowrate at the outfall is maximum 7,343 m^3/h, coming 565 m^3/h from WTP brine/Filtration backwash and 6,778 m^3/h from cooling tower blowdown.

3.3.9 Intake Cleaning System

The pipes cleaning system combines the following operational and maintenance requirements:

- Chlorination system at the intake heads. Double wall chlorination pipes for the intake pipelines will be installed outside the intake pipes. To monitor leaks, the following will be implemented:
  - Visual inspection by divers during the shock dosifications
  - Sudden changes in the chlorine pressure flow
  - Frequent measurements in the water received in the pumping station to detect chlorine after injections.
- Cleaning through pigging(Optional) The pig is pre-assembled inside a "removable" pig launcher and lowered with a crane to position. Connection to the Intake pipe will be peformed by divers. A temporary spool pipe will be installed to provide flow and pressure on the back side of the pig.

3.3.10 Water Discharge Systems

The discharge will be mainly concentrated seawater. It is envisioned that the preliminary depth at which water will be discharged is 8m.

Should the salinity in seawater intake be 60,000 mg/l TDS, the average increase of salinity will be 1.52 times therefore the salinity at the outfall will be 91,000 mg/l.

Provided just the WTP is operating (the cooling tower blowdown closed), then the maximum expected salinity will be 1.65 times the salinity of the intake, that means 99,000 mg/l TDS. This is expected during commissioning phase of the project.

<u>Chemical Materials</u>

It is anticipated that the discharge will contain traces of chemical traces. There will be traces of an antiscalant, that is expected to be injected in the circulating water system in order to avoid scaling. The product is to be decided and the expected dose < 15 ppm.

Biocide could be injected for disinfection, if required. A shock dosing once per month with no effluent discharged may be administered. The chlorine concentration will be < 0.2 mg/l. Sodium bisulphite will be added to the cooling tower blowdown in order to remove chlorine when injected as a shock dosing.

Chemicals during the construction phase and commission phase is outlined as below:

- Surfactant,
- Antifoam,
- Caustic soda,
- Corrosion inhibitor,
- Citric acid,
- Ammonium bifluoride,

- Liquid ammonia,
- Sodium nitrite.

Storage of Chemicals

Chemicals will be stored according to the information provided by supplier in the respective SDS, typically in a suitable location protected from direct sunlight. Chemicals for commissioning will be brought to site when required, respecting the product lifetime according to the information provided by supplier in the respective SDS.

It is intended that a dedicated chemical storage area will be prepared during the construction and commissioning phases. This storage area will implement the requirements set forth for the storing of chemicals and incompatible chemicals by the different official entities and SDS.

3.3.11 Environmental Monitoring System

The plant will include a Continuous Emission Monitoring System (CEMS) for each HRSG which will comply with local regulatory requirements in KSA and those of the lenders. The continuous, quantitative analysis of flue gas for the purpose of emissions monitoring will be performed by appropriate analysers of proven type, acknowledged by the local authorities.

Monitoring will be undertaken for:

- Total particulates (only for back-up liquid fuel);
- Nitrogen oxides (NO_x);
- Carbon Dioxide (CO_2);
- Sulfur Dioxide (SO_2);
- Carbon Monoxide (CO);
- O_2;
- Flue gas velocity;
- Flue gas pressure; and
- Flue gas temperature.

All CEMS equipment will be suitable for operation in dusty and humid environments at high ambient and flue gas temperatures. In addition, the emission data will be calculated, converted, printed, and stored according to government requirements.

3.3.12 Future Carbon Capture Facility

The Hajr Two IPP plant will have a plot allocated to develop a Carbon (CO_2) Capture plant and integrate it into the operation in the near future to reduce the CO_2 footprint emissions from the Project. The Project will be decarbonisation-ready with measures implemented to allow for the addition of carbon capture technology at a later date without major modifications to the Plant. Refer to Figure 3-1 for the Future Carbon Capture Facility proposed plot.

3.3.13 Access to Site

The site will be accessed from an existing acees road from Qurrayah road as shown on the following figure.

Figure 3-8 Existing Access Road from the Qurrayah Road

3.3.14 Ancillary/Support Facilities

The following elements will also be part of the Project:

- Administration and social buildings (office, meeting rooms, prayer rooms, kitchen, dining room, social room, sanitary facilities etc.).
- Workshop & store.
- Gate house.
- Black start cum emergency diesel generator.
- Fire-fighting system.
- Parking facilities.
- Heating, ventilation & air conditioning (HVAC) system.
- Laboratory.
- Other mobile plant and vehicles.

3.3.15 Project Associated Facilities

In accordance with IFC PS1 there is a requirement to assess the impacts of the Project's associated facilities. 'Associated facilities… are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.'

Details of the Project's associated facilities have been outlined below:

- Saudi Aramco will develop a Fuel Connection Facility (FCF) in the vicinity of the project site. The gas pipeline connection from the Fuel Connection Facility (FCF) to the project will be developed by Saudi Aramco and SPPC to supply the natural gas to the project.
- National Grid Saudi Arabia (NGSA) will develop a 380 kV Gas Insulated Switchgear (IGIS) in the vicinity of the project site. The construction of the same will be carried out by Project company and

handed over to NGSA once commissioned. The project will connect to an overhead transmission line (OHTL) that will be developed by the NGSA, a subsidiary of the Saudi Electricity Company (SEC) to evacuate power to the national grid.

Figure 3-9 Indicative Location of the Future FCF and the Gas Pipeline with Respect to the Project

3.3.16 Construction Requirements

3.3.16.1 Civil Works

The Project will include considerable civil works. The main civil works required for the construction phase will consist of the following:

- Site development,
- Flood protection and embankments, as required,
- Road design and construction,
- Plant buildings,
- Support structures for equipment and other facilities,
- Service water, sewage, drainage, storm water and wastewater systems, basic design of evaporation pond,
- Boundary fences, and
- Water treatment systems etc.

3.3.16.2 Concrete Placing

Building of the plant will commence after site grading and excavation have progressed to a point that large areas are at their final grade. Either a neat excavation will be made to the size of the foundation, or a concrete form will be built to contain the foundation. Reinforcement steel (rebar) will then be placed in the form of excavation. In addition, placing of any embedded items such as anchor bolts, drains etc will be undertaken and concrete placed.

For some foundations concrete will be poured directly from the mixing trucks into the forms. However, most of the concrete will be placed by pumping the concrete either with trailer mounted pumps or with boom trucks.

3.3.16.3 Mechanical Equipment

Installation of equipment and process systems will begin after the power plant units are constructed and the concrete has cured. It is expected that equipment deliveries will be ongoing throughout the project, but this will increase as various system components become ready for installation. After delivery, equipment will be placed on foundation, levelled, balanced, and finally grouted into place. The equipment will be connected to piping, ductwork, electrical power, and control systems as applicable.

Crawler cranes, forklifts, or other hoists will be required onsite to offload and install the equipment.

3.3.16.4 Instrumentation and Controls

Each piece of equipment in the power plant will be monitored and controlled from the centralized control console located in the centre control building. The equipment will be wired back to the central control panel which will allow operators to see the status of each equipment at any time. The controls will have multiple set points, different status denotations, and automated programs to optimize the plant operations. The systems will be able to test the process effectiveness and adjust operating parameters to reduce power consumption, improve effluent quality, monitor odour etc. These will be based on providing devices at the point of operation and tying them back to the central computer and control panel via hard wired or remote signal connections.

3.3.16.5 Intake and Outfall Construction

The water intake consists of a concrete structure at the water intake point and a buried HDPE pipe. The concrete structure will be prefabricated in sections, on land, and then transported to be installed in its final location.

The marine part of the HDPE pipe will be manufactured on land, then the trench will be executed in the marine section. For this purpose, a rotary excavator will be installed on a pontoon. Once the trench has been made, the pipe will be dragged over it, counterweights will be installed to prevent it from floating and the trench will be filled.

3.3.16.6 Dewatering

Dewatering activities may be required at different locations within the Project site, as part of the site preparation for civil works and foundations.

The dewatering process primarily consists of deep wells with submersible pumps and wellpoint dewatering for effective groundwater extraction, supplemented by sump pits with centrifugal pumps to manage surface water. The extracted water is conveyed via a network of flexible hoses to a sedimentation pond or tank, where suspended solids are allowed to settle before the water is discharged into the marine environment through a shoreline pipe. Water quality will be analyzed prior to discharge to ensure compliance with applicable water quality standards.

3.3.16.7 Temporary Construction Areas

The laydown areas will be located within the Project boundaries and will include:

- Offices.
- Storage area and Warehouse.

- Workshop and fabrication yard.
- Batching Plant

The construction phase will also include the provision of temporary site fencing including gates, first aid, site safety and security system, temporary roads and site drainage including water and sanitary drainage etc. In addition, a Camp area will be provided for the Project.

Figure 3-10 Temporary Construction Facility

3.3.16.8 Construction Workforce

The contractor anticipates that in addition to the owner policy for Saudization, most of the subcontracted foreign labour (manual workforce) shall come from the Middle East mainly Egypt, Asia and the Far East, mainly India, Pakistan, Bangladesh, Nepal, and Philippines.

At this stage it is understood that about 4,500 personnel are expected to be present on site during peak periods. The anticipated construction period for the project is 40 months, it is intended that construction workforce will be transported to and from the site.

It is noted that the Project Company is obliged to employ qualified Saudi Arabia citizens to the maximum extent possible and in accordance with Saudization law.

3.3.16.9 Temporary Construction Accommodation Facilities

The EPC Contractor will rent existing labour camps in a nearby town outside the Qurrayah Complex. Workers will be accommodated in these camps and transported by busses to site.

The EPC Contractor will be required to audit the accommodation camp to ensure it aligns with the applicable local regulations and requirements of the IFC/European Bank for Reconstruction and Development (EBRD) Worker Accommodation Processes and Standards.

3.3.16.10 Security

The Project site is located within the fenced-off Qurrayah industrial complex which is secured and controlled by SEC. It is expected that required site-based security personnel for the Project will be sub-contracted from a third party company. It is understood that by law in KSA all security personnel have to be Saudi locals and are not allowed to be armed. Security personnel are expected to be stationed at the project offices and laydown areas, and patrol the project area to prevent the public from trespassing onto the construction sites. Their presence will help maintain a secure environment and minimize the risk of construction site incidents. The Project construction sites will also be secured from public access and trespassing by proper fencing and delineation of sites, installation of warning boards, and appointment of onsite guards.

3.3.16.11 Construction Equipment

The likely types and number of the main construction plant and equipment are listed in following table.

Table 3-2 Indicative Construction Plant and Equipment

Activity	Equipment
Earth works Equipment	Hydraulic Excavators Hydraulic Hammers Wheel and truck loaders Motor grader Compactors
Concrete Works Equipment	Cement Mixer Trucks Truck mounted Concrete Pumps
Piling and drilling rigs	Drilling Rig (Equipment for bored piles
Machinery for Material transportation and Movements	Trucks Cranes Wheel mounted cranes Crawler Cranes Aerial Work Platforms (AWP)

Note: The equipment/machinery listed above are indicative.

3.3.16.12 Batching Plant

A batching plant dedicated for the Project will be installed within the project allocated areas. For forecast concrete, it has been projected that the plant will utilise an estimate of 85,000 m^3. The project is envisioned to have a dedicated area to clean and wash the mixer trucks, concrete pumps, machinery, etc. This area is delimited by an earth barrier, once the water has evaporated, the solid waste will be removed and collected offsite.

3.3.17 Commissioning Requirements

Pre-commissioning activities ensure that construction is completed, systems are integrated, and components such as turbines, generators, and cooling systems are ready. This includes hydraulic testing of the marine intake and outfall system to check for leaks and flow rates, as well as flushing the cooling system to remove debris. Individual components like gas turbines and heat recovery steam generators are started up and tested for performance.

Integrated system testing follows, where the cooling system is monitored for flow, temperature, and pressure to ensure its efficiency and environmental compliance. The entire plant undergoes performance testing to verify that all systems, including the marine intake and outfall, meet regulatory standards for discharge quality and water temperature. Continuous environmental monitoring is conducted to ensure compliance with regulations. After all systems are successfully tested, optimized, and certified, the project is formally commissioned and handed over for commercial operation.

3.3.18 Operation and Maintenance Requirements

Operations and maintenance of the plant will be by the 'First National Operation & Maintenance Company' (NOMAC), a wholly owned subsidiary of ACWA Power and SEC. This will include the provision of all services including all routine operation, maintenance, overhaul, specialist repair services to the plant etc. NOMAC and SEC will also provide Power Availability guarantee and fuel consumption guarantee for the facility.

NOMAC and SEC will be responsible for the long-term service agreement for the gas turbine and generator and they will sign the Long Services Agreement for parts supply, repair, refurbishment, and technical field advisory service. In addition, labour for Scheduled Outages will also be provided.

All facilities will be designed to ensure the stability of the electrical system in the event of a Power Unit tripping or any other transient condition affecting the grid stability.

Maintenance activities for the Plant Units shall be planned to take place during winter, when power demand in KSA is at its lowest. Planned maintenance will take place in sequence, with a maximum of one (1) Gas Turbine Unit being maintained at a time.

3.3.18.1 Operational Workforce

The requirements for the operational phase workforce are expected to be more than 100 personnel. Further details on the staff will be provided within the ESIA where available. It is noted that the O&M is obliged to employ qualified Saudi Arabia citizens to the maximum extent possible and in accordance with Saudization law.

In addition, the Project Company will be required to implement a long-term training program for the plant personnel.

3.3.18.2 Workers Accommodation

The exact accommodation arrangements for the operational phase have not been finalised at this stage.

3.3.19 Project Life and Decommissioning

The design lifetime of the Project will be 25-years and the day-to-day operation of the Plant (O&M) will be the responsibility of the O&M and the Project Company.

Although there will be certain environmental and social risks during decommissioning, due to the type of project, it is not expected that there will be major or other significant risks that necessitate management or specialised mitigation outside of common good practices (or that would be like those implemented during construction).

Based on the PPA, it is expected that the Project will have a lifetime of at least 25-years prior to decommissioning. Based on this timeline there may also be changes to future environmental and social conditions including the sensitivity of current or future receptors, or facilities that may or may not be present to handle wastes etc., or the extent of environmental and social regulation that may exist.

As such, the ESIA will not be assessed in detail (or provide mitigation recommendations) for potential E&S at the time of decommissioning. However, it is proposed that all impacts relating to the decommissioning stage will be planned to be approached and mitigated via a specific decommissioning plan and updated baseline surveys prepared closer to the time of decommissioning. This would be able to account for changes in regulation (e.g., which may be linked to circular economy), improvements in technology and requirements for re-use and recycling of components and materials. The decommissioning plan would be developed at least 12-months prior to decommissioning and would be based on the Project's ESMS.

3.4 Project Footprint

3.4.1 Area Required for the Project

The key assets and footprint of the Project assets are summarised in Table 3-3 below.

Table 3-3 Summary of the Project Assets and their Areas

Asset	Area
Temporary Construction Facility • Laydown Area 1 • Laydown Area 2 • Batching Plant Area	 • 20.2 Ha • 22.5 Ha • 3.7 Ha
Hajr Two CCGT Boundary	35.6 Ha
ESF Boundary	16.0 Ha
Proposed FCF Expansion	4.1 Ha
Future Carbon Capture Facility Proposed Plot	10.4 Ha
Proposed Evaporation Pond Options: • Option 1 • Option 2	• 7.49 Ha • 2.64 Ha

3.4.2 Project Resources

3.4.2.1 Construction Phase

The Engineering, Procurement and Construction (EPC) Contractor will be solely responsible for all construction utilities including power supply, potable water, firefighting supplies and systems and waste management and temporary medical and welfare facilities etc.

It is understood that the EPC Contractor will purchase potable water from a qualified water supply company and purify the water through a qualified drinking water purification equipment for the staff. The drinking water will be tested by a KSA accredited laboratory.

ENERGY & FUEL REQUIREMENTS

Fuel requirements

For the construction phase, the projected fuel consumption over 26 days working days per month is estimated to be approximately 52,000 L/month.

Energy requirements

It is envisioned that the project will be connected to the grid during the construction phase. Power consumption estimates are as outlined below:

- Month 1 - Month 15: 500 kVA
- Month 16 - Month 25: 1,500 kVA
- Month 26 - Project End: 2,500 kVA

WATER REQUIREMENTS

During the construction phase, water will be sourced from municipality-approved suppliers and transported to the site by trucks. The Project is expected to use an estimated 350m^3/day for washing, cleaning, sanitary purposes etc.

Additionally, approximately 25,500$m^3$of water will be required for the concrete as well as 1m^3 of water per 1m^3 concrete will be needed for washing/cleaning the mixer trucks, concrete pumps & equipment etc.

It is understood that the EPC Contractor will purchase potable water from a qualified water supply company and purify the water through a qualified drinking water purification equipment for the staff. The drinking water will be tested by a KSA accredited laboratory.

RAW MATERIALS REQUIREMENTS

the main raw materials required during the construction stage include steel structures, cement and sand of roughly estimated at 7,000 tons, 44,000 tons and 55,000 tons respectively. It is understood that the local sourcing of raw materials will be prioritised, however, materials may also be sourced internationally depending on availability.

3.4.2.2 Commissioning Phase

Energy and Fuel requirements

Approximately 355 MBD of fuel oil and fuel gas 25,240 MMSCFD with HHV of 1080 BTU/SCF will be required during the commissioning stage.

Water requirements

During the commissioning phase the Project is expected to require an estimated 800,000 m^3 of water. This will be supplied by the project RO plant.

3.4.2.3 Operation Phase

Raw Materials

During Operation, Ammonia (aqueous), Sulfuric Acid, Coagulant, and Mineral Oil will be required for the process and the quantity will be subject to the operating regime. These chemicals will be stored in designated areas with proper management to prevent spills and leaks.

Energy and Fuel requirements

Natural gas required for operating the power plant is 450 MMSCFD, with HHV of 1080 BTU/SCF gas heating value.

In the event of an emergency where the standby generators will be required, the diesel fuel consumption rates for BSDG and EDG are 7400 kg/h and 1300 kg/h, respectively.

Water requirements

During operation, the Project is expected to require an estimated 400,000 m^3/year. This will be supplied by the project RO plant.

Water reuse:

Evaporative cooler blowdown water and the water treatment plant clean drains will be treated in a dedicated wastewater treatment plant for reuse. It has a design capacity of 50 m^3/h and consists of a homogenization basin, coagulation/flocculation and clarification (using Dissolved Air Flotation or an equivalent process), a clarified water tank, sand/multimedia filtration, and a sludge treatment system. The sludge treatment process includes a thickener that receives sludge from the DAF system and WTP, followed by a dewatering system (centrifuge or equivalent) that reduces water content to below 80%. The treated water is returned to the raw water tank for reuse in demineralisation and service water production, while the collected sludge is disposed of offsite.

The Boiler Blowdown Treatment Plant is responsible for treating HRSG blowdown water and other steam-water cycle drains such as steam condensate. It has a design capacity of 60 m^3/h and includes mechanical filtration using cartridge filters and a demineralization system with cation and anion resin vessels. Once treated, the water is returned to the desalinated water tank for reuse in demineralized water production.

3.4.3 Waste, its Types and Management

3.4.3.1 Construction Phase

Dedicated areas will be allocated within the Temporary Site Installation Area for storing and handling waste materials. The following types of wastes are expected to be generated during construction of the Project:

- Concrete debris, bricks, tiles and ceramics
- Glass, plastic (primarily arising out of packaging)
- Wood and Cardboard (arising out of packaging)
- Spent containers, cans, tools
- Used oil or residual paints/varnishes etc.
- Domestic waste from construction workers

Domestic wastewater will be stored in temporary storage tanks and transferred to licensed wastewater treatment plants within the region.

Excavated material will be stored in designated temporary stockpiling areas for reuse where possible. Where it is deemed unsuitable, excavated material will be removed from site to a licensed disposal facility.

The EPC Contractor will enter contractual agreements with MWAN licensed waste service providers to transport and dispose or treat different construction waste streams.

3.4.3.2 Operation Phase

SOLID WASTE

Maintenance waste: these may potentially be generated, from used equipment parts, filters, cleaning materials, and any other consumables utilized during the maintenance and repair of the Project.

Domestic waste: these will be generated from the operation workforce.

The O&M Company will enter contractual agreements with MWAN licensed waste service providers to transport and dispose or treat different waste streams.

WASTEWATER DISCHARGE SYSTEMS

A dedicated wastewater system is intended to collect all wastewater streams produced within the plant. Wastewater can be classified into storm water, oily wastewater, chemical wastewater and sanitary wastewater.

Stormwater will pass through a treatment system before it is diverted to the raw water tank for subsequent use as process water.

The **Wastewater Treatment Plant** treats chemically contaminated effluents from different systems such as chemical wastewater before discharge. With a design capacity of 60 m^3/h, it consists of a homogenization and neutralization basin, recirculation pumps, and a chemical dosing system etc. Oily wastewater will pass through oily-water separator and then it will be directed to the wastewater treatment plant.

The treated wastewater will be discharged along with brine from RO plant and cooling tower blowdown through the outfall to the sea only after confirming compliance with applicable quality standards which is the wastewater treatment plant design basis. In case of extreme conditions like malfunctioning of wastewater treatment plant for both working and standby equipment, one of the following alternatives will be applied as per finalised design during detailed engineering.,

i. Wastewater flow during the extreme conditions where the quality of the wastewater does not meet applicable standards will be sent to intermittent storage tank for collection by tankers (authorised third party) if decided to be treated outside of the plant or sent back to the wastewater treatment plant if the extreme conditions are short term and wastewater treatment plant is back to operation and discharged with brine from RO plant and cooling tower blowdown through the outfall to the sea only after confirming compliance with applicable quality standards.

ii. The effluent will be diverted to a lined evaporation pond for safe containment.

While potential impacts on marine water quality could occur due to accidental discharge, pond overflow, or flooding as per selected methodology indicated above, these are unlikely under normal conditions due to planned monitoring and engineering controls. To mitigate risks, the wastewater treatment plant will be properly maintained and equipped with automated dosing and alarms, water quality will be monitored prior to discharge, and any exceedances will trigger system checks and corrective actions. If the evaporation pond option is selected, it will include HDPE lining, leak detection, flood protection, and perimeter security, with contingency and emergency response plans in place to manage unexpected events.

Figure 3-11 Proposed Options for the Evaporation Pond

The **Sanitary Wastewater Treatment Plant** treats sanitary effluents from the administration building using biological treatment. With a design capacity of 0.5 m³/h, the treated water is directed for irrigation purposes.

The reject of **Reverse Osmosis (RO) and the Circulating water discharge** (incl. auxiliary cooling water) will be directly discharged to the outfall.

Any water that is directed to the sea will by analysed to ensure compliance with the national discharge standards before being dicharged.

3.5 Project Timeline

Based on the details provided by ACWA Power, the Project will have the following timeline.

Table 3-4 Key Project Milestone/Timeline Dates

Milestone	Target Date
Pre-Limited Notice to Proceed (PLNTP)	06 October 2024
Notice to Proceed (NTP)	04 April 2025
2x1 Simple Cycle Commissioning	31 July 2026
3x1 Simple Cycle Commissioning	31 May 2027
PCOD	31 May 2028

4 Project Alternatives

4.1 Methodology

In accordance with good practice methodologies for ESIA, the evaluation of various project design and activity alternatives should be considered, in order to ensure that the objectives of the proposed project have accounted for social, environmental, economic and technological options. The following project alternatives were considered:

- No Project Alternative.
- Site Location; and
- Project Layout.

4.2 No Project Alternative

The no project alternative would result in future demand for electricity in KSA exceeding the available supply and result to a deficit. The lack of a secure and reliable electricity generation and supply system would have significant social and economic development implications including the realisation of the KSA vision 2030. In addition, the no project alternative would hinder KSA's efforts of the climate strategy to transition from liquid-based fossil fuels to natural gas power generation.

As such, the "no project alternative" option is not considered a viable option and it would not align with KSA's development goals. Based on that, the 'No Project' option has not been considered further.Additionally, there are major socio-economic benefits due to this Project as outlined in this ESIA.

4.3 Site Location

Locating the Project close to existing infrastructure prevents other E&S impacts relating to the development of new associated facilities.

Using the current proposed site located near similar facilities, also prevents the need to disturb any critical habitats since the Project site has already been cleared for previous use as laydown area and has limited flora and fauna species that are common in KSA.

4.4 Project Layout

The current Project layout was negotiated with and agreed by SPPC. The Project layout is adopted based on the available land and as per plant operation and maintenance requirements.

4.4.1 Intake And Outfall Layout

The originally proposed intake and outfall locations for the Project are illustrated in the following figure. Initial modelling indicated that the proposed alignment did not provide adequate dilution of the brine and thermal plumes, as well as potential recirculation and interaction between the two.

Figure 4-1 Preliminary Intake and Outfall Pipelines' Alignment

As a result, the intake and outfall alignment, along with the diffuser design, were revised and optimised to enhance plume dispersion, ensure compliance with discharge standards, and minimise the risk of recirculation. The final, selected layout is presented in the following figure.

Figure 4-2 Optimised Intake and Outfall Pipelines' Alignment

5 Baseline Environment

5.1 Project Area

5.1.1 Land Ownership

The land selected for this project is the Qurrayah industrial area under the ownership of SEC. Several other plants are already under operation. SEC is the shareholder in this Project and has allocated the land for this project.

5.1.2 Site Conditions and Land Use

The Qurrayah complex was initially developed to meet Saudi Arabia's growing power generation needs, featuring infrastructure centered around gas turbines and combined cycle power generation, taking advantage of the Kingdom's natural gas resources. As projects expanded, large areas of the complex including the project site were dedicated to temporary accommodation facilities to support EPC contractors and project staff. These accommodations included housing, amenities, and landscaped areas to create a functional environment for workers. Recently, the temporary accommodation facilities were fully decommissioned and cleared, freeing up the site for the Hajr Project.

General Site Photos

Satellite imagery of the Project area reveals its gradual transformation over time. In 2010, a small section of the site served as temporary facilities for the development of the Qurrayah Power Plant to the south, while the rest of the area remained sandy and devoid of vegetation. By 2017, the site and surrounding areas had been repurposed as an accommodation area for the EPC Contractor supporting the development of the Qurrayah IPP, located along the northern boundary. This accommodation area was landscaped with ornamental trees.

Between 2019 and 2023, the accommodation facilities were gradually decommissioned and dismantled, leaving the site with only remnants. Presently, the site includes remaining landscape trees, low-lying shrubs, grass, compacted soil areas, compacted roads, concrete foundation slabs, and scattered construction and demolition waste.

	
2010	**2017**
	
2019	2021

2023

Figure 5-1 Historical Satellite Imagery of the Project Development Area

5.1.2.1 Receptors

Receptors have been pre-identified within a 10km radius from the project development site. The receptors and assigned sensitivities are outlined below.

Table 5-1 Receptors within a 10km radius

ID	Receptor	Receptor Type	Sensitivity	Justification
R-1	Qurrayah Power Plant 2	Industrial	**Low**	Qurrayah Power Plant 2 is situated around 650m from the project boundary
R-2	Qurrayah IPP			Qurrayah IPP is situated approximately 100m from the project boundary
R-3	Qurrayah Power Station			Qurrayah Power Station is located 2.1km from the project boundary
R-4	Qurrayah Sea Water Plant			Qurrayah Sea Water Plant is located 6km from the project boundary
R-5	Uqair Beach	Commercial/ Recreational	**High**	The Uqair beach is located 4.9km from the project boundary
R-6	Qurrayah Saudi Aramco Beach			Qurrayah Saudi Aramco beach is located 7km from the site
R-7	Continent Hotel Al Uqayr			Continent Hotel Al Uqayr is located 9.4km from the site
R-8	Qurrayah Power Plant Housing	Residential	**High**	Qurrayah Power Plant Housing is located 3.5km from the project site

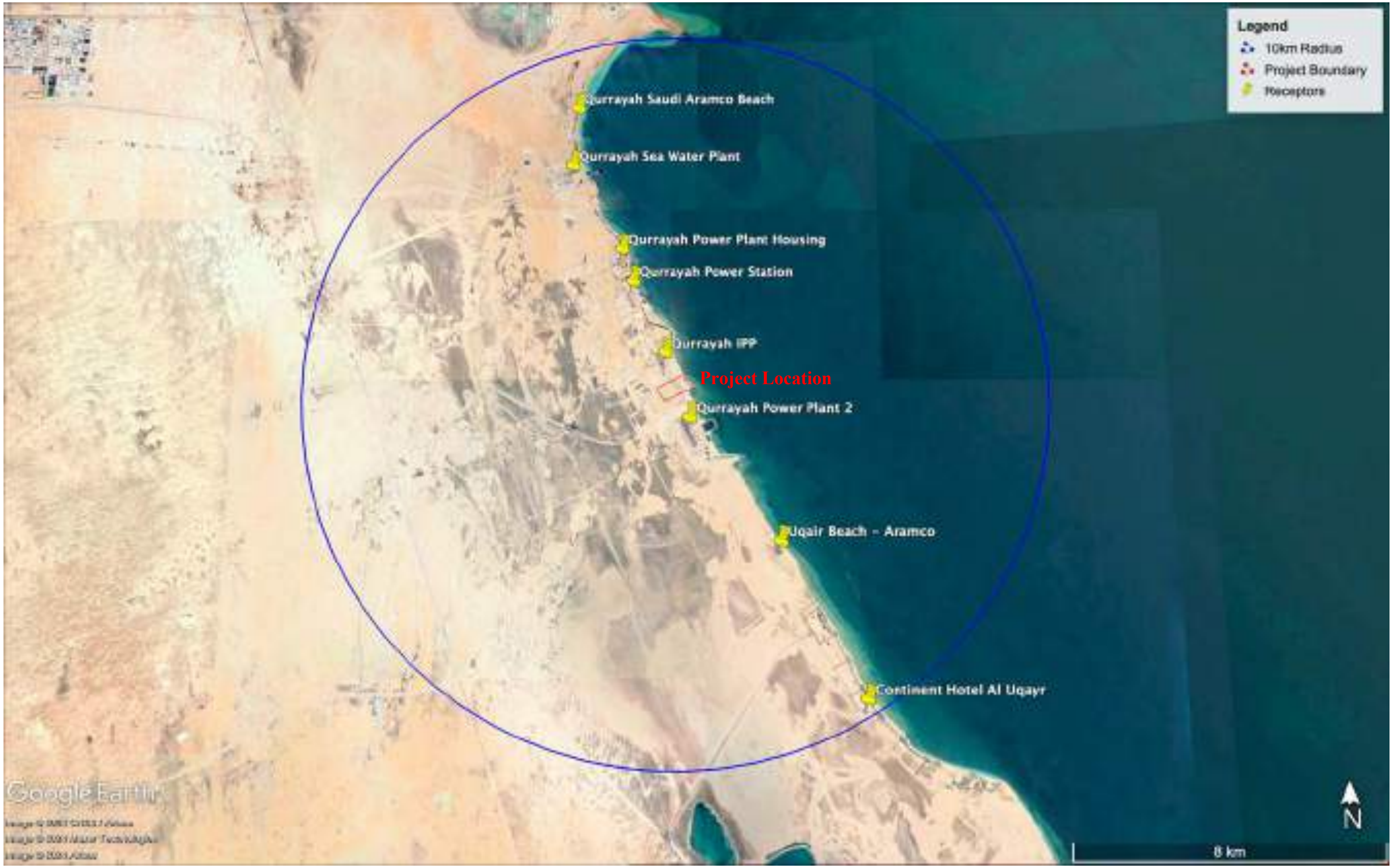


Figure 5-2 Land Users/Receptors within 10km

5.2 Physical Environment

5.2.1 Air Quality

5.2.1.1 Baseline Survey Methodology

The airshed within the Qurrayah industrial complex is expected to be influenced by the area's industrial activities, including power generation, petrochemical processing, and seawater injection facilities. These activities contribute various emissions, notably nitrogen oxides (NOx), sulfur dioxide (SO_2), particulate matter (PM), and volatile organic compounds (VOCs), which can affect air quality. Due to its industrial nature, the airshed in the Qurrayah area is expected to be moderately impacted.

Methodology

Continuous ambient air monitoring was conducted at one location for a period of seven days by the air quality monitoring station (AQMS). The air quality monitoring was undertaken from 19 December to 26 December 2024. Data was logged every 15 seconds and stored every 1 minute. The ambient air quality standards used to identify pollution include the national standards set out in the Implementing Regulations for Air Quality of the Environmental Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH.

The following air pollutants were measured at each point:

- Particulate matter with aerodynamic diameters less than 10 microns (PM_{10})
- Particulate matter with aerodynamic diameters less than 2.5 microns ($PM_{2.5}$)
- Hydrogen Sulfide (H_2S)
- Sulfur dioxide (SO_2)
- Oxides of Nitrogen (NO_2)
- Ozone (O_3)
- Carbon Monoxide (CO_2)

Additionally, meteorological data for wind speed, wind direction, ambient temperature, relative humidity, and barometric pressure were also measured.

The locations for the ambient air quality monitoring surveys are outlined below.

Figure 5-3 Ambient Air Quality Monitoring Station

Table 5-1 Air Quality Monitoring Locations

Location ID	Location Description	Image
Continuous AQ-1	The continuous air quality monitoring station was installed at a central location within the project development footprint	 

5.2.1.2 Continuous Air Quality Monitoring Results

The following meteorological data were recorded during the period of continuous air quality monitoring:

- Temperature: hourly maximum and minimum temperature were 24.1°C and 6.9°C respectively
- Relative humidity: was found to be 86.3% and 16.8% respectively
- Barometric pressure: was recorded as 1023 hpa and 1013 hpa respectively.
- Wind speed: 8.1 m/s and 0.6 m/s respectively
- Wind direction: west

The air quality monitoring average concentrations of the surveyed parameters compared to the ambient air quality standards stipulated in the exectutive regulations and the WHO ambient air quality targets and guidelines (WHO, 2021) are provided in

Table 5-2. The survey results are provided in **Appendix E**.

Table 5-2 Air Quality Monitoring Results

Parameter	Average Time	Concentration (µg/m^3)	Standards		
		AQ1	WHO Ambient Air Quality Standards (µg/m^3)[5]	National Ambient Air Quality Standards (µg/m^3)	National Ambient Air Quality Allowable Exceedances
PM_{10}	24 hours	215.7	150 (interim target 1) 100 (interim target 2) 45 (Guideline)	340	12 per year
$PM_{2.5}$	24 hours	34.4	75 (interim target 1) 50 (interim target 2) 15 (Guideline)	35	12 per year
Carbon Monoxide (CO)	8 hours	677.1	-	10,000	1 per year
Nitrogen Dioxide (NO_2)	1 hour	21.5	200 (Guideline)	200	24 per year
Hydrogen Sulfide (H_2S)	24 hours	2.7	100 (30-minute average Guideline)	4	-
Sulfur Dioxide (SO_2)	24 hours	34.4	125 (interim target 1) 50 (interim target 2) 40 (Guideline)	217	3 per year
Ozone (O_3)	8 hours	107.7	160 (interim target 1) 120 (interim target 2) 100 (Guideline)	157	25 per year over 3 years

The results obtained from the monitoring station demonstrate that concentration of all parameters are well below applicable standards stipulated in the executive regulations for air quality standards and the WHO targets and guidelines. No exceedences of NCEC daily standards were observed.

5.2.2 Climate Change Impacts & Adaptation

The climate of Saudi Arabia varies widely depending on the region and time of year where Saudi Arabia has a desert climate with the exception of the southwestern part of the country, which exhibits a semi-arid climate. Key historical trends are provided below (World Bank Climate Change Knowledge Portal, 2021):

- General warming varied from a minimum of about 0.15 °C since 1950 in Tabuk, Makkah and Al Ahsa, to a maximum of about 0.75 °C since 1950 in Khamis Mushait, Wadi Al Dawasser and Yanbu;
    - Great variability in precipitation changes with high decreases to the north and southwestern parts of the country by up to 50 mm; and
- The mean annual temperature and precipitation for Saudi is 25.94°C and 102.05mm for the period 1991 – 2020, respectively.

Summers in the central region are extremely hot and dry, temperature in inland areas range from 27°C to 43°C and in coastal areas range from 27°C to 38°C. In winter, the temperature ranges of 19°C to 29°C have been

[5] Interim targets serve as incremental steps in the progressive reduction of air pollution towards the air quality guideline levels and are intended for use in areas where air pollution is high.

recorded in the coastal areas of Red Sea. The average annual rainfall in most parts of the country is below 150mm throughout the year (World Bank Climate Change Knowledge Portal (WBCCKP), 2024).

Figure 5-4 presents the average monthly temperature and precipitation from 1991 till 2020 in the Eastern Province where the Project is located. The highest average maximum temperature of 43.74°C and the lowest average minimum temperature of 11.23°C were recorded in July and January respectively. The annual mean temperature in Ash Sharqiyah was recorded at 27.36°C in 1991, increasing to 28.85°C in 2023. The highest precipitation levels of 16.79mm are recorded in March compared to the lowest levels of 0.04mm in September (WBCCKP, 2024).

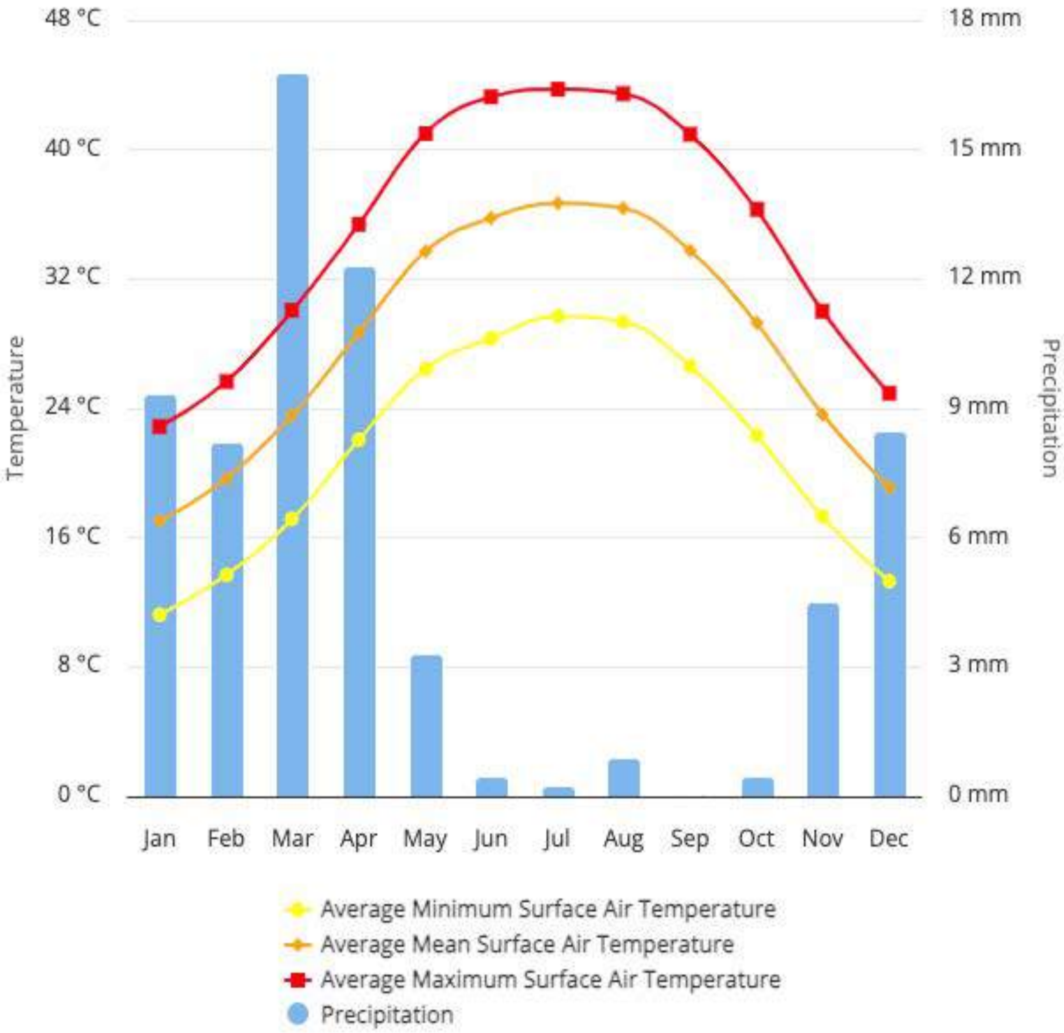


Figure 5-4 Average Monthly Climate Conditions in Ash Sharqiyah for 1991-2020 (WBCCKP, 2024)

The World Bank Climate Change Knowledge Portal reported the natural disasters occurring in KSA between 1985 and 2020. According to the Global Facility for Disaster Reduction and Recovery (GFDRR), Saudi Arabia is most vulnerable to coastal and river floods, earthquakes, volcanoes, and water scarcity. Sand and dust storms are also frequent in the country mainly due to its desert nature. High winds carrying sand and dust rise into the air forming clouds that often disrupt transport, communication, increase respiratory health-related diseases, and impact crops and natural habitats.

Flooding is considered the most common natural disaster in the country. Floods in Saudi Arabia occur as flash floods with little warning, damaging property and causing loss of lives. As indicated in the Figure 5-5 below, the most significant floods that occurred from 1985 to 2018 were recorded in the years 1985, 2003, 2004, 2005, 2009, 2010, 2013, 2016 and 2017.

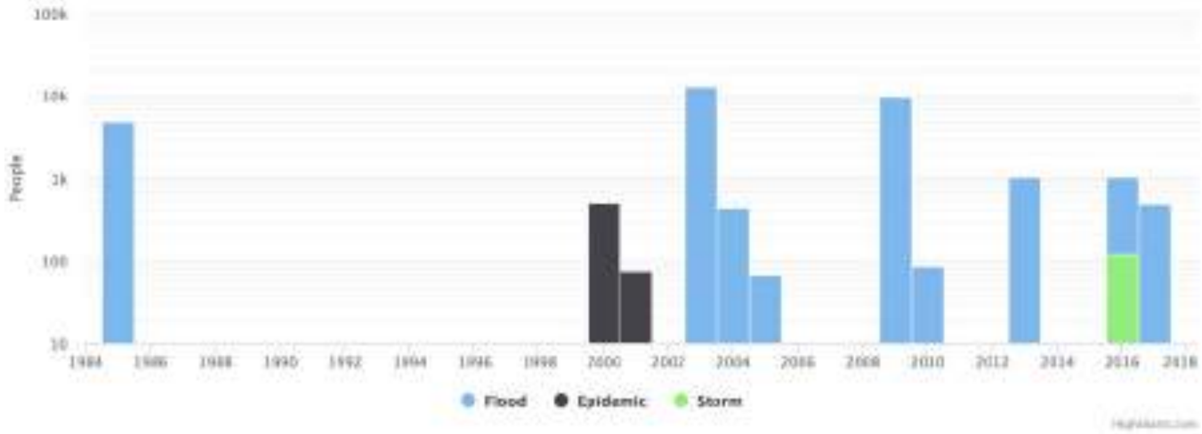


Figure 5-5 Key Natural Disasters in KSA 1985 - 2018 (WBCCKP, 2020)

The table below presents the key natural disasters in KSA along with the number of people affected. According to the GFDRR, unplanned urban development including lack of risk-informed territorial planning and weak enforcement of building codes are the main causes of damage and loss (Saudi Arabia - GFDRR, 2020).Table 5-3 below presents the number of people affected by the key natural disasters in KSA (WBCCKP, 2023).

Table 5-3 Key Natural Disasters in KSA 1985 - 2020 (WBCCKP, 2023)

YEAR	NATURAL HAZARD/ DISASTER	PEOPLE AFFECTED
1985	Flood	5,000
2000	Epidemic	497
2001	Epidemic	74
2003	Flood	13,050
2004	Flood	430
2005	Flood	67
2009	Flood	10,000
2010	Flood	85
2013	Flood	1,021
2016	Storm	122
2016	Flood	915
2017	Flood	481
2019	Flood	1,418
2020	Flood	600

Sand and dust storms are frequent in KSA. The graph below presents the number of monthly sandstorms in KSA during the period 2010-2017. As per the GAStat, the highest number of sandstorms was recorded in 2012 with 212 dust storms and the lowest in 2014 with 83 storms.

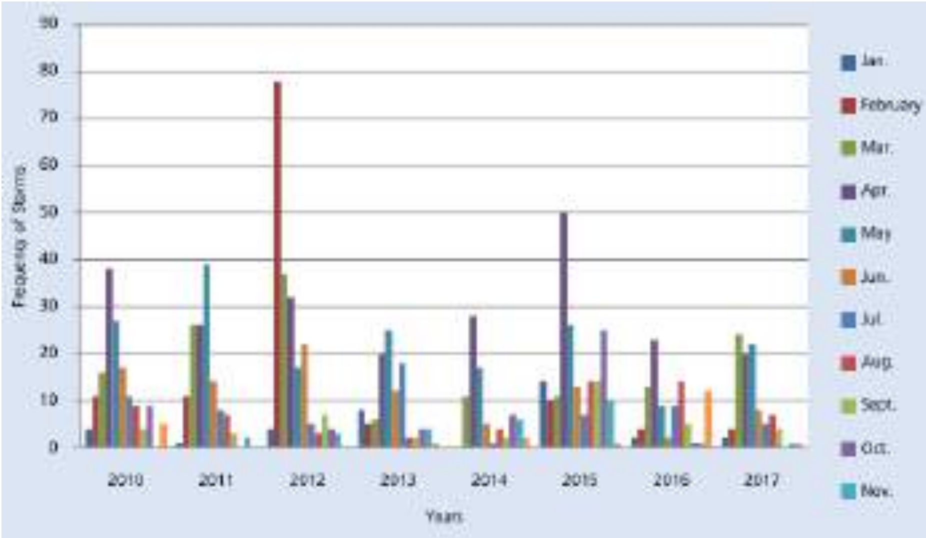


Figure 5-6 Frequency of Dust Storms in KSA Between 2010 and 2017 (GAStat)

The sea level differences compared to the 1993 to 2015 annual averages for KSA are presented in the figure below which shows rising sea levels throughout the period. The sea level change reported from 2008 to 2015 indicates a difference between 50 and 100 mm.

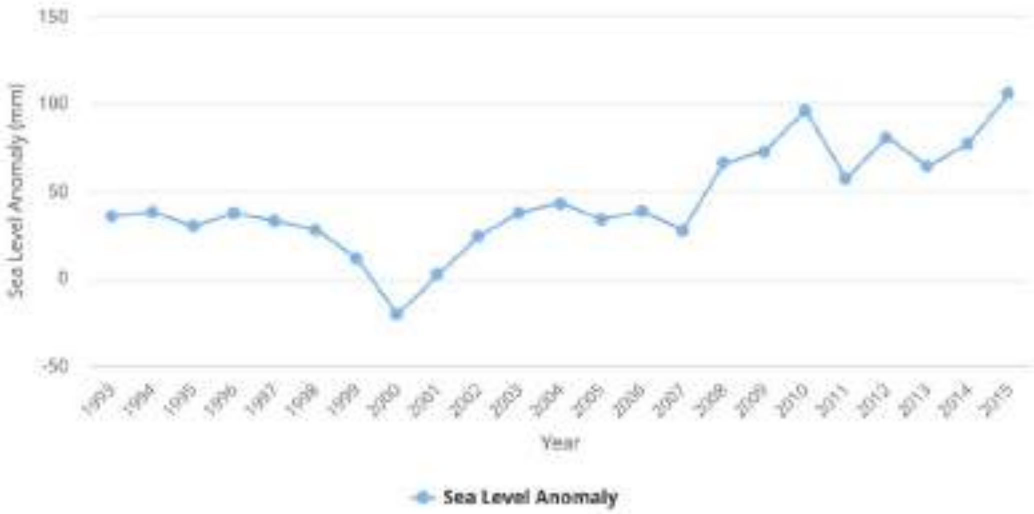


Figure 5-7 Sea Level Anomaly of Saudi Arabia for the Period 1993 to 2015 (WBCCKP, 2020)

Sea level temperature recorded the highest in 2010 with annual average of 28.31ºC. The lowest temperature was recorded in 1997 and 2000 with annual averages of 27.49 ºC and 27.50 ºC, respectively.

5.2.3 Noise & Vibration

5.2.3.1 Baseline Survey Methodology

Primary noise sources at the site are a result of the operation of the existing power plants and other industrial facilities which require the operation of the gas turbines, generators, cooling systems, air compressors and pumps that run continuously.

Additional noise may arise from occasional heavy machinery or transport within the area. However, noise at the site from the operation of these facilities and the traffic on the road within the project site was not significant at the time of the visit.

In order to confirm baseline conditions prior to construction work, a noise monitoring survey was undertaken. The noise monitoring was carried out by Bander Said Allehiany (BSA), an accredited laboratory in KSA. Noise monitoring was conducted at four (4) locations, for a 24- hour period; both day and night for each monitoring location within the period of 19 – 25 December 2024. Nosie levels during day and night time were found to be within the limits of NCEC noise executive regulation. The baseline survey monitoring locations are shown in Figure 5-8 below.

The survey results and calibration certificates are provided in **Appendix F**.

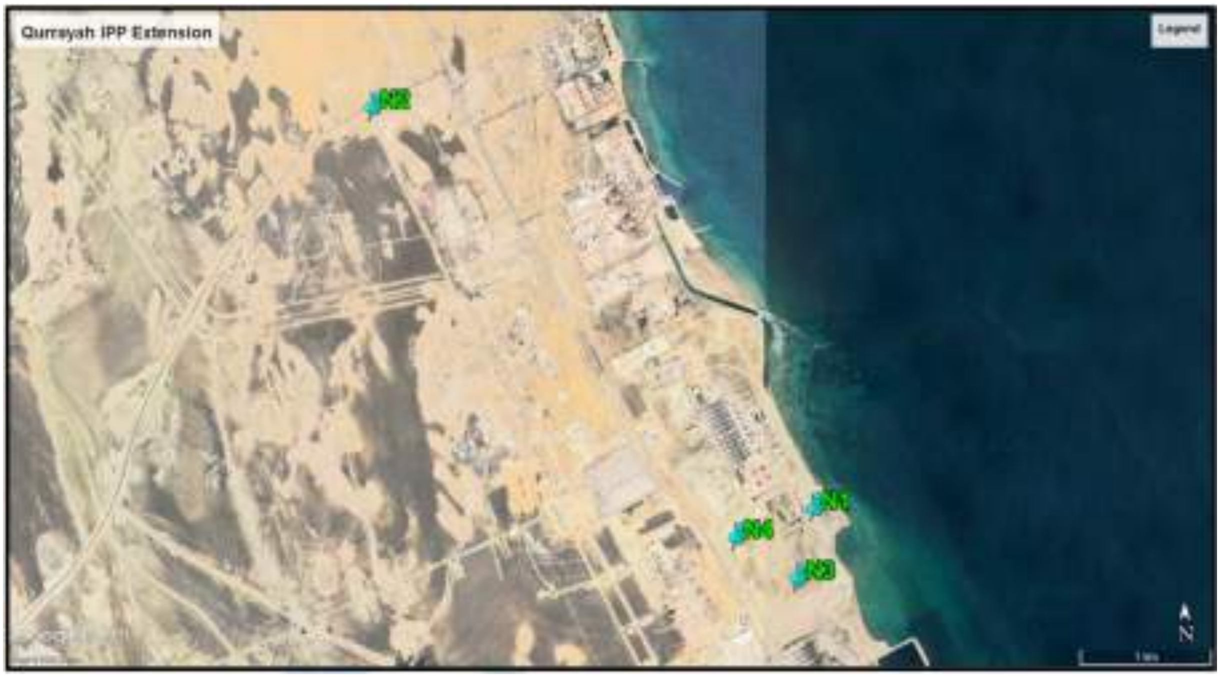


Figure 5-8 Noise Monitoring Locations

Table 5-4 Noise Monitoring Locations

Location ID	Location Description	Image
NM - 1	Located within the site	
NM - 2	Located approximately 3.5 km from the project site, at the Qurrayah Complex fence and boudnary	
NM - 3	Located 250m South of the closest project boundary	
NM - 4	Located at the Eastern project boundary	

NM – Noise Monitoring

5.2.3.2 Survey Results

The results from the noise monitoring are provided in the following table and compared to the applicable World Bank Guidelines and standards stipulated in the executive regulation for noise in residential and commercial receptors; considering the national MEWA standards are more stringent, they will be implemented for the Project.

The monitoring results at all monitoring stations are well within the applicable daytime and nighttime standards when compared to the WBG guidelines. In addition, monitoring results at all monitoring stations are well within the applicable daytime and night-time standards when compared to the standards stipulated in the executive regulations for noise as per the national standards.

Table 5-5 Noise Monitoring Results

SITE ID	NOISE MONITORING RESULTS								WHO EHS GUIDELINE *		NATIONAL NOISE STANDARDS **	
	L_{DAY}	L_{NIGHT}	$L_{Aeq,T}$ dB	L_{Amin} dB	L_{Amax} dB	L_{A10} dB	L_{A50} dB	L_{A90} dB	DAYTIME (07:00 – 20:00)	NIGHT-TIME (20:00- 07:00)	DAYTIME (07:00 – 20:00)	NIGHT-TIME (20:00- 07:00)
NM-1	55.04	52.83	53.90	44.50	70.90	55.10	51.80	48.30	70		65	70
NM-2	49.24	49.12	49.13	37.60	67.70	52.00	46.70	42.80	70		65	70
NM-3	51.39	50.01	50.72	42.50	67.00	52.40	49.70	46.40	70		65	70
NM-4	49.18	47.78	48.37	38.00	63.80	50.70	47.20	42.00	70		65	70

*WHO EHS noise guidelines for industrial areas with a limit exceedance of 70 dB for both daytime and night-time.
**KSA National Noise Standards guidelines for industrial area with a limit of 65 dB for daytime and 70 dB for night-time noise.

5.2.4 Soil, Geology and Groundwater

5.2.4.1 Desktop Review

SOIL GEOLOGY

The Hajr Two CCGT IPP Project is located in the eastern region of the Kingdom of Saudi Arabia. The soils found in Qurrayah, located along the Arabian Gulf coast of Saudi Arabia, are predominantly sabkha soils. These are saline, fine-grained sediments characterized by high salt content and low bearing strength. Sabkha soils in this region typically consist of a mixture of quartz sand, silt, clay, and soluble salts. The primary soil type found in Qurrayah is sabkha soil whhich are coastal, saline, and fine-grained sedimentary soils that form in arid and semi-arid regions.

The elevation in Qurrayah, Saudi Arabia, is very low, as it is a coastal area along the Arabian Gulf. The region is mostly at or near sea level, with elevations typically ranging from 0 to 10 meters above sea level. Due to its proximity to the coast, the area is influenced by tidal movements, groundwater fluctuations, and high salinity. The flat topography also contributes to the formation of sabkha soils, which are common in low-lying coastal zones with poor drainage.

The coastal plains of the Arabian Gulf consist of quatenary deposists and neogene sands.

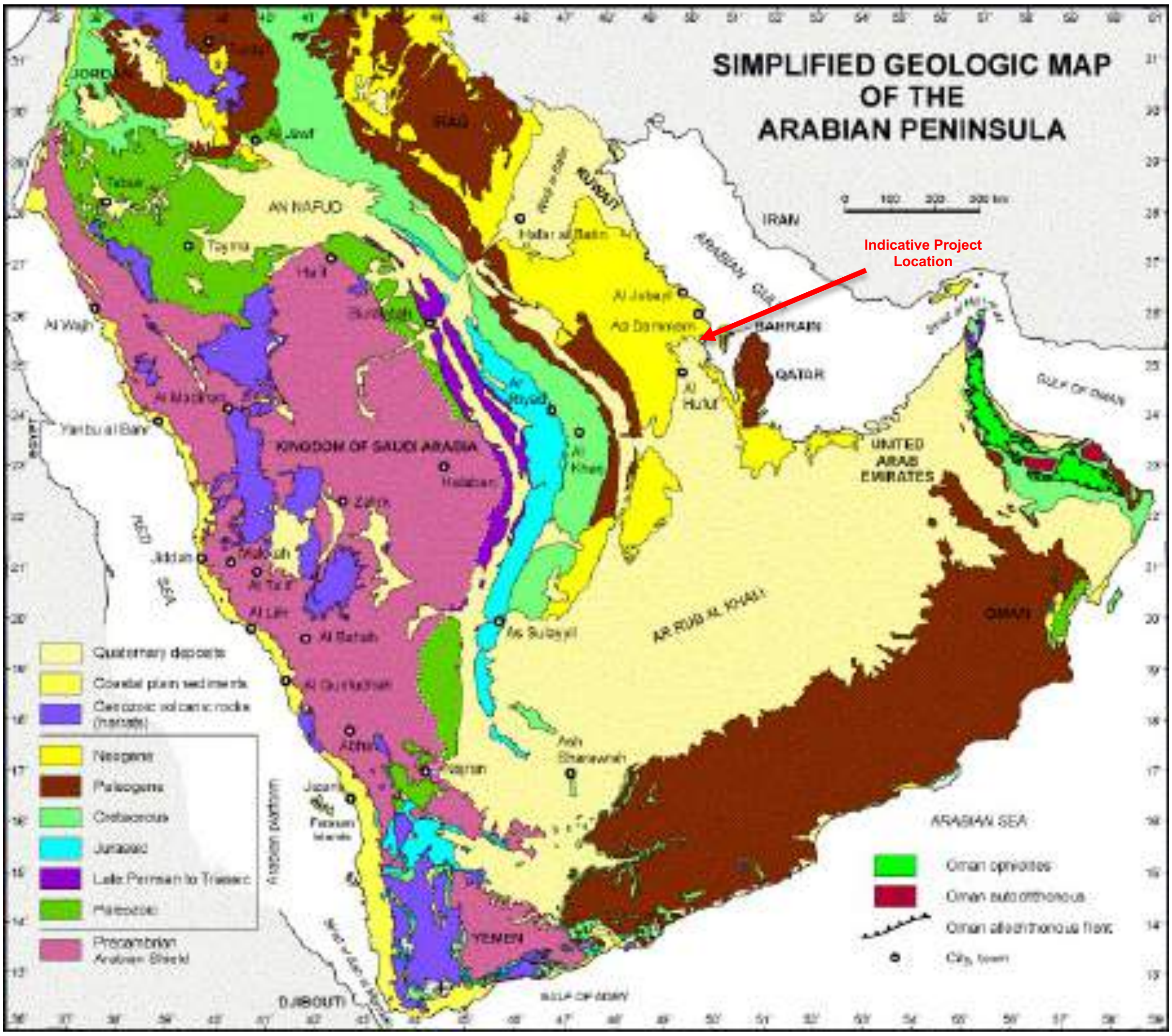


Figure 5-9 Geological Map of the Arabian Peninsula

Source: Nindre et al (2003).

The rocks underlying the entire Arabian Peninsula are pre-Cambrian and consist of a complex set of igneous and metamorphic rocks. They are best known where exposed in the Arabian Shield, in the western part of the kingdom.

GROUNDWATER RESOURCES

Saudi Arabia is one of the driest regions in the world with no perennial rivers. The main source of groundwater in the Kingdom comes from six major consolidated old-age aquifers located in the eastern and central parts of the country known as Arabian Shelf. These are namely, 5 different sandstone aquifers: The Saq, Wajid, Tabuk, Minjur, Wasia, and the limestone aquifer of Umm er Radhuma (Abderrahman, 2006).

The overexploitation or continuous mining of these aquifers for agricultural and domestic purposes without replenishment has resulted in depletion of groundwater. In 1995 the World Bank reported that 35% of non-renewable groundwater sources in Saudi Arabia were depleted.

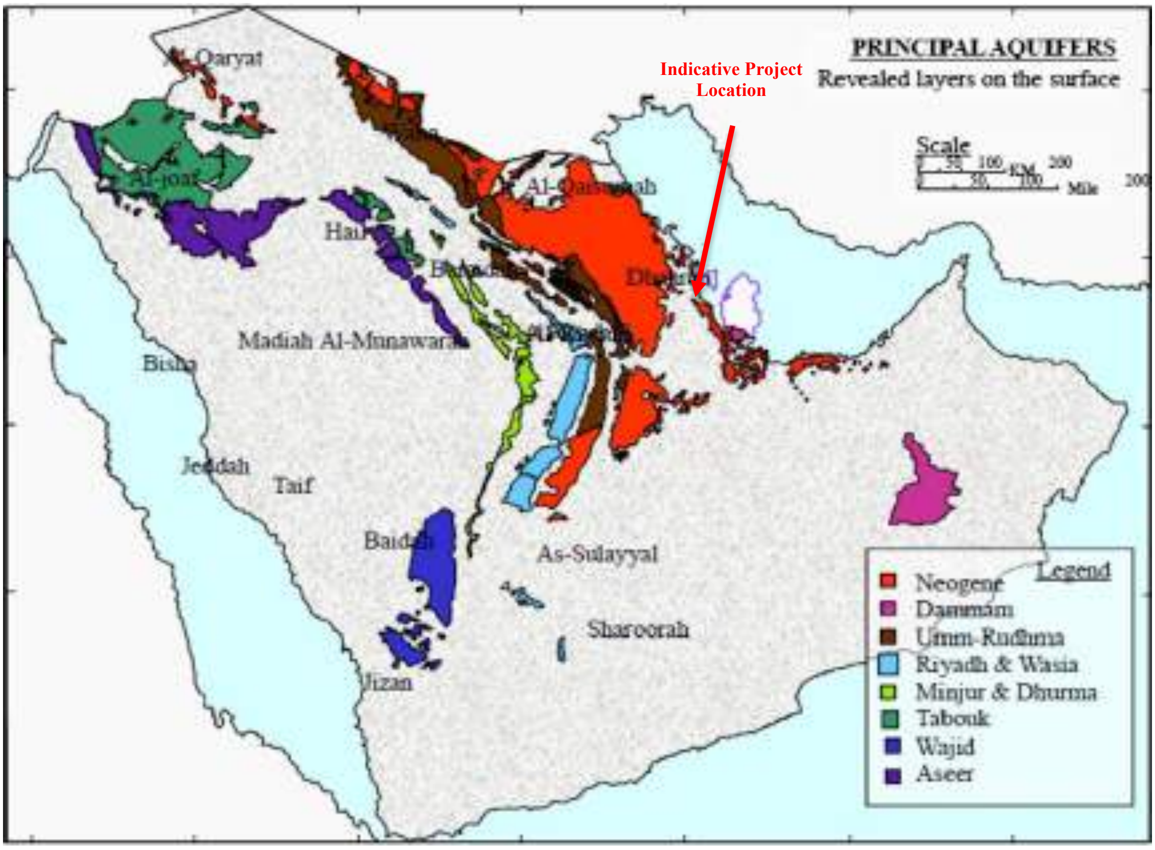


Figure 5-10 Principal Aquifers in Saudi Arabia

Source: Chowdhury, S., & Al-Zahrani, M. (2015).

As indicated in Figure 5-10 above, the Project is not located on a groundwater aquifer.

SEISMICITY

Saudi Geological Survey (SGS) is responsible for earthquake monitoring in Saudi Arabia. Currently, SGS has 75 stations, mostly concentrated in western Saudi Arabia, which is where most of the seismic activity occurs. According to SGS, the risk of damage from earthquakes is quite low over most of Saudi Arabia, with exception for areas near the Gulf of Aqaba and Jazan, with lower risk in the west near the Red Sea and in some of the Harrats (SGS, 2019).

The region of the Gulf has active sinistral transform faults with associated pull-apart basins (the deeps in the Gulf of Aqaba), and hence is an area where large damaging earthquakes occur quite regularly. The last major event was the 1995 Haql earthquake in the Gulf of Aqaba (magnitude 7.3) which caused significant damage on both sides of the Gulf and was felt hundreds of kilometers away. Earthquakes of magnitude 6 are common along the spreading axis of the Red Sea but generally they are not felt onshore or further inland and appear to pose little risk to infrastructure (SGS, 2019).

Apart from the seismicity along the axis of the Red Sea and along the Gulf of Aden, considerable activity occurs along the Dead Sea transform fault system. In the central and western part of the shield some of the Cenozoic volcanic areas are still potentially active, and some seismicity is associated with this low-level volcanism (SGS, 2019). The table below present the number of seismic shocks by level recorded for 2018.

Table 5-6 Number of Seismic Shocks in Saud Arabia for 2018

Level of Seismic Shocks	Dec.	Nov.	Oct.	Sep.	Aug.	July	June	May	April	March	Feb.	Jan.	Total
< 1	617	497	470	320	363	457	263	263	274	282	318	617	4741
1-2	295	250	693	467	131	153	107	150	208	214	227	295	3190
2-3	42	51	59	25	17	29	6	24	39	41	31	42	406
3-4	5	5	1	5	1	4	0	0	2	2	2	5	32
4-5	1	1	1	2	2	8	0	3	0	1	1	1	21
5-6	0	1	0	1	1	3	0	1	2	0	0	0	9
6-7	0	1	0	0	1	2	0	0	0	0	0	0	4
>7	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**960**	**806**	**1224**	**820**	**516**	**656**	**376**	**441**	**525**	**540**	**579**	**960**	**8403**

Source: General Authority for Statistics, Saudi Arabia

The Seismic Zone Classification for the area is Saudi Building Code, SBC 301. The general environs of the proposed facility is located within a zone without locally significant seismicity. '*the risk of damage from earthquakes is quite low over most of Saudi Arabia, with the main area of risk being the Gulf of Aqaba and Jazan, with lower risk in the west near the Red Sea and in some of the Harrats (SGS, 2019*).

5.2.4.2 Baseline Survey

Site Visit Observations - Soil

At the Qurrayah site, previously used as workers' accommodation for an EPC contractor, the soil conditions have likely been affected by the long-term presence and removal of temporary facilities. The site has remaining concrete slabs and the soil at the majority of the project site is compacted from the weight of structures and heavy vehicle activity, leading to reduced porosity and permeability.

The worker's accommodation has been decommissioned but the site has construction and demolition waste scattered across it, which includes remnants of concrete, bricks, metal, wood, plastic, and other materials.

Figure 5-11 Remaining Concrete Foundations, Compacted Road and Demolition Waste at the Project site

SOIL SURVEY METHODOLOGY

Despite an absense of obvious pollution or contamination sources, a precautionary approach to benchmark existing soil quality was undertaken. Subsequently, topsoil samples were collected at four (4) soil sampling locations within the project site taken at 10cm from the surface. He soil samples were analysed for the following:

- pH and heavy metals (As, Ba, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Se, V, Zn, etc.,)
- Oil & Grease.
- Total Petroleum Hydrocarbon (TPH) and;
- BTEX

The soil sample were collected and analysed by an NCEC accredited laboratory in KSA. The soil sampling locations were selected in several areas accross the site and along the access road as shown on the figure below to provide and overview of the different Project areas, ground cover, and soil type.

Figure 5-12 Soil Sampling Locations

SURVEY RESULTS

The results from the soil quality laboratory analysis are presented in Table 5-70 and provided in **Appendix G**. The soil analysis results are compared with the standards stipulated in the executive regulations for soil quality and the Dutch target values; depending on the parameter, the more stringent standards will be followed.

The analysis of the soil results as sampled within the AoI revealed that the soil quality is within both the applicable Dutch and National soil quality standards, no outliers and anomalities were observed.

The results at the four (4) sampling locations are displayed below.

Table 5-7 Soil Analysis Results

Parameter	MDL	Test Method	S-1	S-2	S-3	S-4	Dutch Target Values*	Dutch Intervention Values*	National Soil Quality Standards**
Inorganic Parameter									
pH (pH units)	-	APHA 4500 -H^{+}B	8.12	8.17	8.07	8.15	-	-	**8.5**
Petroleum Hydrocarbon (TPH)									
F1: C6 to C10	-	EPA 5021A	<10	<10	<10	<10	-	-	-
F2: C10 to C16		EPA 8015D	<20	<20	<20	<20	-	-	-
F3: C16 to C34		ASTM D5442	<40	<40	<40	<40	-	-	-
F4: C34 to C50		ASTM D5442	<100	<100	<100	<100	-	-	-
Metals -Water Soluble (mg/kg)									
Chromium (Cr VI)	0.1	US EPA 7196A	0.009	0.003	0.006	0.007	-	-	**0.4 – 1.4**
Anions (mg/kg)									
Nitrate (NO_3)	0.1	US EPA 300.1	1.2	1.4	1.2	1.3	-	-	-
Metals -Total (mg/kg)									
Antimony (Sb)	0.1	EPA 200.7	0.0008	0.001	0.0008	0.0008	**3**	**15**	**20 – 40**
Arsenic (As)	0.1	EPA 200.7	0.007	0.003	0.005	0.003	**29**	**22**	**17 – 26**
Beryllium (Be)	0.1	EPA 200.7	0.0003	ND	0.0001	ND	-	-	**5 – 8**
Baron (B)	0.1	EPA 200.7	0.02	0.02	0.01	0.01	-	-	**3.3 – 5**
Cadmium (Cd)	0.1	EPA 200.7	0.0003	0.0001	0.0008	ND	**0.8**	**12**	**3.8 – 22**
Chromium (Cr)	0.1	EPA 200.7	0.085	0.017	0.054	0.06	**100**	**380**	**64 – 87**
Cobalt (Co)	0.1	EPA 200.7	0.012	0.004	0.005	0.007	**9**	**240**	**20 – 300**
Copper (Cu)	0.1	EPA 200.7	0.02	0.005	0.006	0.008	**36**	**190**	**63 – 91**
Lead (Pb)	0.1	EPA 200.7	0.002	0.0014	0.0024	0.0009	**85**	**530**	**70 – 600**
Mercury (Hg)	0.25	EPA 200.7	0.016	0.026	0.015	0.03	**0.3**	**10**	**12 - 606**
Molybdenum (Mo)	0.1	EPA 200.7	0.0018	0.0027	0.0026	0.002	**3**	**200**	**4 – 40**

Parameter	MDL	Test Method	S-1	S-2	S-3	S-4	Dutch Target Values*	Dutch Intervention Values*	National Soil Quality Standards**
Nickel (Ni)	0.5	EPA 200.7	0.033	0.01	0.027	0.024	**35**	**210**	**45 – 89**
Selenium (Se)	0.1	EPA 200.7	0.014	0.004	0.008	0.005	-	-	**1 – 29**
Silver (Ag)	0.5	EPA 200.7	0.006	0.006	0.007	0.004	-	-	**20 – 40**
Thallium (Tl)	0.1	EPA 200.7	0.031	0.008	0.018	0.012	-	-	**1**
Tin (Sn)	0.1	EPA 200.7	0.0003	0.0002	0.0002	0.0002	-	-	**5 – 300**
Uranium (U)	0.25	EPA 200.7	0.0043	0.0032	0.0030	0.0023	-	-	**25 – 300**
Vanadium (V)		EPA 200.7	0.068	0.026	0.048	0.037	-	-	**130**
Zinc (Zn)		EPA 200.7	0.029	0.004	0.065	0.006	**140**	**720**	**200 – 360**
Volatile Organic Compounds - BTEX (mg/kg)									
Benzene	0.05	EP080	<0.01	<0.01	<0.01	<0.01	-	-	**0.046-0.078**
Ethyl benzene	0.05	EP080	<0.02	<0.02	<0.02	<0.02	-	-	**0.073-0.14**
Xylene	0.05	EP080	<0.2	<0.2	<0.2	<0.2	-	-	**0.99-1.9**
Toluene	0.05	EP080	<0.06	<0.06	<0.06	<0.06	-	-	**0.12-0.52**

** The soil values are calculated for a 'Standard Soil' with 10% organic matter and 25% clay.*

*** KSA standards vary depending on classification of particle size (coarse / fine) and land use type (e.g., Natural Area / Industrial). The standards given reflect the range from most stringent to most lenient.*

5.2.5 Hydrology, Surface Water Drainage and Flood Risk

5.2.5.1 Hydrology Study

A preliminary hydrology study was carried out by Worely Consulting in March 2025[6]. The site's elevation ranges between 1 to 6 meters above sea level (ASL), while the broader catchment area varies from 0 to 335 meters ASL. Catchments were delineated using the Copernicus Digital Elevation Model (DEM), revealing that the site is located within a coastal catchment with no distinct flow paths. Three catchments were identified, with an overall slope direction from southwest to northeast. Catchment C2, the largest among them, spans approximately 7,440 km². Runoff from the catchment is collected in a sabkha situated to the east of the site, with flows ultimately discharging into the Arabian Gulf to the south.

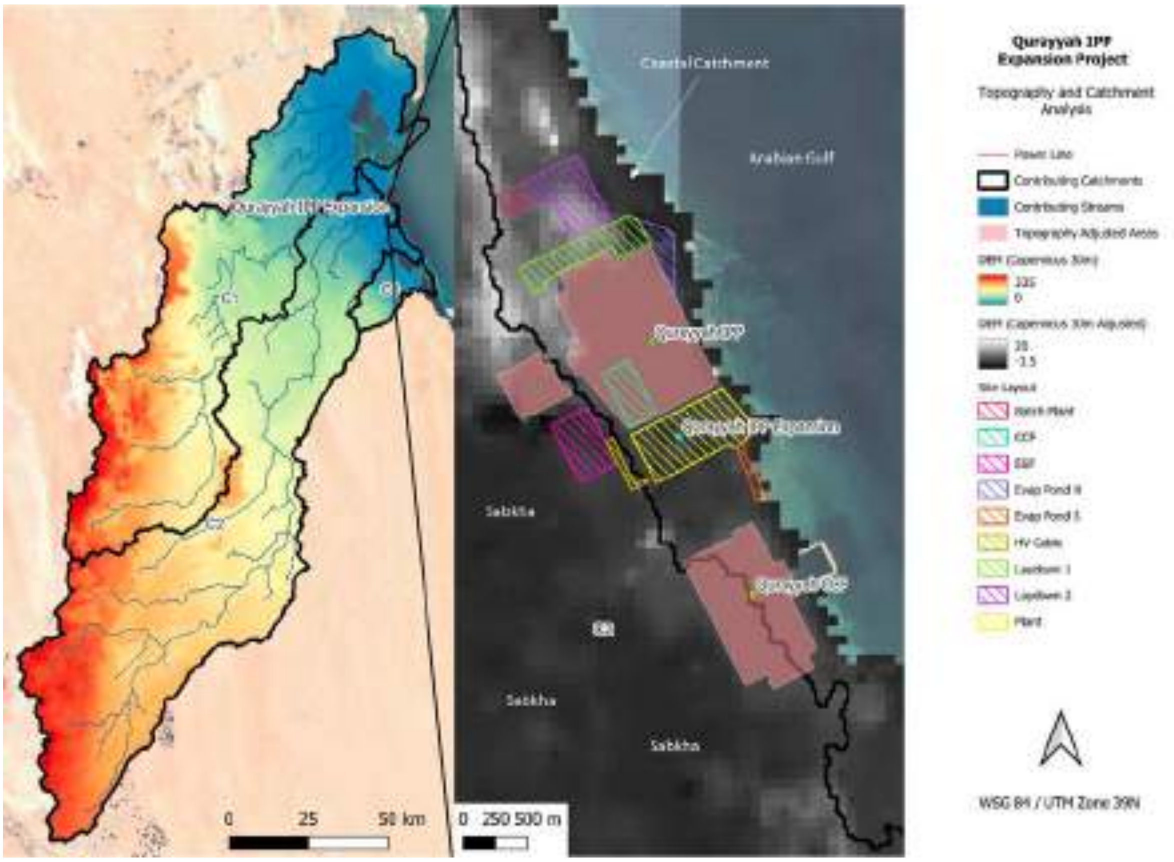


Figure 5-13 Topography and Catchment Areas

Details on the preliminary hydrology and flood risks are discussed in the assessment section 6.2.4.1 and in **Appendix M.**

5.2.5.2 Site Visit Observations

The site visit undertaken in November 2024, indicated the absence of permanent surface water features or identifiable water sources on the site and due to the relatively flat topography of the project site, no obvious

[6] A revised hydrology study is currently underway to reflect the new TCF and evaporation pond areas.

drainage channels were identified. Although the project site is located along the coast, it does not have any permanent surface water features.

5.2.6 Marine Ecology

5.2.6.1 Desk Review

The Hajr Two CCGT Project is located in Qurayyah, in the Eastern Province of the Kingdom of Saudi Arabia on the Arabian Gulf. As per the secondary data provided within the marine ecology survey report prepared by Leaf Global Environmental Services (LGES), the Arabian Gulf is characterized by extreme oceanographic conditions due to high evaporation, limited freshwater inflow, and restricted exchange with the Indian Ocean through the Strait of Hormuz (Sheppard et al., 2010; Vaughan et al., 2019). Additionally, the Gulf experiences high salinity levels that often exceed 43 PSU and seasonal water temperatures ranging from 15 °C in winter to over 36 °C in summer (Price et al., 1993; Al-Yamani et al., 2017). However, the Arabian Gulf continues to host diverse and productive ecosystems, including coral reefs, seagrass beds, mangroves, intertidal mudflats, and soft sediment habitats (Naser, 2011a; Erftemeijer & Shuail, 2012; Burt, 2013).

According to Sheppard et al., 2010 and Riegl & Purkis, 2012, the coral reefs in the Arabian Gulf are patchily distributed, often found on offshore shoals or fringing coastlines in Saudi Arabia, Bahrain, Qatar, and the UAE. Due to prevalent exteme oceonographic environmental conditions, the Arabian Gulf is dominated by stress-tolerant genera such as Porites, Favia, and Platygyra. Although these reefs exhibit remarkable resilience, they remain vulnerable to recurrent bleaching events and chronic anthropogenic pressures. Several severe thermal anomalies were observed in 1996, 1998, and 2017 which resulted in the widespread coral mortality (Burt et al., 2011). It is understood that these bleaching events reflect the Gulf's role as a natural analog for understanding future climate stress scenarios projected for tropical reefs by the end of the century (Riegl & Purkis, 2012).

The Gulf's ecosystems faces stress from the increase in urbanization, industrialization, coastal development, and large-scale dredging and reclamation projects. It is estimated that over 40% of the Gulf's coastline has been significantly altered, with several megaprojects such as artificial islands and waterfront developments contributing to habitat loss (Hamza & Munawar, 2009; Naser, 2014). Despite these threats and continued habitat loss, the marine biodiversity of the Arabian Gulf is host to the following species

- over 700 fish species which are endemic and adapted to extreme environmental conditions present in the Gulf (Sheppard et al., 1992; Khan et al., 2002).
- three seagrass species (Halodule uninervis, Halophila stipulacea, and Halophila ovalis) dominate the Gulf's seafloor flora and form critical nursery grounds for penaeid shrimps, fish, and endangered megafauna such as green turtles (Chelonia mydas) and dugongs (Dugong dugon) (Preen, 2004; Abdulqader & Miller, 2012).

According to (Hemami et al., 2018) the distribution, abundance, and seasonal dynamics of these species remains limited.

In addition to industrialisation impacts, climate change poses additional threats to the Gulf. According to Wabnitz et al., (2018), conditions such as warming ocean temperatures, sea-level rise, and acidification are expected to significantly alter the structure and function of Gulf ecosystems. Projections suggest that up to 35% of species richness could be lost in the southwestern Gulf by 2090 due to climate-driven habitat shifts. As such, coral reefs are increasingly exposed to temperatures that exceed physiological tolerance thresholds, while acidification threatens calcifying organisms and reef accretion processes (Uddin et al., 2012).

5.2.6.2 Marine Ecology Survey

A marine survey was conducted by LGES from 29th May to 7th May 2025. The survey methodology and outcomes are summarised in the following sections and provided in detail in **Appendix J**.

SURVEY METHODOLOGY

Benthic Habitat Assessment

The benthic habitat survey was conducted to evaluate the condition of coral reef habitats within the defined project development footprint. The survey methodology utilised both qualitative and quantitative data collection for analysis of coral cover, seagrass presence and the broader ecological and abiotic factors. Surveys covered a 10-meter-wide corridor per transect, with photoquadrats (0.25 m² each) captured for accuracy. GPS tracking and CPCe software were used for precise spatial analysis. CPCe software was utilized to calculate the number of corals and to quantify benthic cover effectively. Following the description and analysis of the belt transects and photoquadrats, the benthic habitat was classified into five main categories in the CPCe analysis: Sand, Rock, Macroalgae, Coral, and Dead Coral.

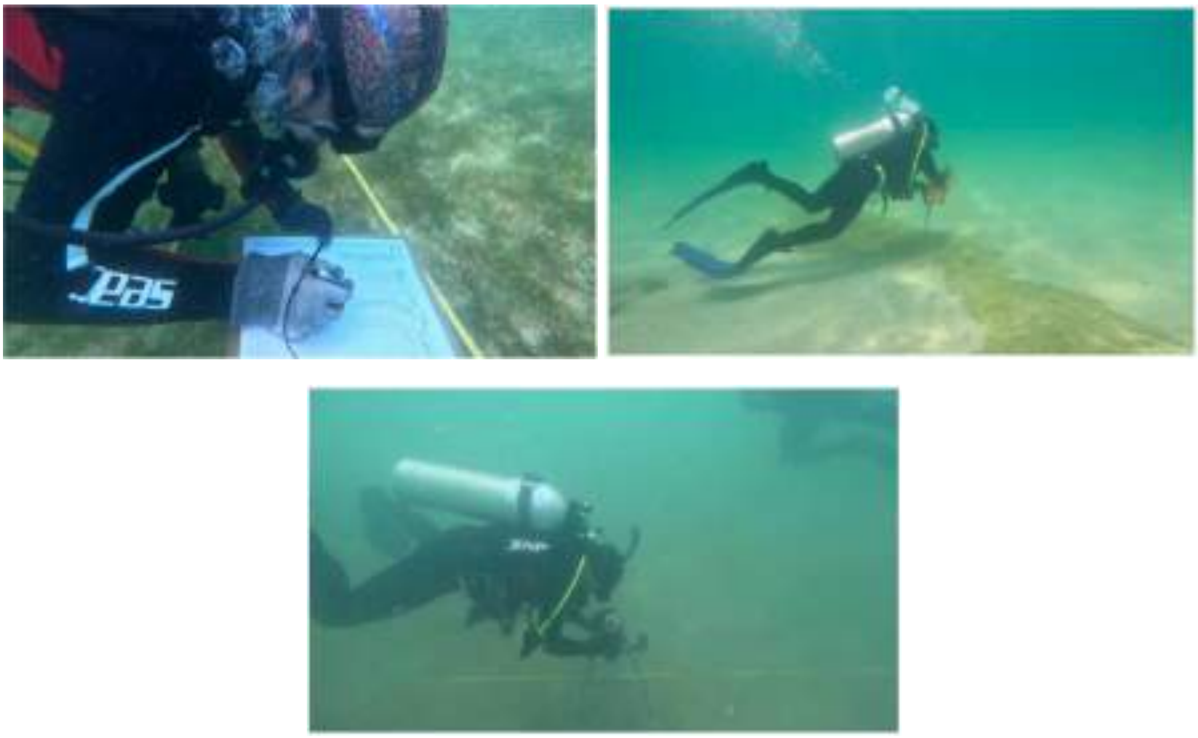


Figure 5-14 Divers Deploying Transect and Capturing Photoquadrats (LGES, 2025)

Benthic Mapping

A Remotely Operated Vehicle (ROV) survey was conducted to obtain a detailed visual characterization of the seabed across the project impact areas. The mapping survey was carried out using the FIFISH E-MASTER AI ROV, a high-resolution, AI-assisted underwater platform designed for precision habitat mapping and visual documentation of marine environments. The ROV was systematically deployed along the full length of both the intake and outfall pipelines. At each segment, the high-definition underwater camera mounted on the ROV was oriented at an approximate 30° angle from the horizontal plane to optimize visibility and resolution of the benthic substrate.

Figure 5-15 Deployment of the FIFISH E-MASTER AI ROV (LGES,2025)

The survey area is shown in the figure below.

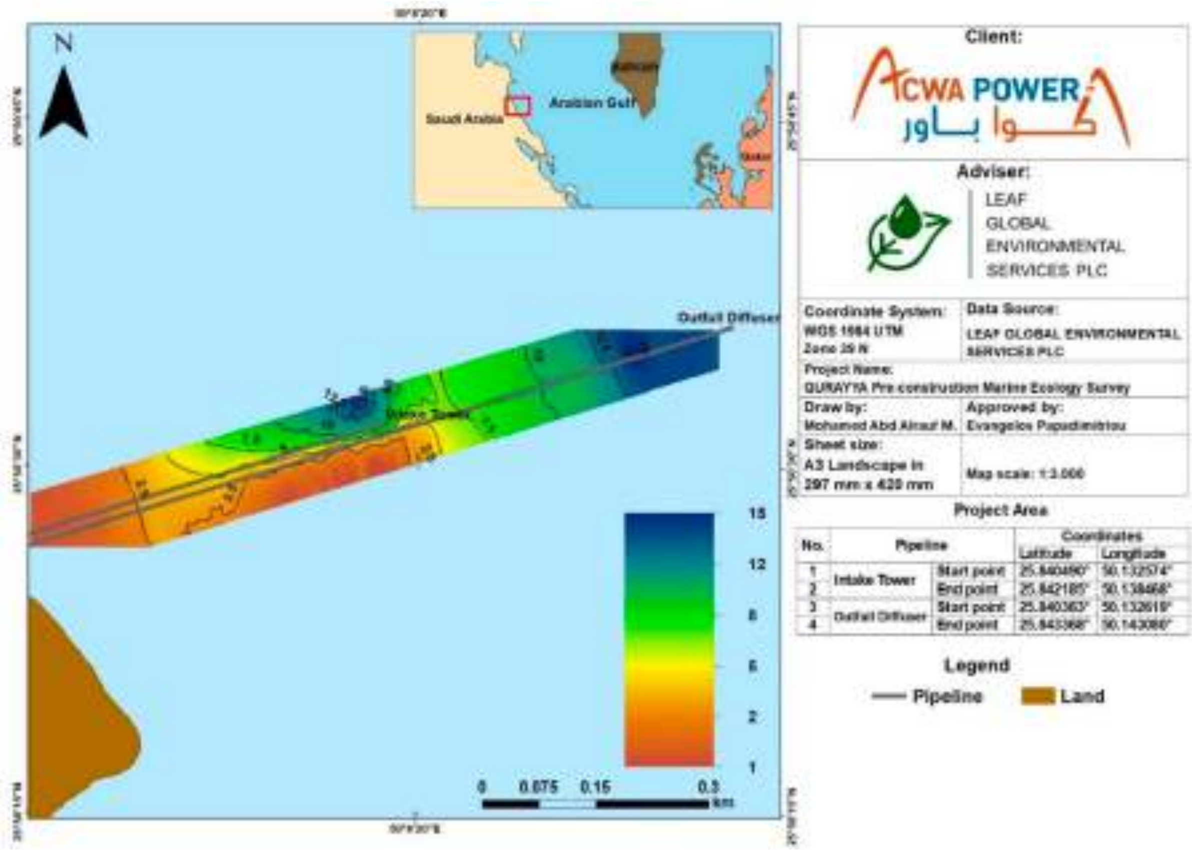
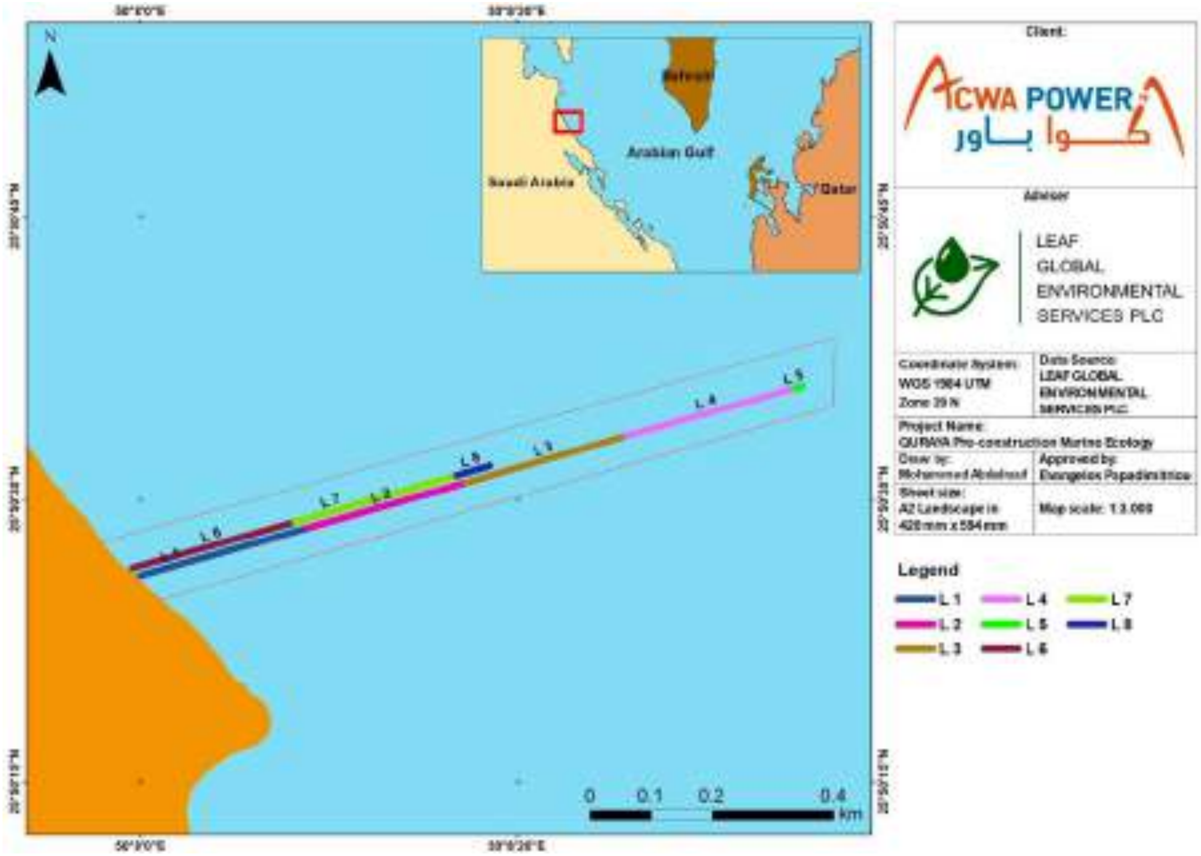


Figure 5-16 Bathymetric Survey Map (LGES, 2025)



Location	Start point		End point		Length
	Latitude	Longitude	Latitude	Longitude	
L 1	50.1333160	25.8405395	50.1357126	25.8412206	250 m
L 2	50.1357126	25.8412206	50.1381260	25.8419065	250 m
L 3	50.1381260	25.8419065	50.1405045	25.8426018	250 m
L 4	50.1405045	25.8426018	50.1429176	25.8432845	250 m
L 5	50.1429176	25.8432845	50.1430930	25.8433333	19 m
L 6	50.1331971	25.8406457	50.1356119	25.8413287	250 m
L 7	50.1356119	25.8413287	50.1379991	25.8420163	250 m
L 8	50.1379991	25.8420163	50.1384821	25.8421567	61 m

Figure 5-17 Transects Locations and Coordinates

Marine Megafauna

Opportunity observations of marine megafauna were conducted adhoc monitoring for large marine species such as dolphins, dugons, and turtles, and other large marine species. The survey included a 30-minute observation window noting location, time, species, and behavior (e.g., swimming, breaching, feeding).

MARINE SURVEY RESULTS

Benthic Habitat

The benthic habitat assessment conducted along the proposed intake and outfall pipelines revealed a clear gradient in both substrate composition and bathymetric features across the surveyed marine corridor. At Location 1, the nearshore area was primarily composed of sandy substrates, with depths ranging from approximately 0.3 m to 2.13 m. Consolidated rock outcrops were also present at shallower points (less than 0.7 m), interspersed within the sandy matrix. This area lacked vegetative cover such as seagrass or turf algae and exhibited low habitat complexity. At Location 2, a notable shift in benthic structure was observed, with seagrass meadows becoming predominant across depths of 2.76 m to 4.59 m. These were interspersed with rocky substrates and localized turf algae. The seagrass beds were primarily composed of *Halophila stipulacea* and *Cymodocea serrulata*, which are categorised as Least Concern on the national and IUCN red list. Both species are typical of soft-bottom environments and are known to contribute to sediment stabilization. Turf algae were noted at specific points around 2.78–2.81 m depth in association with hard substrates, enhancing the structural heterogeneity of the habitat.

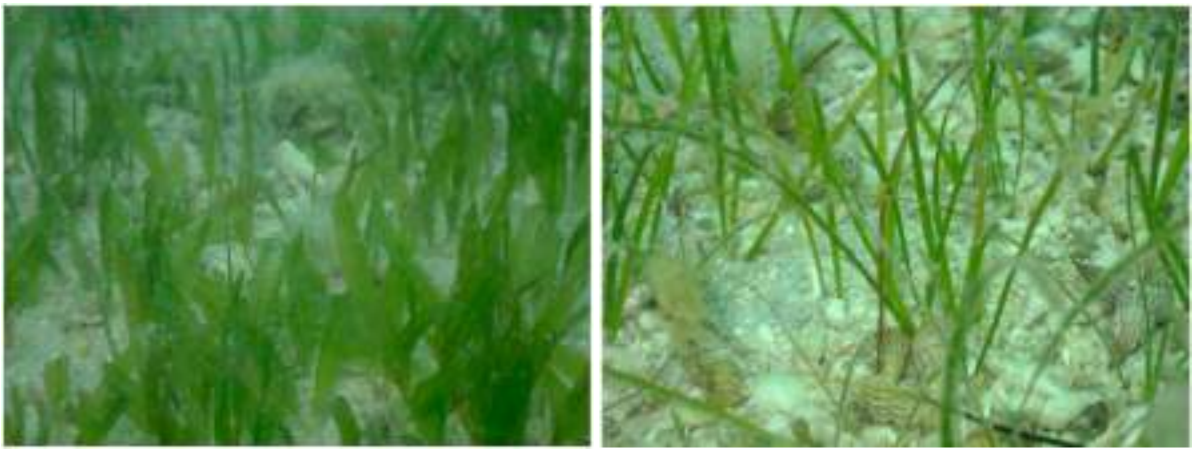


Figure 5-18 Benthic Habitats – *H. stipulacea* (Left) – *C. serrulate* (right)

At Location 3, the benthos was dominated exclusively by continuous seagrass coverage, extending from 5.87 m to 9.81 m depth. No other substrate types or vegetation forms were recorded in this section. Location 4 continued this pattern, with seagrass meadows recorded throughout the surveyed depth range of 6.65 m to 12.87 m. The assemblage remained consistent in species composition and structural characteristics, with no other dominant benthic types observed. At Location 5, the benthic environment transitioned to being predominantly covered by turf algae, particularly at greater depths between 12.25 m and 15.38 m. Seagrass was still present but more sporadic, recorded between 12.36 m and 14.6 m, typically in co-occurrence with patches of turf algae. No live or dead coral structures were recorded throughout the entire survey area, and no coral taxa were observed.

Figure 5-19 Representative benthic habitats – Sand (Left), Shell fragments Right)

The habitat map of Benthic habitats is shown on the figure below indicating ht elocations of seagrass along the intake and outfall.

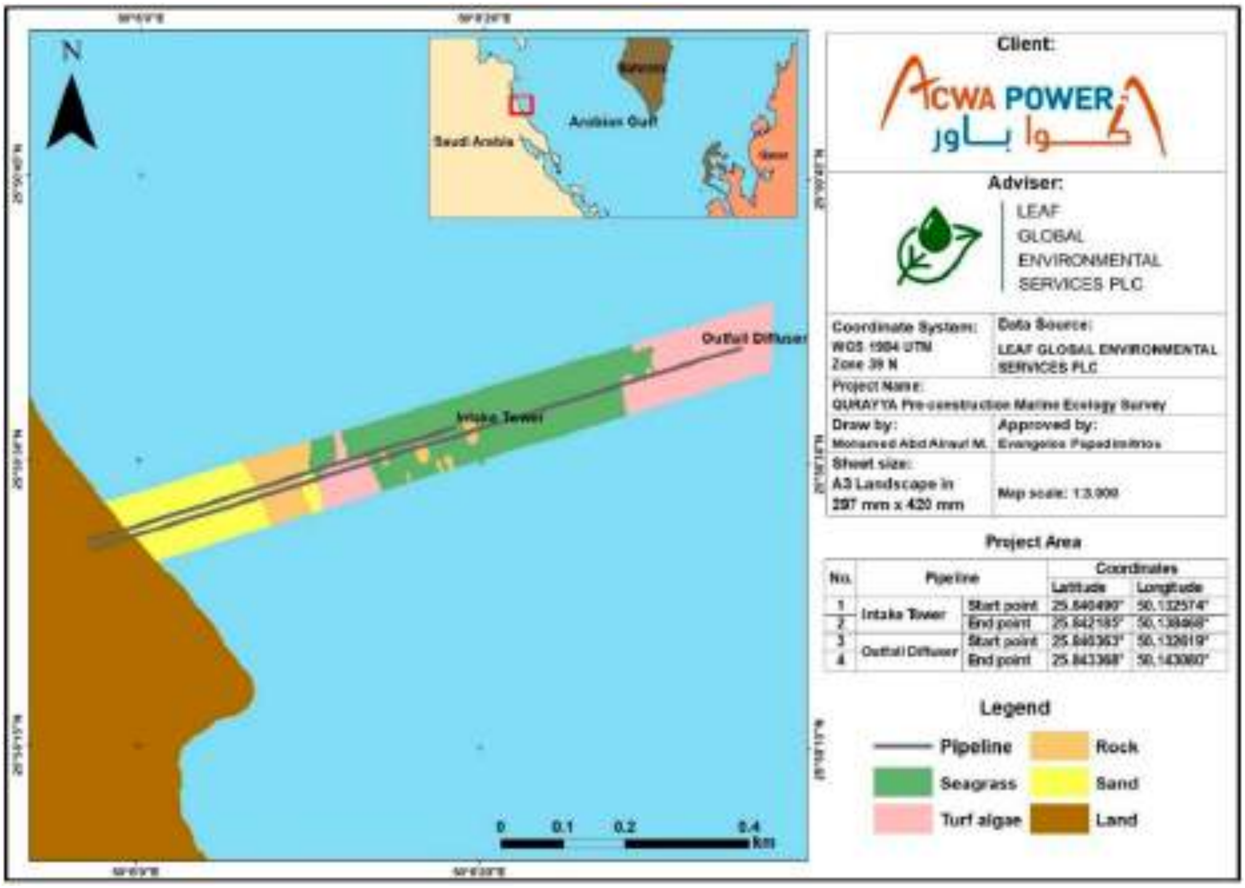


Figure 5-20 Habitat Mapping of the Survey Area (LGES, 2025)

<u>Reef Fish Census</u>

The reef fish census conducted across the five surveyed locations recorded variable species presence and abundance. At Location 1, no fish species were observed during the assessment. At Location 2, three species were identified. *Pomacanthus maculosus* was recorded with six individuals observed within small size classes. *Caranx melampygus* (bluefin trevally) was present with three individuals, and *Scomberoides lysan* was observed with two individuals. At Location 3, five species were recorded. *Pomacanthus maculosus* was represented by five individuals. *Scomberoides lysan* was observed with three individuals. *Stegostoma fasciatum* (zebra shark) was recorded with two juvenile individuals. *Ostracion cubicus* (boxfish) was present with four individuals, and Gobiodon spp. (goby) was observed with six individuals. Location 4 exhibited four fish species. *Pomacanthus maculosus* was the most frequently recorded species at this location, with eight individuals. *Gobiodon* spp. was observed with four individuals, *Blenniidae* spp. (blenny) with three individuals, and *Ostracion cubicus* with two individuals. At Location 5, only *Pomacanthus maculosus* was recorded, with a total of four individuals. All identified species are categorised as least concern on the International Union for Conservation of Nature (IUCN) red list except for the Endangered zebra sharks (*Stegostoma fasciatum*).

<u>Megafauna</u>

No marine megafauna were observed during the survey.

5.2.7 Marine and Sediment Quality

5.2.7.1 Desk Review

The Arabian Gulf is a shallow, semi-enclosed marginal sea characterized by extreme oceanographic conditions due to high evaporation, limited freshwater inflow, and restricted exchange with the Indian Ocean through the Strait of Hormuz (Sheppard et al., 2010; Vaughan et al., 2019). These factors result in high salinity levels that often exceed 43 PSU and seasonal water temperatures ranging from 15 °C in winter to over 36 °C in summer (Price et al., 1993; Al-Yamani et al., 2017).

The quality of marine water and sediments in Qurrayyah, the Arabic Gulf is significantly influenced by human activities, including industrial discharge and urbanization, which leads to the accumulation of heavy metals and hydrocarbon pollution (Youssef et al., 2015; al-Jber and al-Sarawi, 2024). Environmental factors such as geomorphological changes further exacerbate these problems (Loughland et al., 2012; Siddig et al., 2019). Understanding the characteristics of the sediment is vital for effective management (AlShenawy et al., 2021; Youssef and El-Sorogy, 2016) and for addressing the broader climatic influences and their effects on sea level is essential (Abdul Muttalib et al., 2020; Madah and Gharbi, 2022).

Despite these environmental extremes, the Arabian Gulf supports diverse and productive ecosystems, including coral reefs, seagrass beds, mangroves, intertidal mudflats, and soft sediment habitats (Naser, 2011a; Erftemeijer & Shuail, 2012; Burt, 2013). Marine biodiversity in the Gulf includes more than 700 fish species, of which a notable proportion are endemic or regionally adapted to extreme environmental conditions (Sheppard et al., 1992; Khan et al., 2002). Three seagrass species (Halodule uninervis, Halophila stipulacea, and Halophila ovalis) dominate the Gulf's seafloor flora and form critical nursery grounds for penaeid shrimps, fish, and endangered megafauna such as green turtles (Chelonia mydas) and dugongs (Dugong dugon) (Preen, 2004; Abdulqader & Miller, 2012). The region also supports significant populations of marine mammals, including Indo-Pacific humpback dolphins (Sousa plumbea),

However, the water quality in the Arabian Gulf varies widely by location and is affected by both natural conditions and anthropogenic activities. The Gulf is shallow with average depth of approximately 35 meters, making it more sensitive to pollution and temperature changes. It is further characterised by high salinity due to high evaporation rates and limited freshwater inflow, salinity levels are among the highest in the world, ranging from 40–50 PSU in some areas. Additionally, the warm water temperatures can exceed 35°C (95°F) in summer, resulting in stress on marine ecosystems.

5.2.7.2 Marine Water and Sediment Sampling and Analysis

Marine water and sedimet quality samples were collected and sent for analysis by LGES as part of the marine survey. The methodology and outcomes are summarised in the following sections and provided in detail in **Appendix J.**

SURVEY METHODOLOGY

In Situ Water Quality

In-situ water quality measurements were conducted at five locations within the study area. A multiparameter probe (Xylem YSI ProDSS) was deployed to collect data by systematically lowering and raising the probe through the water column. Measurements were taken at two depth intervals: near the surface (-1 m) and near the seabed

(+1 m). The recorded parameters included turbidity, temperature, depth, total dissolved solids (TDS), conductivity, dissolved oxygen (DO), pH, and salinity. In areas with shallow water depths, measurements were limited to a single depth due to minimal vertical stratification.

Seawater, Sediment and Infauna Sampling

Seawater, sediment, and infauna samples were collected from five locations, with one sample taken from each location, to assess environmental quality and evaluate ecological conditions. Seawater samples were obtained using a Niskin water sampler from mid-water column depths and analyzed in the laboratory for key environmental parameters, including biological oxygen demand (BOD), chemical oxygen demand (COD), hydrocarbons (HC), ammonia (NH), chloride (Cl), calcium (Ca), dissolved oxygen (DO), total organic carbon (TOC), dissolved organic carbon (DOC), heavy metals (Cd, Cr, Fe, Pb, Hg, Cu), and microbiological indicators such as fecal coliforms. Sediment samples were collected to determine physical and chemical characteristics, including grain size distribution and sediment chemistry.

A total of 5 seawater, sedimnet and Infauna samples taken at different location points were analysed. These samples were processed following EPA Environmental Monitoring and Assessment Program guidelines. Samples were sieved through a 0.5 mm mesh, preserved, and examined under a dissecting microscope to separate organisms from sediment. Identification was conducted to the lowest reliable taxonomic level, with verification by external taxonomists. Community composition was analyzed by comparing numerically common taxa and higher taxonomic groupings such as polychaetes, amphipods, bivalves, and oligochaetes to observe distribution patterns.

Figure 5-21 In-situ Water Quality and Seawater, Sediment and Infauna Sampling Locations

SURVEY RESULTS

Survey results are as summarised below. Refer to **Appendix J** for the comprehensive report.

In Situ and Seawater Quality

The water exhibited a pH of 8.1, well within the NCEC acceptable range (6.5–9), indicating stable buffering capacity. Temperature was measured at 24.7 °C, consistent with expected ambient levels for late spring in the Arabian Gulf. Turbidity was low and significantly below the 3 NTU threshold, thus suggesting minimal suspended particulate matter in the water column. Salinity was high at 49.78 PSU however, this is typical for the Gulf as it reflects strong evaporation and limited freshwater inflow. TDS (Total Dissolved Solids) was elevated, a typical characteristic of hypersaline environments in the region. Sulfate concentrations reached 3,400 mg/L likely due to seawater ionic composition and evaporation effects. Dissolved Oxygen was 7.2 mg/L, well above the minimum requirement (5 mg/L), indicating good oxygenation and limited organic pollution. Nutrient-related parameters such as ammonia, nitrate and nitrite remained within expected background concentrations. These parameters are typical for the Arabian Gulf, with no signs of stratification or water quality degradation.

Key physicochemical and nutrient parameters including chloride, sulfate, total phosphorus, total nitrogen, and total organic carbon, were well below regulatory thresholds. Heavy metals such as lead, cadmium, mercury, chromium, and copper were either not detected or present in trace concentrations far below levels of concern. Microbiological parameters, including total coliforms and E. coli, were undetectable across all sites. Sediment analysis confirmed a predominance of carbonate-rich sand and low levels of contaminants. Total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), and heavy metals were either absent or detected at minimal levels across all locations, reflecting the absence of historical or ongoing anthropogenic pollution.

Sediments

Grain size analysis showed a predominance of coarse particles, with 100% of sediment passing the 9.5 mm sieve and a significant portion retained above 2 mm, particularly at Location 3, where 90.1% passed the 2 mm sieve. Finer fractions (<0.075 mm) ranged from 5.0% (Location 3) to 8.1% (Location 5), indicating overall coarse-grained sediments.

Macro-benthic Infauna

The macro-benthic infauna from five samples had a population with an average of 74 individuals per sample. The total population recorded in all five samples is 370 individuals.

The macro-benthic community from the Project Area consisted of two phyla. Mollusca (99.2%) followed by Retaria (0.8%) were the major phyla of macro-benthic infauna from the Project area.

A total of 28 species of macro-benthic infauna were recorded from all the samples. Cerithium sp. (57.3%), Timoclea sp. (8.9%), Veneridae sp. (4.6%), Trochidae sp. (4.3%) and Phasianellidae (3.5%) were the major species of the macro-benthic infauna from the Project area.

5.2.8 Solid Waste and Wastewater

5.2.8.1 Desk Review

Solid waste generation in Saudi Arabia is growing rapidly due to continued industrial and economic growth. Consequently, responsible waste management is essential to minimise direct and indirect impacts upon the environment as a result of waste generation and resource consumption. Rapid economic development often precedes the required infrastructure to handle the wastes generated. Therefore, in order to allow sustainable and environmentally friendly economic development of KSA, it is vital to consider the methods for handling, storage and management of waste generated in conjunction with progressions in a country's economy.

Waste management sites and facilities in KSA are operated and managed by private companies or local municipalities, with MWAN providing an advisory role in their operation. Municipal solid waste is disposed of at landfill sites under the management/responsibility of the municipality. Whilst hazardous waste is regulated and permitted by NCEC in accordance with license transporters and hazardous waste management service providers. When new sites are proposed, NWMC will advise the operators on the environmental protection requirements for each facility.

Industrial waste generators are required to engage with MWAN licensed private contractors to collect, transport, manage, treat and/or dispose of their waste. Several waste management companies are available in KSA, and this depends on their region. A number of these own and operate their own treatment and/or landfill facilities, where industrial wastes are processed. There is no data on the quantities of non-hazardous industrial waste produced in Saudi Arabia as it is calculated in the total of municipal solid waste. These wastes are disposed of as part of the municipal solid waste in municipal landfills.

The Ministry of Environment, Water and Agriculture (MEWA) is responsible for household wastewater from connected sewerage systems. Users that are not connected to sewerage systems (including all industrial generators) are required to arrange wastewater collections and treatment via licensed wastewater contractors and facilities.

Waste management sites and facilities in KSA are operated and managed by private companies or local municipalities, with the National Waste Management Centre (NWMC) providing an advisory role in their operation. Municipal solid waste is disposed of at landfill sites under the management/responsibility of the municipality. Whilst hazardous waste is regulated and permitted by NCEC in accordance with license transporters and hazardous waste management service providers. When new sites are proposed, NWMC will advise the operators on the environmental protection requirements for each facility.

Based on the MEWA website, there is more than 1,000 facilities in KSA for the collection, transport, sorting, handling or management of general municipal waste, hazardous waste, construction and demolition waste etc. The facilities closest to the Project Area are those located in Khobarlisted in Table 5-8 below. In addition to these, more than120 waste handling and management facilities are loctaed in Dammam.

Table 5-8 Waste Handling Facilities Closest to Hajr Two CCGT IPP (MWAN, 202)

Location	Type of Facility	Distance to Hajr Two IPP
Khobar	• Three facilities for hazardous waste collection: - Oil waste collection - Chemical waste collection - Chemical waste & sludge collection • Two facilities for non-hazardous waste collection: - Commercial & administrative waste collection - Construction & demolition waste collection • Three facilities for hazardous (Asbestos) waste treatment • Two facilities for sorting & processing recyclables	40 km

5.2.8.2 Site Condition

At the Qurrayah site, previously used as workers' accommodation for an EPC contractor. The worker's accommodation has been decommissioned but the site has construction and demolition waste scattered across it, which includes remnants of concrete, bricks, metal, wood, plastic, and other materials as shown on the following figure.

Figure 5-22 Construction and Demolition Waste at the Project Site

5.2.9 Landscape and Visual Amenity

The area allocated for the proposed Project is located in the Eastern Region of KSA, where the Kingdom's main oil and gas fields and refineries are located. The Project is located within a fenced-off site, controlled by SEC in the Qurrayah industrial complex, between the existing SEC Qurrayah Steam Plant in the north and the SEC Qurrayah Combined Cycle Plant in the south as shown on the following photos.

Figure 5-23 SEC Qurrayah Steam Plant

Figure 5-24 SEC Qurrayah Combined Cycle Plant

The complex also includes support infrastructure, site offices and worker accommodation, laydown areas and gas pipeline corridors. As such the predominant theme in the areas is functionality, with little or no landscaping typically associated with administration and office or accommodation buildings.

5.2.10 Traffic & Transportation

5.2.10.1 Desktop Review

Ports

The Qurrayah Complex benefits from well-developed logistics infrastructure, with multiple efficient routes available by air, sea, and road for the transport of equipment and materials. Located approximately 60 kilometers to the north, the city of Dammam serves as a major logistics hub, featuring a commercial port that facilitates the import and export of large equipment and materials. Dammam also hosts an international airport with dedicated freight handling facilities, enabling rapid and secure transport by air.

The site is well-connected by road, with main highways linking the Qurrayah industrial area. These routes provide reliable access for heavy and oversized vehicles, which is essential for the continuous supply chain. With the site being within an active industrial complex, the existing transportation network minimizes logistical challenges, making the site accessible for large-scale operations.

Roads and Site Access

It is intended that the project will utilise the existing public road network for the logistics of project materials and components, and to access the development site. Existing road networks will be utilised as far as possible to minimise potential impacts.

In the local region context, it is envisaged that the project will utilise the Khobar-Salwa Coastal Road then connect to the local Qurrayah Road. To gain access to the project development footprint, a secondary access road that spans approximately 4km, directly connecting to Qurrayah road will be utilised.

Internal access roads will be developed within the development footprint; however, existing internal access roads will be utilised as far as possible.

Ports

The project will utilise the Jubail Industrial port that is located approximately 200km away from the project development footprint to transport project components. The route from the port to the development site is as depicted below.

Figure 5-25 Logistics routes from Jubail Industrial Port to the project footprint

Airports

The nearest airport to the project development site is the Al Ahsa Airport located 89km away from the development footprint. Additionally, the King Fahd International Airport is located approximately 75km from the project site.

5.3 Terrestrial Ecology

5.3.1 Desktop Review

The flora and fauna diversity of the Saudi Arabia is influenced by the habitats that are created by the varying topography, geology, and localised climate conditions. The vast majority of the Saudi Arabia is characterised by arid desert conditions, which provides harsh environments for species to thrive in due to the extreme temperatures and lack of water sources.

The flora of KSA reflects the geographical position of the Arabian Peninsula between Africa, Asia and Europe. There are 2,250 species of flowering plants in Saudi Arabia of which some 246 species are considered regionally endemic. There are 93 mammal species, 432 bird species, 9 freshwater fish species, 103 reptiles and 7 amphibians found in KSA[7].

The Key Biodiversity Areas (KBA) and Important Bird Areas (IBA) identified within the 50 km and 100 km buffer area of the Project are shown on the following figure.The project is located within Khalij Salwa[8] which was proposed as a protected area in Saudi Arabia in 1990 under the IUCN Management Category IV (habitat or species management area). However, it remains a proposed designation with limited available information on the ecological significance of the area are not published and no reported management plans to date.

The project is also located around 8km from the Gulf of Salwah. The Gulf of Salwah, a shallow, hypersaline bay between Saudi Arabia and Qatar, is ecologically significant for the presence of seagrass, diverse breeding and wintering seabird species, including the vulnerable Socotra cormorant, and marine mammals like the dugong. It has been designated as a KBA and an IBA by BirdLife International[9].

The remaining protected areas are more than 30km away from the project site.

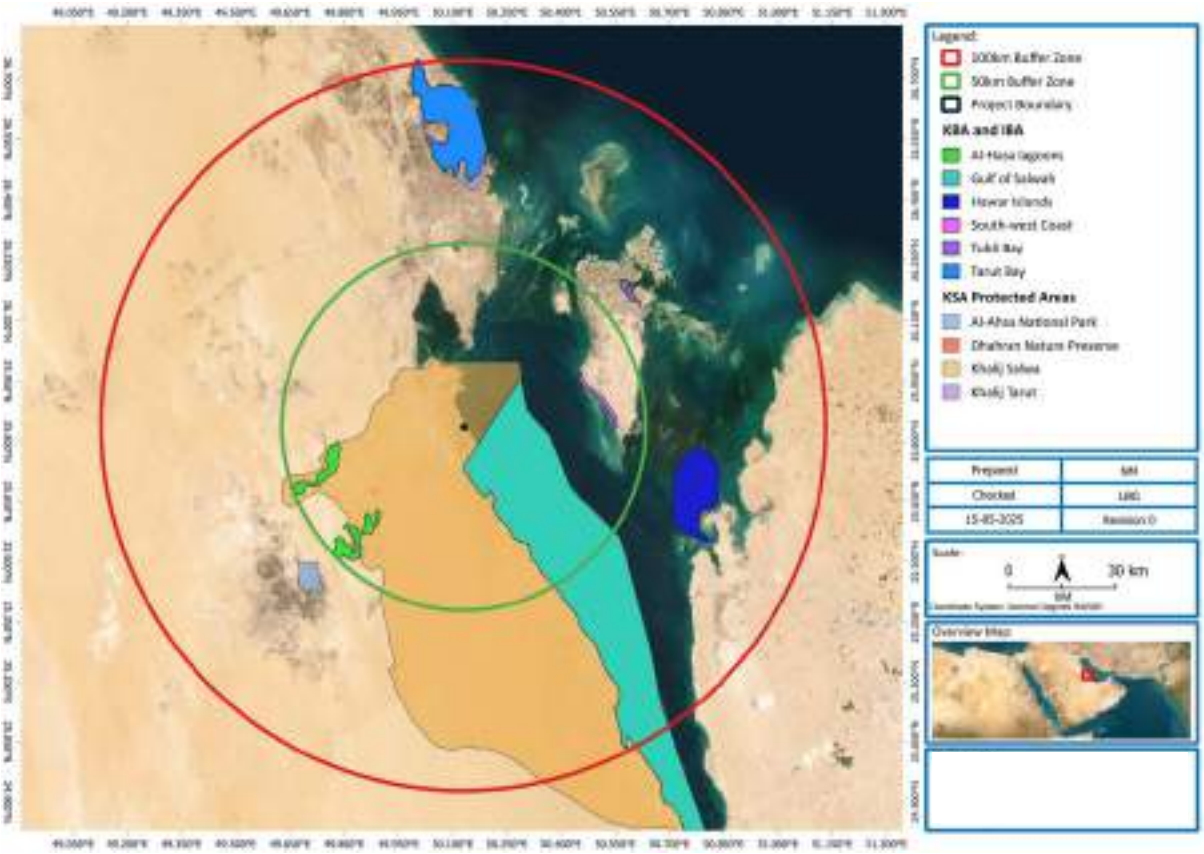


Figure 5-26 KBAs and IBAs within the Project Area

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7 https://www.cbd.int/countries/profile/?country=sa
8 UNEP-WCMC (2025). Protected Area Profile for Khalij Salwa from the World Database on Protected Areas, May 2025. Available at: https://www.protectedplanet.net/11995
9 BirdLife International (2025) Site factsheet: Gulf of Salwah. Downloaded from https://datazone.birdlife.org/site/factsheet/gulf-of-salwah?utm on 18/05/2025

5.3.2 Baseline Survey

The Project site is located along the coast is approximately 60km south of Dammam city and 40km east of Buqayq town. The Project is located within heavily disturbed area previously used for temporary accommodation and site offices during the construction of nearby power plants.

Although the site has since been vacated, it remains littered with construction waste, such as large concrete slabs, tarmac, rockwool, metal, and HDPE pipes. Vegetation at the site is abundant but limited to a few species, including date palms, ornamental trees, grasses, herbs, and shrubs. A low-lying area with reeds is also present along the northern boundary.

Figure 5-27 Photos from the Project Site

A site visit was undertaken in November 2024 and observations indicated the Project site is a typical desert habitat with sparse natural and native vegetation, primarily small shrubs as well as large ornamental and landscape trees. No fauna species were identified during the site visit.

All flora species observed during the site visit were recorded and identified. All species recorded are common for the region, and none are listed on the KSA high priority list. Four specie are Least Concern on the IUCN list while the remaining species are not evaluated. The results are presented in the following table.

Table 5-9 Flora Species Recorded on Site

#	Scientific Name	IUCN Conservation Status	KSA High Conservation Priority List[10]	Photo
1	*Salsola sp.*	Not evaluated	Not Listed	
2	*Conocarpus erectus*	Least Concern	Not Listed	
3	*Heliotropium bacciferum*	Least Concern	Not Listed	
4	*Phragmites australis*	Not evaluated	Not Listed	

[10] https://www.cbd.int/doc/world/sa/sa-nr-01-en.pdf

#	Scientific Name	IUCN Conservation Status	KSA High Conservation Priority List[10]	Photo
5	*Tamarix arabica*	Least Concern	Not Listed	
6	*Heliotropium curssavicum*	Least Concern	Not Listed	

No mammal species were observed during the site walk-over survey.

No reptiles were observed across the site. In addition, no burrows of the Spiny Tailed Lizard (Saudi High Conservation Priority Species) were observed.

Additionally, no avifaunal species were observed during the site surveys with no recordings of bird nests.

5.3.3 Critical Habitat Screening

5.3.3.1 Approach

The critical habitat screening was informed by a high-level review of globally recognized biodiversity datasets. This included the examination of protected areas, Key Biodiversity Areas (including Important Bird and Biodiversity Areas and Alliance for Zero Extinction sites), biodiversity hotspots, and the known distribution of IUCN Red List species. At the site level, the review considered available information on species occurrences, habitats, and broader landscape-scale ecological features to identify any potential sensitivities within or near the Project area.

The Critical Habitat criteria outlined under IFC PS6 considered during the screening are presented in Table 5-10.

Table 5-10 IFC PS6 Critical Habitat Criteria with Quantitative Thresholds

Criteria	Thresholds
Criterion 1: Critically Endangered and Endangered Species	Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (0.5% of the global population AND 5 reproductive units of a CR or EN species);

Criteria	Thresholds
	Areas that support globally important concentrations of an IUCN Red-listed VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds at (a). As appropriate, areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species.
Criterion 2: Endemic and Restricted-range Species	areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species.
Criterion 3: Migratory and Congregatory Species	areas known to sustain, on a cyclical or otherwise regular basis, ≥1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle. areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.
Criterion 4: Highly threatened and/or unique ecosystems	Areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. Other areas, not yet assessed by IUCN, but determined to be of high priority for conservation by regional or national systematic conservation planning.
Criterion 5: Key Evolutionary Processes	No quantitative thresholds applicable.

5.3.3.2 Methodology

IBAT Assessment

The Integrated Biodiversity Assessment Tool (IBAT) was utilized during the Critical Habitat (CH) screening process to identify potential overlaps with globally recognized biodiversity priorities. The IBAT platform provides access to data from key global conservation datasets, including the IUCN Red List of Threatened Species, the World Database on Protected Areas (WDPA), and Key Biodiversity Areas (KBAs). This assessment was instrumental in identifying the presence of critical species and habitats within the Project landscape.

Review of Literature and Secondary Resources

A review of available data and literature on the biodiversity potentially occurring in and around the Project landscape was undertaken. This primarily included biodiversity databases. Information was considered from datasets such as the IUCN Redlist of species including range distributions and occurrence points. Additional occurrence data were reviewed from the Global Biodiversity Information Facility and iNaturalist.org, as needed.

Table 5-11 List of Secondary Resources Reviewed

SN	Data Source	Purpose
1	IUCN Red List for Threatened Species Online Version (2025-1)	It is the world's most comprehensive inventory of global conservation status of species. It provides a list of threatened species by classifying them under different categories from Least Concern (LC) to Extinct (EX) through an understanding of global distribution, population status and trends of the species. Classification of species, distribution, habitat preference and threats of species are also given.
2	ebird.org	ebird.org provides a geo-referenced list of identified bird species in a given area.
3	Alliance for Zero Extinction	The Alliance for Zero Extinction (AZE) is a global initiative aimed at preventing extinctions by identifying and safeguarding sites that are crucial for the survival of endangered species. These sites, known as Alliance for Zero Extinction sites, are locations where species considered to be at the brink of extinction have their last remaining habitat.
4	Integrated Biodiversity Assessment Tool (IBAT)	It screens the Project landscape for the presence of IUCN threatened, migratory, endemic species and provide a list of potential species for the assessment.

SN	Data Source	Purpose
5	Bird Life International Data Zone	Birdlife International maintains a database of Important Bird Areas (IBAs) with a species list found in these IBAs, measure of sensitivity of these habitats and identifies migratory, congregatory and threatened species in the area.
6	iNaturalist	An online social network of naturalists, citizen scientists, and biologists built on the concept of mapping and sharing observations of biodiversity across the globe. Areas falling within scoping area were run through this database.
7	Global Biodiversity Information Facility (GBIF)	GBIF is an international organization that focuses on making scientific data on biodiversity available online. The data are provided by many institutions from around the world; GBIF's information architecture makes these data accessible and searchable through a single portal.

Identification of CH Scoping Area for Screening

It involved defining relatively wider landscape to evaluate the potential presence of species or habitats that could meet Critical Habitat criteria. A buffer of 5 km to the Project Site (approximately 90 km²) was considered as scoping area for the screening exercise.

5.3.3.3 Screening against Criteria 1 through 3

Critical habitat screening was undertaken using the IBAT tool to identify species of conservation concern within a 50 km radius of the Project site. The focus was on Critically Endangered (CR), Endangered (EN), and range-restricted species. An initial list of potential species was generated and reviewed to assess their likelihood of occurrence and the presence of suitable habitats in and around the Project area.

As a further step, a high-level assessment was conducted for species with overlapping distribution ranges to evaluate the likelihood of their occurrence in globally significant concentrations.

IUCN Vulnerable (VU) and migratory/congregatory species were excluded at the initial screening stage. This was based on the extremely small footprint of the Project site compared to the extensive distribution ranges of these species. Additionally, a review of online databases such as eBird, GBIF, etc. indicated no evidence of significant congregations of these species in the Project area or its immediate surroundings. Therefore, it is unlikely that the area supports globally significant concentrations of congregatory species, or any population of VU species that would be significant enough for its loss to affect the global IUCN status of the species.

Majority of the IBAT screened species are associated with marine biome with extensive distribution ranges. In the absence of evidence for any nesting or aggregation sites of such species near the Project area, they have been scoped out.

Based on the available data and high level review, none of the identified species are likely to meet the quantitative thresholds outlined in IFC PS6 for Critical Habitat designation under Criteria 1, 2 or 3. The species were scoped out from requiring further assessment based on one or more of the following considerations:

- No known or regular occurrences within the Project area or surrounding landscape, as indicated by existing databases and literature.
- Occurrence records were sporadic or did not suggest populations that would meet quantitative thresholds.
- No evidence of aggregation, staging or nesting sites, and no records of significant congregations of migratory or congregatory species within the area..

- No spatial overlap between the Project footprint, species distribution range or any conservation areas, Important Bird and Biodiversity Areas (IBAs) designated for target species.
- Project area constitutes a negligible portion of the species' extensive distribution range, making it unlikely to hold globally significant populations.
- Absence of suitable/preferred habitat of the species in the Project area

The list of species screened has been provided in the following table.

Table 5-12 List of Species Screened for CH

SN	Class	Common Name	Scientific Name	IUCN Status (v 2025-1)	Range Restricted	IFC CH Criteria	Global Population (IUCN Database)	Rationale for scoping out
1	Aves	Great Knot	*Calidris tenuirostris*	EN	No	1a, c	292,000-295,000 individuals	The scoping area is unlikely to hold 0.5% of the global population i.e. 1428 individuals of the species
2	Aves	Saker Falcon	*Falco cherrug*	EN	No	1 a, c	12,200-29,800 mature individuals	No records from scoping area (eBird.org) and it is unlikely to hold 0.5% (61 individuals) of global population.
3	Aves	Steppe Eagle	*Aquila nipalensis*	EN	No	1 a, c	50,000-75,000 mature individuals	No records from scoping area (eBird.org) and it is unlikely to hold 0.5% (250 individuals) of global population.
4	Aves	Socotra Cormorant	*Phalacrocorax nigrogularis*	VU	No	1b, 3a	220,000	Reported from Gulf of Salwah IBA, located at around 8 km from the Project area, but no records from the scoping area. Unlikely to support 1% (2200 individuals) of global population.
5	Mammalia	Indian Ocean Humpback Dolphin	*Sousa plumbea*	EN	No	1 a, c	Unknown	No records from scoping area. Unlikely to support globally significant population.
6	Reptilia	Hawksbill Turtle	*Eretmochelys imbricata*	CR	No	1 a, c	Unknown	No known records within the scoping area. None of the important turtle foraging/nesting areas in Arabian Gulf mapped in SWOT[11] report are in located the scoping area or surrounding landscape. Species has an extremely wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to support globally significant population.
7	Reptilia	Green Turtle	*Chelonia mydas*	EN	No	1 a, c	Unknown	No known records within the scoping area. None of the important turtle foraging/nesting areas in Arabian Gulf

[11] https://www.seaturtlestatus.org/articles/2015/important-turtle-areas-in-the-arabian-gulf

SN	Class	Common Name	Scientific Name	IUCN Status (v 2025-1)	Range Restricted	IFC CH Criteria	Global Population (IUCN Database)	Rationale for scoping out
								mapped in SWOT[12] report are in located the scoping area or surrounding landscape. Species has an extremely wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to support globally significant population.
8	Chondrichthyes	Sand Tiger Shark	*Carcharias taurus*	CR	No	1 a, c	Unknown	No known records within the scoping area. Species has a wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to support globally significant population.
9	Chondrichthyes	Scalloped Hammerhead	*Sphyrna lewini*	CR	No	1 a, c	Unknown	No known records within the scoping area. Species has an extremely wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to support globally significant population.
10	Chondrichthyes	Great Hammerhead	*Sphyrna mokarran*	CR	No	1 a, c	Unknown	No known records within the scoping area. Species has an extremely wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to support globally significant population.
11	Chondrichthyes	Green Sawfish	*Pristis zijsron*	CR	No	1 a, c	Unknown	No known records within the scoping area. IUCN Redlist indicates "Presence Uncertain" in the scoping area and along the Saudi Arabian coastal region of Arabian Gulf.
12	Chondrichthyes	Whitespotted Wedgefish	*Rhynchobatus djiddensis*	CR	No	1 a, c	Unknown	No known records within the scoping area. Species has a wide distribution, with the scoping area representing only a tiny

[12] https://www.seaturtlestatus.org/articles/2015/important-turtle-areas-in-the-arabian-gulf

SN	Class	Common Name	Scientific Name	IUCN Status (v 2025-1)	Range Restricted	IFC CH Criteria	Global Population (IUCN Database)	Rationale for scoping out
								fraction of its range. Unlikely to support globally significant population.
13	Chondrichthyes	Bowmouth Guitarfish	*Rhina ancylostomus*	CR	No	1 a, c	Unknown	No known records within the scoping area. Species has an extremely wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to support globally significant population.
14	Chondrichthyes	Bottlenose Wedgefish	*Rhynchobatus australiae*	CR	No	1 a, c	Unknown	No known records within the scoping area. Species has an extremely wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to support globally significant population.
15	Chondrichthyes	Halavi Guitarfish	*Glaucostegus halavi*	CR	No	1 a, c	Unknown	No known records within the scoping area. Scoping area represents a tiny fraction of its range. Unlikely to support globally significant population.
16	Chondrichthyes	Smoothnose Wedgefish	*Rhynchobatus laevis*	CR	No	1 a, c	Unknown	No known records within the scoping area. Scoping area represents a tiny fraction of its range. Unlikely to support globally significant population.
17	Chondrichthyes	Sandbar Shark	*Carcharhinus plumbeus*	EN	No	1 a, c	Unknown	No known records within the scoping area. Species has an extremely wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to support globally significant population.
18	Chondrichthyes	Whale Shark	*Rhincodon typus*	EN	No	1 a, c	27,401-179,794 individuals (Tentative estimate)	No known records within the scoping area. Species has an extremely wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to hold 0.5% (137 individuals) of global population.

SN	Class	Common Name	Scientific Name	IUCN Status (v 2025-1)	Range Restricted	IFC CH Criteria	Global Population (IUCN Database)	Rationale for scoping out
19	Chondrichthyes	Smoothtooth Blacktip Shark	*Carcharhinus leiodon*	EN	No	1 a, c	Unknown	No known records within the scoping area. Species has a wide distribution range northern Indian Ocean, including the Gulf (UAE, Kuwait, Bahrain), Sea of Oman and Arabian Sea (Oman and Yemen). The scoping area represents a tiny fraction of its range. Unlikely to support globally significant population.
20	Chondrichthyes	Porcupine Ray	*Urogymnus asperrimus*	EN	No	1 a, c	Unknown	No known records within the scoping area. Species has an extremely wide distribution, with the scoping area representing only a tiny fraction of its range. Unlikely to support globally significant population.
21	Chondrichthyes	Winghead Shark	*Eusphyra blochii*	EN	No	1 a, c	Unknown	No known records of these species within the scoping area. The distribution ranges of all these marine species are extremely wide and scoping area represents a very small fraction of their distribution ranges. Thus, it is unlikely that the landscape around Project site supports globally significant numbers of these species.
22	Chondrichthyes	Sharptooth Lemon Shark	*Negaprion acutidens*	EN	No	1 a, c	Unknown	
23	Chondrichthyes	Snaggletooth Shark	*Hemipristis elongata*	EN	No	1 a, c	Unknown	
24	Chondrichthyes	Indo-Pacific Leopard Shark	*Stegostoma tigrinum*	EN	No	1 a, c	Unknown	
25	Chondrichthyes	Panther Torpedo	*Torpedo panthera*	EN	No	1 a, c	Unknown	
26	Chondrichthyes	Bentfin Devil Ray	*Mobula thurstoni*	EN	No	1 a, c	Unknown	
27	Chondrichthyes	Mangrove Whipray	*Urogymnus granulatus*	EN	No	1 a, c	Unknown	
28	Chondrichthyes	Leopard Whipray	*Himantura leoparda*	EN	No	1 a, c	Unknown	
29	Chondrichthyes	Oman Cownose Ray	*Rhinoptera jayakari*	EN	No	1 a, c	Unknown	
30	Chondrichthyes	Oceanic Manta Ray	*Mobula birostris*	EN	No	1 a, c	Unknown	
31	Chondrichthyes	Spotted Eagle Ray	*Aetobatus ocellatus*	EN	No	1 a, c	Unknown	
32	Chondrichthyes	Whitecheek Shark	*Carcharhinus dussumieri*	EN	No	1 a, c	Unknown	

SN	Class	Common Name	Scientific Name	IUCN Status (v 2025-1)	Range Restricted	IFC CH Criteria	Global Population (IUCN Database)	Rationale for scoping out
33	Chondrichthyes	Ocellate Eagle Ray	*Aetomylaeus milvus*	EN	No	1 a, c	Unknown	
34	Chondrichthyes	Spinetail Devil Ray	*Mobula mobular*	EN	No	1 a, c	Unknown	
35	Chondrichthyes	Longhead Eagle Ray	*Aetobatus flagellum*	EN	No	1 a, c	Unknown	
36	Chondrichthyes	Coach Whipray	*Himantura uarnak*	EN	No	1 a, c	Unknown	
37	Gastropoda	-	*Assiminea nitida*	LC	Yes	2 a	Unknown	*Assiminea nitida* is distributed across the Indo-Pacific and in the Arabian Peninsula, it is only recorded in parts of eastern Saudi Arabia. It inhabits mangroves, swamps, and coastal freshwater habitats.
38	Hydrozoa	-	*Millepora tenera*	EN	No	1 a, c	Unknown	
39	Hydrozoa	-	*Millepora platyphylla*	EN	No	1 a, c	Unknown	
40	Actinopterygii	Persian Mullet	*Planiliza persica*	DD	Yes	2 a	Unknown	
41	Actinopterygii	Stanaland's Sole	*Solea stanalandi*	DD	Yes	2 a	Unknown	
42	Actinopterygii	Convict Zebra Sole	*Zebrias captivus*	DD	Yes	2 a	Unknown	
43	Anthozoa	-	*Acropora divaricata*	EN	No	1 a, c	Unknown	All of these coral species of class Anthozoa are primarily distributed throughout the Indo-Pacific region and are known to have broad geographic ranges. There are no known records of these species within the scoping area, and marine baseline surveys conducted in the area did not detect their presence. Given their extensive distributions and the fact that the scoping area represents only a very small fraction of their global range, it is unlikely that this area supports globally significant populations of these species.
44	Anthozoa	-	*Montipora stilosa*	EN	No	1 a, c	Unknown	
45	Anthozoa	-	*Montipora informis*	EN	No	1 a, c	Unknown	
46	Anthozoa	-	*Montipora foliosa*	EN	No	1 a, c	Unknown	
47	Anthozoa	-	*Montipora efflorescens*	EN	No	1 a, c	Unknown	
48	Anthozoa	Cauliflower Coral	*Pocillopora damicornis*	EN	No	1 a, c	Unknown	
49	Anthozoa	-	*Acropora nasuta*	EN	No	1 a, c	Unknown	
50	Anthozoa	-	*Acropora pharaonis*	EN	No	1 a, c	Unknown	
51	Anthozoa	-	*Montipora stellata*	EN	No	1 a, c	Unknown	

SN	Class	Common Name	Scientific Name	IUCN Status (v 2025-1)	Range Restricted	IFC CH Criteria	Global Population (IUCN Database)	Rationale for scoping out
52	Anthozoa	-	*Montipora aequituberculata*	EN	No	1 a, c	Unknown	
53	Anthozoa	-	*Montipora tuberculosa*	EN	No	1 a, c	Unknown	
54	Anthozoa	-	*Acropora downingi*	EN	No	1 a, c	Unknown	
55	Anthozoa	-	*Stylophora subseriata*	EN	No	1 a, c	Unknown	
56	Anthozoa	-	*Acropora yongei*	EN	No	1 a, c	Unknown	
57	Anthozoa	-	*Acropora arabensis*	EN	No	1 a, c	Unknown	
58	Anthozoa	-	*Acropora valenciennesi*	EN	No	1 a, c	Unknown	
59	Anthozoa	-	*Montipora venosa*	EN	No	1 a, c	Unknown	
60	Anthozoa	-	*Montipora mollis*	EN	No	1 a, c	Unknown	
61	Anthozoa	-	*Acropora muricata*	EN	No	1 a, c	Unknown	
62	Anthozoa	-	*Acropora tenuis*	EN	No	1 a, c	Unknown	
63	Anthozoa	-	*Acropora clathrata*	EN	No	1 a, c	Unknown	
64	Anthozoa	-	*Acropora valida*	EN	No	1 a, c	Unknown	
65	Anthozoa	-	*Acropora horrida*	EN	No	1 a, c	Unknown	

Note: Scoping out a species from the further assessment or need of detail CHA does not confirm its absence in the Project Area. It simply evaluates the likelihood of the species meeting the IFC PS6 quantitative thresholds.

5.3.3.4 Screening against Criteria 4 and 5

The Project site is located within industrial area and habitats within the Project area are of arid type, characterized by sparse vegetation. They are not recognized as highly threatened ecosystems in global or regional conservation frameworks, such as those identified by the IUCN Red List of Ecosystems, etc.

Thus, Project site does not have any highly unique or threatened ecosystem types or distinctive evolutionary processes that could result in a CH determination under IFC CH Criteria 4 or 5.

5.4 Archaeology & Cultural Heritage

5.4.1 Desktop Review

KSA has a rich archaeological and cultural heritage resource, which extends back some 100,000 years or more. A review of existing literature on archeologically and historically relevant sites in KSA shows a selection of significant sites, which include ancient palaces, castles, trading villages and more. Within these sites, archaeological artefacts have also been found.

5.4.1.1 Intangible Cultural Heritage

Intangible heritage is defined as the practices, representations, expressions, as well as the knowledge and skills (including instruments, objects, artefacts, cultural spaces), that communities, groups and, in some cases, individuals recognised as part of their cultural heritage. It is sometimes called living cultural heritage and includes oral traditions and expressions, including language; performing arts; social practices, rituals and festive events; knowledge and practices concerning nature and the universe; and traditional craftsmanship (UNESCO, 2003).

Saudi Arabia is a signatory of the UNESCO Convention on Intangible Cultural Heritage (ICH), and a number of elements of ICH within KSA have been added to UNESCO's Representative List of the Intangible Cultural Heritage of Humanity. These are:

- Date palm, knowledge, skills, traditions, and practices
- Almezmar, drumming and dancing with sticks.
- Falconry, a living heritage
- Alardah Alnajdiyah, dance, drumming and poetry in Saudi Arabia
- Arabic coffee, a symbol of generosity
- Majlis, a cultural and social space
- Al-Qatt Al-Asiri, female traditional interior wall decoration in Asir

5.4.1.2 Critical Cultural Heritage

Critical cultural heritage consists of one or both of the following types of cultural heritage:

(i) The internationally recognised heritage of communities who use, or have used within living memory, their cultural heritage for long-standing cultural purposes; or

(ii) Legally protected cultural heritage areas, including those proposed by host governments for such designation.

Saudi Arabia has six (6) cultural sites inscribed on the World Heritage List:

- Al-Hijr Archaeological Site (Madâin Sâlih) (2008; WHS Ref. 1293);
- At-Turaif District in ad-Dir'iyah (2010; WHS Ref. 1329);
- Historic Jeddah, the Gate to Makkah (2014; WHS Ref. 1361);
- Rock Art in the Hail Region of Saudi Arabia (2015; WHS Ref. 1472);
- Al-Ahsa Oasis, an Evolving Cultural Landscape (2018; WHS Ref. 1563); and
- Hima Cultural Area (2021; WHS Ref. 1619).

The closest UNESCO World Heritage Site to the Hajr Two IPP site is the Al-Ahsa Oasis. It is approximately 41km from the Al-Asfar Lake UNESCO Site as shown on the following figure.

Figure 5-28 Nearest UNESCO Sites

Tentative List

In addition to the sites already inscribed on the World Heritage list, the below nine sites are on Saudi Arabia's Tentative List, which is an inventory of sites which it intends to consider for nomination as World Heritage Sites, these are:

- Darb Zubayda (Pilgrim Road from Kufa to Makkah);
- Hejaz Railway;
- Syrian Hajj Road;
- Egyptian Hajj Road;
- Al-Faw Pre-Islamic City in Central Arabia (Qariah);

- Rijal Almaa Heritage Village in Assir Region;
- Zee Ain Heritage Village in Al-Baha Region;
- Hima a rock art site in Najran; and
- Dûmat Al-Jandal Historical Oasis in Al-Jawf Region.

5.4.2 Site Visit Observations

The historic port of Al Uqair, situated approximately 22 km south of the project site, is the only noted historical site in the area. The project site itself is located within an industrial area between two existing power plants, with no known archaeologically sensitive sites closer than Al Uqair. Therefore, potential impacts on this heritage site are unlikely.

There is no evidence to suggest that the project site contains significant archaeological or cultural features, and observations from the site visit revealed no findings of concern. The site has also been modified, excavated and compacted, having previously served as temporary construction facility during the construction of the adjacent power plants. As such, impacts on any buried artifacts are considered unlikely. Therefore, archaeology and cultural heritage has been scoped out and is not discussed further in this report.

Nonetheless, an archaeological 'Chance Find Procedure' will be developed prior to the start of site earthworks. This will include protocols and procedures to stop work and methods to preserve potential finds, as well as reporting requirements and coordination with the Authorities.

5.5 Socio-Economic

5.5.1 Desktop Review

5.5.1.1 Administrative Structure

KSA is divided into 13 Administrative Regions which are governed by a Governor, Deputy Governor and Provincial Council. These Administrative Regions are further divided into Governates and Districts. The Project area is located within Eastern Administrative Region, which is the country's largest administrative region in terms of land area comprising 672,520m^2, and is the third most populated Region in KSA.

The Eastern Region is bordered in the north by Kuwait, Iraq and the Northern Region, in the east by the Arabian Gulf, United Arab Emirates and Qatar, in the south by The Sultanate of Oman, and in the west by the regions of Riyadh, Qaseem, and Najran. The Eastern Region is divided into its Capital, Dammam and 10 governorates including Ahsa Dhahran Khobar Qatif Hafr al-Batin Jubail Khafji Ra's Tanura Abqaiq Na'iriyah Qaryat al-Ulya Governorates[13].

The Project is located within a fenced-off site, controlled by SEC in the Qurrayah industrial complex, and therefore, during a site visit undertaken in November 2024, no land users or herders were observed within the project boundary.

[13] https://www.stats.gov.sa/sites/default/files/en-dmaps2010_0_0.pdf

5.5.1.2 Population and Demographics

According to General Authority of Statistics Saudi Arabia (GAStat) the population of the Kingdom in mid-year 2022 was 32,175,224 million, of which approximately 13,382,962 individuals are thought to be non-nationals, representing approximately 41.6% of the total population. According to the Central Intelligence Agency (CIA) World factbook, official growth rate estimates put the current rate of annual growth at 1.63%, although this is currently focused upon a few key growth points. The table below gives a summary of KSA population information.

Table 5-13 Saudi Arabia Population Data Summary

Criteria	Data (2022 Estimates unless otherwise stated)
Population	35, 939, 806 (Est. 2023) Including 12,420,173 non-nationals (According to GAStat)
Age Structure	0-14 years: 24.55% 15-24 years: 14.53% 25-54 years: 51.35% 55-64 years: 6.07% 65 years and over: 3.48% (According to GAStat)
Median Age	**Total:** 30.8 years **Male**: 33 years **Female**: 27.9 years (According to CIA World Factbook)
Annual Growth	1. 63% (According to CIA World Factbook – 2023 est)

Source: *https://www.stats.gov.sa/en/43* *and* *https://www.cia.gov/the-world-factbook/countries/saudi-arabia/#people-and-society* The project is located in the Eastern Province of Saudi Arabia. According to the KSA General Authority for Statistics, the total population of the Eastern Region was estimated in 2019 to be 5,148,598 individuals (both Saudi Nationals and expatriates). Of these 3,103,263 were males and 2,045,335 were females, representing approximately 60% and 40% respectively of the total population. In comparison with the estimated 2019 Saudi Arabia population of 34,218,169 individuals (both Saudi Nationals and expatriates), Eastern Region represented in 2019 approximately 15.04% of the national population.

Table 5-14 Eastern Administrative Region Population Data

Indicator Name	2019 Data
Total Population	5,148,598
Female	2,045,335
Male	3,103,263
Source: General Authority for Statistics Kingdom of Saudi Arabia. https://www.stats.gov.sa/en/1007-0 Accessed 10th December 2023	

In 2022, the female population in Eastern Region was concentrated in the age group of 5 - 9 years, with 210,012 women, accounting for 11.3% of the total female population of Eastern Region. Similarly, the male population was concentrated in the age group of 30 - 34 years, with 463,131 men, representing 14.2% of the total male population.

5.5.1.3 Economy and Employment

Official figures from the CIA World Factbook place the Gross Domestic Product (GDP) of Saudi Arabia at approximately $792.8 billion. National GDP growth rate for 2017 was estimated in -0.9%. As one might anticipate, the economy of the Kingdom is heavily focused upon hydrocarbon-based industry, with this accounting for almost half of overall GDP. The Kingdom possesses about 16% of the world's proven petroleum reserves, ranking as the largest global exporter of petroleum, and playing a pivotal role in OPEC management of world oil markets.

Although the hydrocarbon sector accounts for roughly 42% of GDP, it’s importance to the economy of the Kingdom is not truly reflected in this figure. Petroleum accounts for roughly 87% of budget revenues within Saudi Arabia and for 90% of export earnings, thus providing the country with its main source of both Government revenue and foreign currency. The petroleum market within the Kingdom has also been used in recent years as the Government’s primary means of regulating inflationary pressures within the economy. Outside of the hydrocarbon sector and other industries, the next largest contributor to the economy is the service sector. Unlike the hydrocarbon sector, this exists chiefly to service the domestic market and accounts for very little export earnings.

The labour market of Saudi Arabia is subject to significant challenges, with considerable unemployment and skills shortage in key sectors. Official records estimate to total labour force to be 13.8 million with approximately 6% to be unemployed. Unemployment amongst the Saudi national are more than double that of expatriates. Despite this high level of unemployment, there is a large demand for expatriate labour, particularly in high skill sectors. A further pool of low skill expatriate labour exists to serve a requirement for manual labour and service sector support staff, of which there is also an apparent shortage at the prevailing market rate.

Table 5-15 Summary of Saudi Arabia Economic Data

Criteria	Data (2017 Estimates unless otherwise stated)
GDP (Official Exchange)	US$792.8 billion
GDP (Purchasing Power Parity)	US$1.54 trillion (2020 estimate)
GDP per Capita (Purchasing Power Parity)	US$44,300 (2020 estimate)
GDP Real Growth Rate	-0.9%
Industrial Production Growth Rate	1.71% (2023 estimate)
Labour Force	13.8 million (About 78% are Non-Saudi National)
Labour Force - by Sector	Agriculture: 6.7% Industry: 21.4% Services: 71.9% (2005 Estimate)
Unemployment Rate	7.36% (2021 estimate)
Exports	US$ 286.502 billion (2021 estimate)
Imports	US$ 213.016 billion (2021 estimate)

Source: *https://www.cia.gov/the-world-factbook/countries/saudi-arabia/#economy* Accessed 14th September 2023.

5.5.1.4 Indigenous Peoples

The legislation of the KSA does not recognize any segment of the local population as meeting the essential qualification criteria for Indigenous Peoples. The population of Saudi Arabia is considered homogenous and predominantly Arab and Muslim. Bedouin were estimated by the government in the 1960s to be over 50% of the total population (Bedouin settlements, 1977). Due to rapid economic and urban growth and the oil revenue boom, the majority of the nomadic and semi-nomadic Bedouin have settled and resided in permanent housing while retaining their tribal identity, while the herding activities of their livestock is carried out by hired male shepherds (Cole, 2003), who are predominantly foreign workers. Therefore, Bedouin and tribal groups are not considered Indigenous People or minorities in Saudi Arabia.

In addition, the World Directory of Minorities and Indigenous Peoples indicates that there are no Indigenous Groups listed for Saudi Arabia however it lists some religious minorities including Shi'is, Isma'ilis and Zaydis Muslims. Shi'a, estimated at 10-15% of the population (though some estimates suggest their numbers may be as high as 25%) are mainly in the Eastern Province or 'Ash Sharqiyah' with communities elsewhere as well. Isma'ilis are mainly in the region of Najran while the Zaydis live on the borders with Yemen (Saudi Arabia - World Directory of Minorities & Indigenous Peoples, 2023)[14]. However, these minorities are not characterized by nationally distinct ethnic backgrounds, exclusive and aggregated historical attachment to natural resource bases and customary community-level autonomy, and they are demonstrably well integrated into the mainstream population. Also, Indigenous People were not identified for Saudi in the Indigenous World 2023 Report issued by the International Work Group for Indigenous Affairs (IWGIA), which is a global human rights organisation dedicated to promoting, protecting and defending Indigenous Peoples' rights, with broad-based expertise on Indigenous Peoples and broader social inclusion.

[14] https://minorityrights.org/country/saudi-arabia/

5.6 Environmental Receptors

The sensitive environmental and social receptors that may potentially be impacted during the Project's construction or operation and are sensitive to the changes caused by the Project are presented below.

No.	Receptor	Sensitivity	Description of Receptor
1	Local communities and residential areas	Low	Communities and residences are located more than 40km away from the Project hence impact significance is low.
2	Commercial areas	Low	Industrial plant facilities in the surrounding area may be impacted by the construction activities.
3	Workers (migrant and local)	Medium	Manpower employed with the Project may be impacted by the construction and operation activities and vulnerable to poor working conditions and welfare.
4	Climate	High	KSA is a signatory to The Paris Agreement, UNFCCC addressing the impacts and causes of climate change and aimed at returning global temperatures to a level which will not cause irreversible significant harm to ecosystem functioning. The Paris Agreement's long-term temperature goal is to keep the rise in mean global temperature to well below 2°C above pre-industrial levels, and preferably limit the increase to 1.5°C, recognising that this would substantially reduce the impacts of climate change.
5	Soil and groundwater quality	Low	Changes in soil quality may create secondary impacts on local terrestrial ecology or groundwater.
6	Drainage and run-off areas	Low	These areas provide key habitats for flora and fauna (especially when wet) and are noted as the key areas where flora species in the project Area of Influence (AoI) were present. However, the development footprint has low vegetation cover and has been deemed to be of low environmental diversity.
7	Waste management infrastructure	Medium	Capacity of existing waste and wastewater management infrastructure (offsite) may be impacted by the Project.
8	Landscape and visual amenity	Low	Landscape character and visual amenity of the Project area is influenced by several anthropogenic activities due to the nature of the study area which is highly industrial with several industrial facilities operating in the area.
9	Transport infrastructure and motorists	Low	Capacity of existing transport infrastructure may be impacted by the Project.
10	Existing aboveground archaeological site	Low	No archaeological or culturally significant artefacts were discovered or observed within the proposed development footprint. However, a Chance Find protocol will be in place should archaeological materials be uncovered.
11	Unknown subsurface archaeological sites	Low	Potential presence of unknown buried artefacts of any cultural significance within the project footprint is unlikely.
12	Terrestrial ecology - common species and habitats	Low	Sparce vegetation and flora species were observed on site whilst no fauna species were seen. Impacts on these species is deemed low.
11	Marine habitats	Medium	The marine ecology survey confirmed that the project area primarily consists of non-sensitive habitats dominated by sand and sediments with seagrass identified along parts of the intakes and outfall pipelines. The seagrass beds were primarily composed of *Halophila stipulacea* and *Cymodocea serrulata*, which are categorised as Least Concern on the national and IUCN red list. Both species are typical of soft-bottom environments and are known to contribute to sediment stabilization. Although the presence of seagrass is limited, the pipeline trenching and construction may result in the loss of seagrass located within the pipelines footprint. However, the overall direct environmental impact of this loss on the broader ecosystem remains relatively low.

No.	Receptor	Sensitivity	Description of Receptor
12	Least concern marine flora and fauna	Low	The surveys undertaken to inform this Report did not identify the presence any critical habitats (as per IFC PS 6) or IUCN Red List Species. Seagrass recorded during the marine survey contribute to local biodiversity. Fish populations were generally sparse, with low abundance and species diversity. No megafauna sightings were reported, indicating that the area is not a critical habitat for large marine species.
13	*Stegostoma fasciatum*	Medium	Categorised Endangered on the IUCN Red list
14	Infaunal communities	Low	Sediment dwelling infauna will be directly impacted by construction activities.
15	Marine water quality	Low	Water quality may potentially be impacted during the construction of the intake and outfall pipelines. However, the seabed primarily consists of sediments and the limited seagrass presence, reducing the risk of significant ecological disruption from temporary construction-related sedimentation or turbidity.
13	Sediments quality	Low	Sediment quality may be impacted during construction of the intake and outfall pipelines. However, sediment within the relevant area is not contaminated and given the ongoing activities in the area, sediment conditions are less susceptible to additional short-term disturbances from construction activities such as trenching and side-casting.
14	Local economy	Low	Local businesses and employment may be impacted by the Project during construction
15	Future human receptors	Medium	This includes the Project operational workforce and visitors that may be impacted by the Project.
16	Project structures	Low	Project structures that may be impacted by unplanned events

6 Impact Identification, Analysis and Assessment

6.1 ESIA Methodology

This section provides information about the data collection and other processes followed to inform the ESIA and the methodology that has been used to describe the sensitivity of environmental receptors; predict the magnitude of environmental impacts and assess the significance of impacts upon applicable environmental parameters.

6.1.1 Baseline Data Collection

Forming an integral part of the ESIA, the baseline studies as outlined in the previous section of this ESIA Report provide a benchmark of existing conditions and allow a platform for which Project potential impacts can be assessed for the construction and operational phases.

A series of physical site surveys within the Project's AoI were carried out, these have been described in the relevant environmental and social impact assessment chapters of this report. These were supplemented by existing secondary data. The environmental baseline surveys carried out as part of the ESIA as summarised in Section 5 of this ESIA.

6.1.2 Impact Assessment Methodology

6.1.2.1 Process

The ESIA process is a systematic tool for examining and assessing the potential beneficial and adverse environmental and social impacts of a proposed development. In addition to identifying impacts of the Project, the ESIA has also identified key environmental and social mitigation measures and guidance to avoid, minimise and compensate for any adverse environmental and social impacts associated with the construction and operation of the Project. To obtain a credible assessment of environmental and social impacts, the assignment of 'significance' to each identified impact needs to be a robust, consistent, and transparent process. The methodology to assess 'effect significance' is outlined below and follows a GIIP approach based on the assumption that the significance of an impact on resources or receptors is considered to result from an interaction between two factors:

- The nature and magnitude of the impact (i.e., a change in the environment, social and/or health baseline conditions); and
- The environmental value or sensitivity of those resources or receptors to the change.

A three-step approach has been used to determine the significance of environmental and social impacts, as follows:

- **Step 1** – Evaluation of value/sensitivity/vulnerability of resource or receptor.
- **Step 2** – Assessing the magnitude of the impact on the resource or receptor; a
- **Step 3** – Determining the significance of impacts.

6.1.2.2 Impact Assessment Significance Criteria

Determining Receptor Sensitivity

The sensitivity of a receptor is understood as the sensitivity of the environmental or social receptor to change, including its capacity to accommodate changes that the Project may bring about. The sensitivity is assigned at the receptor level and as such details regarding sensitivity are provided within the topic specific chapters of this Report. The table below outlines the definition criteria upon which the receptor sensitivities of this ESIA are based.

Sensitive receptors are defined as:

- Elements of the **environment** that are of value to the functioning of natural systems (i.e., areas or elements of ecological, landscape or heritage value, species, habitats and ecosystems, soil, air and water bodies or land-use patterns); and
- **Human** receptors, such as stakeholders (i.e., users of dwellings, places of recreation, places of employment, community facilities or household relocation, cultural heritage – tangible & intangible-, community health, livelihoods & economic activities, gender relationships) and human systems (e.g. employment market, population disease susceptibility and disease communicability, public infrastructure and services, exposure to toxicity of chemicals).

Table 6-1 Receptor Sensitivity Criteria

Sensitivity	Description of Value
Very High	• High importance and rarity on an international scale and limited or no potential for substitution. • The receptor has already reached its carrying capacity, so any further impact is likely to lead to an excessive damage to the system that it supports (e.g., very limited or non-existent infrastructure and services such as hospitals and schools, available natural, economic or local resources are not sufficient to provide means of livelihoods for all local populations). • Locations or communities that are highly vulnerable to the environmental and social impact under consideration or critical for society (e.g., indigenous peoples, hospitals, schools). • Other examples are very high proportion of vulnerable groups (women, elderly, disabled, etc.) in the Project area, very frequent occurrences of gender-based violence, very low probability of female participation in decision making and in the labour market, archaeological items of international importance or designated UNESCO world heritage sites, tangible or intangible cultural assets that contribute to international research objectives, etc.
High	• High importance and rarity on a national scale, and limited potential for substitution. • The receptor is close to reaching its carrying capacity, so a further impact may lead to a significant damage to the system that it supports (e.g., poor or limited public infrastructure and services, with limited access and high pressure on existing natural or economic resources available). • Locations or communities that are particularly vulnerable to the environmental impact under consideration (e.g., residential areas, vulnerable/marginalized groups). • Other examples are high proportion of vulnerable/marginalised groups (women, elderly, disabled, etc.), locations with poor health practices, poor education level, high crime rate, frequent occurrences of gender-based violence, tangible or intangible cultural assets that contribute to national research objectives, etc).
Medium	• High or medium importance and rarity on a regional scale, limited potential for substitution. • The receptor is already significantly impacted, but it is not close to reaching its carrying capacity. Further impacts will increase the stress of the underlying system, but evidence does not suggest that it is about to reach a critical point (e.g., public infrastructure and services with some capacity, alternative natural or economic resources are available but not sufficient or easily accessible). • Locations or groups that are relatively vulnerable to the environmental impact under consideration (e.g., commercial areas). • Other examples area: average proportion of vulnerable/marginalised groups, occasional occurrences of gender-based violence, tangible or intangible cultural assets that contribute to regional research objectives, etc).
Low	• Low or medium importance and rarity on a local scale. • The receptor is not significantly impacted and shows a large spare carrying capacity. Impacts are not likely to generate any noticeable stress in the underlying system (e.g., reasonable public

Sensitivity	Description of Value
	infrastructures and services, sufficient natural, economic, or local resources available but not easily accessible). • Locations or groups that show a low vulnerability to the environmental impact under consideration (e.g., industrial areas). • Other examples are low proportion of vulnerable/marginalised groups, rare occurrences of gender-based violence, tangible or intangible cultural assets that contribute to local research objectives, etc).
Very Low	• Very low importance and rarity on a local scale. • The receptor is not impacted and shows a very large spare carrying capacity. Impacts are very unlikely to generate any noticeable stress in the underlying system (e.g., very good public infrastructures and services with some capacity, equivalent natural, economic, or local resources available and easily accessibly). • Locations or groups that show a very low vulnerability to the environmental impact under consideration (e.g., industrial areas). • Other examples are very low proportion of vulnerable/marginalised groups, no occurrence of gender-based violence, tangible or intangible cultural assets that are not legally protected and have no significance to local people (i.e. local people no longer use the cultural asset, etc).

Identifying Potential Impacts

The following types of impacts have been considered:

- Direct Impacts - Potential impacts that may result from the construction, commissioning, and operations of the Project acting directly on an environmental or social receptor.
- Indirect Impacts – Potential impacts which are not a direct result of a Project activity, that may be realised later in time or at distances further removed from the project footprint but are normally a result of a complex pathway.
- Cumulative Impacts – Changes to the environment that are caused by an action in combination with other past present and future actions.
- Beneficial Impacts – Those impacts that have a positive, desirable or favourable effect on the sensitive resources or receptors (e.g. landscape providing artificial habitat for a variety of species, jobs opportunities during the construction and/or occupation phases of a project);
- Adverse Impacts – Those impacts that are detrimental and have a negative influence on the environment, social structures, resources, or other receptors.
- Secondary Impacts - Potential impacts that may result from the implementation of protection measures applied to mitigate potential direct impacts; and
- Event Related Impacts - Potential unplanned or accidental impacts stemming from an unintentional event such as fire, explosion, oil spill, etc.

Determining Impact Magnitude

The magnitude of an impact has numerous components, for example:

- The extent of physical change.
- The level of change in an environmental condition.
- The permanence of impact and the reversibility of the impacted condition.
- Its spatial footprint.
- Its duration and frequency; and

- Its likelihood of occurrence where the impact is not certain to occur.

The magnitude of the impact will be defined wherever possible in quantitative terms and where necessary, the determination of impact magnitude will be assisted through the use of modelling. The general criteria used for identifying the magnitude of impacts is provided within the table below.

Table 6-2 Impact Magnitude Criteria

Magnitude	Description of Magnitude
Major	**Adverse**: Loss of resource and/or quality and integrity; severe damage to key characteristics, features or elements. A major impact is usually large in extent, permanent and irreversible. **Beneficial**: Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Moderate	**Adverse**: Significant impact on the resource, but not adversely affecting the integrity; Partial loss of/damage to key characteristics, features or elements. Moderate impacts usually extend outside the site boundary, and are usually permanent, irreversible or cumulative. **Beneficial**: Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	**Adverse**: Some measurable change in attributes quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. Minor impacts usually are only noticeable within the site and are temporary and reversible. **Beneficial**: Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	**Adverse**: Very minor loss or detrimental alteration to one or more characteristics, features or elements. **Beneficial**: Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

6.1.2.3 Determining Significance

The significance of effects is a combination of the sensitivity of a receptor or resource and the magnitude of the project impact.

The following matrix provides criterion used for determining the significance of environmental effects through consideration of the potential magnitude of impact and sensitivity of the associated receptor.

As is evident from the matrix, in some cases the significance product is a range (i.e., a 'Minor' Magnitude and a 'Very High' Sensitivity results in a 'Moderate to Major' Significance). In these cases, professional judgement will be used to determine which significance the impact best represents.

Table 6-3 Criteria for Determining Significance of Effects

		Magnitude of impact (degree of change)				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Sensitivity of Receptor	**Very High**	Neutral	Minor	Moderate or Major	Major	Major
	High	Neutral	Minor	Moderate	Moderate or Major	Major
	Medium	Neutral	Negligible or minor	Minor	Moderate	Moderate or Major
	Low	Neutral	Negligible or minor	Negligible or minor	Minor	Moderate
	Very Low	Neutral	Negligible	Negligible or minor	Minor	Minor

The following table outlines general definitions of significance.

Table 6-4 Definition of Significance

Significance Category	Criteria
Major	• The impact is large scale and would cause a large improvement or deterioration in the environment, • Adverse impacts may be considered unacceptable due to exceeded of statutory limits and may require additional studies to ascertain if alternatives (in terms design and location) with the potential for lower impacts should be considered. These impacts represent key factors in the decision-making process. • These impacts are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
Moderate	• The impact gives rise to noticeable improvement or deterioration to the existing environment at a regional or local scale. • If adverse, impacts are potential concerns to the project and may become key factors in the decision-making process. • Whilst the impacts will be experienced, mitigation measures and detailed design work may reduce (or enhance) the effect. Some residual effects will still arise.
Minor	• The impact is small scale and would cause a small improvement or deterioration to the existing environment. • Adverse effects are undesirable but acceptable and within statutory limits and not likely to be key decision-making issues. • Mitigation measures are typically not requited to mitigate such effects. • The cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.
Negligible	• No discernible improvement or deterioration to the existing environment as a result of the Project will occur. • Local issue unlikely to be of importance in the decision-making process. • Effects do not exceed statutory limits. • They are of relevance in enhancing the subsequent design of the project and consideration of mitigation or compensation measures.
Neutral	• No effect or effect that is beneath the level of perception, within normal bounds of variation or within the margin of forecasting error. • No mitigation is required.

The approach to assigning significance relies on reasoned argument, professional judgement and cognisance to the advice and views of the appropriate regulators and organisation. For some disciplines, it is determined by comparison, wherever possible with locally, nationally, or internationally accepted standards.

6.1.3 Mitigation & Management Measures

A key component of the ESIA process is to explore practical ways of avoiding or reducing potentially significant impacts caused by development of the Project. These are commonly referred to as mitigation measures and will incorporate into this Report and the future CESMP and Operational ESMP (OESMP). Mitigation will be aimed at preventing, minimising, or managing significant adverse impacts to as low as reasonably practicable (ALARP) and enhancing and maximising any potential beneficial impacts of the Project.

The approach taken to identifying and incorporating mitigation measures into the Project is based on a typical hierarchy of decisions and measures. This is aimed at ensuring that, wherever possible, potential impacts are mitigated at source rather than mitigated through restoration after the impact has occurred. In ensuring the Project achieves the applicable environmental standards and guidelines, mitigation measures have been adopted within the Project's design. In addition to specific measures included within the design of the Project, the ESIA outlines further mitigation and/or management measures for the construction and the operational phases, upon which the Project can further minimise or avoid negative impacts and enhance positive impacts.

Upon approval of the Project, the stated mitigation and management measures in the approved ESIA will be required for implementation as a condition of the Environmental Permit or as part of the lenders loan agreement.

6.1.4 Residual Impacts

The residual impacts consider the overall significance of impacts following the implementation of the additional mitigation and management measures not included by design. The significance of such impacts is based upon the same criteria used to determine the impact significance stated above.

6.1.5 Cumulative Impact Assessment (CIA)

IFC Handbook on Cumulative Impact Assessment defines cumulative impacts as "those that 'result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones" (IFC, 2013).

In practice, the assessment of cumulative effects requires consideration of some concepts:

- Assessment of effects over a larger (i.e., "regional") area that may be transboundary/cross-jurisdictional; (including effects due to natural perturbations affecting environmental components and human actions).
- Assessment of effects during a longer period of time into the past and future;
- Assessment of effects on Valued Environmental Components due to interactions with other actions, and not just the effects of the single action under review; and
- Evaluation of significance in consideration of other than just local, direct effects.

6.1.6 Transboundary Impacts

As per the IFC Performance Standard 1 Guidance Note 1, "*Transboundary impacts are impacts that extend to multiple countries, beyond the host country of the project, but are not global in nature. Examples include air pollution extending to multiple countries, use or pollution of international waterways and transboundary epidemic disease transmission*."

The Project is not expected to abstract water or risk polluting international waterways in addition, and as per the air emissions modelling (Hajr Two IPP and cumulative between Hajr Two IPP and SEC CCGT), the Project emissions are are not likely to extend outside the Project area. The Project impacts due to the Project will fall within an AOI within KSA only, hence there is considered to be no need for a detailed assessment relating to transboundary impacts.

6.1.7 Project Stakeholder Analysis and Consultation

Consultation with stakeholders is an essential part of the ESIA process. The key objective of the consultation is to establish a dialogue with those stakeholders who may be affected by aspects of the Project or may have an interest in the outcome of the ESIA process.

With regard to the lender requirements, all of the IFC PS include requirements for a certain level of stakeholder engagement (either in the ESIA, or as part of the future ESMS) and therefore the Project will require a level of engagement. In particular, IFC PS 1 on "Social and Environmental Assessment and Management Systems" describes the stakeholder engagement requirements in more depth. It states the following:

"*Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement is an on-going process that may involve, in varying degrees, the following elements:*

- *Stakeholder analysis and planning;*
- *Disclosure and dissemination of information;*
- *Consultation and participation;*
- *Grievance mechanism; and*
- *On-going reporting to Affected Communities.*

The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development."

As is common and good practice, stakeholder engagement is considered a key aspect of all projects and should be undertaken at the ESIA stage in order to notify, gain views and enable a better understanding of the dynamics of the local environment.

Throughout the ESIA process for the Project, Project stakeholders have been consulted to obtain information and further understand the Project design, construction methods and operational activities. Key stakeholders consulted to date include:

- ACWA Power and SEC who have gathered the required input from their engineers and contractors.
- ACWA Power and SEC to confirm the stakeholder engagement that was carried out for the Project.
- NCEC at early Project stages through the submission of the EC Form and Scoping report.

Meetings and engagement with NCEC for the purpose of the ESIAs environmental permitting will be carried out as necessary.

There are not regulatory processes relating to the ESIA permitting that require consultation with communities. National legal and cultural factors in KSA prevent open public meetings or other mass consultations and public participation activities. As such, detailed socio-economic surveys or public consultations were not carried out.

Stakeholder engagement that is carried out with the governmental entiities, regulators, ministries or municipalities is usually led by the Project sponsors. In general, if stakeholder engagement is necessary with affected land owners where land acquisition is required, then this is carried out by the Project sponsors in coordination with the Ministry of Municipal and Rural Affairs in line with the national Law of Eminent Domain and Temporary Taking of Property (Royal Decree No. M/15, May 12, 2003) and its implementing regulation (Ministerial Resolution No. 54, November 23, 2015).

For the Project, a stakeholder engagement plan (SEP) and grievance mechanism (GM) will be developed to coordinate engagement with NCEC and other municipal and regulatory bodies required to be engaged with for permitting purpose or interest based stakeholders relevant to the Project. The GM will be for workers and local affected communities due to Project related works which will enable any complaints or concerns to be dealt with swiftly and adequately.

6.1.8 Framework for Environmental and Social Management

The ESIA includes a framework to guide the Project parties in establishing structures for the management of Environmental and Social risks, impacts, opportunities, and compliance associated with both the construction and operational phases of the Project.

The Framework outlines systematic structures and management programmes that will ultimately be prepared to comprise the Project's respective construction and operational phase Environmental and Social Management Systems (ESMS).

This framework ensures alignment with applicable elements of the established ACWA Power corporate level E&S Policy and ESMS Implementation Manual.

It is intended that the EPC Contractor and O&M Company will prepare their detailed respective Construction Environmental & Social Management Plan (CESMP) and Operational Environmental & Social Management Plan (OESMP) as part of their wider ESMS'. Both the CESMP and OESMP will align with the Project Company and ACWA Power ESMS Implementation Manual.

Other management plans that that will be required based on the outcomes of the ESIA and respective risks and impacts at the Project are included in section 7.6.11 of the ESIA. It is expected that the EPC Contractor and O&M Company will develop E&S policies in line with corporate level Project Company overarching project specific E&S policy.

6.2 Assessment of Impacts

6.2.1 Air Quality

6.2.1.1 Construction Phase Impacts and Mitigation

The main Project and the associated facilities construction activities that could contribute to potential changes in air quality are summarised discussed below.

Dust Emissions from Site Preparation and Earth Works

The principal sources of dust and particulate emissions during construction will be:

- Excavations and earthworks, such as ground-breaking, cutting, filling and levelling;
- Vehicle movements on unpaved, or compacted surfaces; and
- Particulate dispersion from uncovered truckloads;
- Operation of the temporary batching plant.

Nuisance dust can reduce well-being resulting in increased incidence of eye irritation and infection. Nuisance dust is typically defined as particulate matter greater than 10 microns in diameter. Dust resulting from excavations and earthworks typically comprises large diameter particles, which settle rapidly and close to the generation source.

According to the screening guidance of the UK's Institute of Air Quality Management (IAQM) for construction dust, detailed assessment relating to dust generation is required where there is a 'human receptor' within 350m of the boundary of the site. In the case of this project and with respect to the screening criteria above, the closest receptor is R-2 (Qurrayah IPP) located 100m from the closest project boundary which is within the direct AoI of dust emissions. As such, the potential for impacts relating to dust emissions as a result of site preparation and earthworks activities upon the surrounding receptors are anticipated to occur.

DUST EMISSIONS FROM MOVEMENT OF VEHICLES

In addition to vehicle movements on unpaved surfaces, dust generation from truck movements and particulate dispersion from uncovered truckloads would only occur where mitigation measures are not effectively implemented at the site, or by contractors bringing materials to the site.

Uncontained and/or un-sheeted trucks may be subject to losses of material where the containment is not effective (e.g. spills), or where wind or other air turbulence may disturb the contents and result in dispersion of materials. Such impacts have the potential to degrade local air quality in the immediate area of such movements.

In accordance with the UK's IAQM Guidance on the Assessment of Dust from Demolition and Construction, detailed assessment of vehicle movements should only be required where 'human' receptors are located within 50m of the route used by construction vehicles on public roads, up to 500m from the project site entrance. There are no residential and commercial receptors within 50m of the route that will be used by construction vehicles or at 500m from the project site outside of the pre-identified industrial receptors. Thus, the potential for impacts on receptors as a result of dust generation or particulate emissions due to increased vehicle movement on project routes is considered unlikely.

GASEOUS EMISSIONS

Exhaust emissions from construction equipment and plants typically include NOx, carbon monoxide CO, sulfur dioxide SO_2, VOC, and PM. All these pollutants have a diverse of potential adverse health impacts ranging from mild headache to more serious illnesses such as cancer, particularly when exposure is chronic. The quantity of gaseous emissions from the construction equipment in addition to their numbers, will also depend on the number hours of operation and efficiency. As per the design manual for roads and bridges (DMRB), increase concentration of gaseous pollutants is distinguishable from background within a radius of 200m from source. Considering the location of the receptors from the project site where the closest identified receptor is approximately 100m away, the transient and short-term nature of impacts, the magnitude of potential impacts from gaseous emissions are assessed to be **minor**.

Note: Details of the overall greenhouse gas (GHG) emissions during construction are provided in chapter 6.2.2.1 of this ESIA.

ODOUR EMISSIONS

Odour related issues as a result of release of malodourous gases such as H_2S could arise as a result of improper waste management practices such as accumulation of biodegradable wastes. However, impact management actions will be implemented to minimise and manage impacts. Sewage generated from temporary site sanitary facilities such as toilets and holding tanks can cause odour nuisance if not properly managed.

Odours emitted from sewage storage and handling comprise a range of different chemical compounds, though H_2S is often used as an 'indicator' or proxy for the often-complex odour mixture. Whilst exposure to odours can give rise to nuisance, particularly where human receptors may expect a high degree of amenity, this seldom represents a concern for physical health effects.

Any potential odour nuisance impacts associated with the temporary on-site storage of sewage in tanks, on-site treatment / pre-treatment (if applicable) and the transfer to bulk road tankers for transportation for off-site disposal / treatment are anticipated to be limited to 100m from the source.

Considering the absence of residential receptors within 100m of the project site who may be adversely affected from potential odour related nuisance, magnitude of such impacts has been assessed as **negligible**.

EMISSION OF VOCS

Small quantity of fuels, paints, solvents and other volatile substances are likely to be required during the construction phase, which will be stored in secure areas within the construction laydown areas. If not adequately contained, such substances have the potential to result in the dispersion of volatile emissions to the immediate air shed. Given that the storage of such volatile substances will be in small quantities, any potential impacts will be temporary and limited to the immediate surrounding area, likely to be within the project site or in close proximity to the construction boundaries. Magnitude of potential impacts will be **negligible**.

Table 6-5 Construction Phase - Air Quality Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Dust emissions as a result of site preparation and excavation works and movement of vehicles on unpaved surfaces	Minor	Project construction workers	Medium	**Minor**	• Dust generating activities (excavation, etc.) and moving of uncovered waste/materials within the site should be undertaken during periods of low winds (e.g. <15 km/h is recommended as a threshold when a review of works is conducted). • Vehicle speeds on all non-public site access and internal site roads will be restricted to 30km/h. • Where sand and other dusty materials are transported to the site, trucks will not be overloaded and will be appropriately covered / sheeted to avoid loses en-route. • Cement and other fine powders will be sealed or covered after use, stored and transported in enclosed or bunded containers. • Dusty material stockpiles (i.e. any fine sands and powders) dust generating activities (e.g. stone cutting) are to be located away from the site boundaries and be contained or covered with suitable netting to avoid dust dispersion during storage or use. • Where paved routes are not available vehicles routes will be clearly demarcated and appropriate signage displayed around the site. • Compact unpaved site roads in order to reduce dust generation and wet down key access roads if necessary. • The provision of a wheel-washing facilities or high-pressure hose to ensure all vehicles leaving the site are in a satisfactory state of cleanliness. • No burning of wastes will be allowed onsite. • Erect worker shelter on site for protection in the event of a major dust event. • Provide project workers with full PPE kit including dust masks. • Notice will be provided to the sensitive receptors near the site (i.e., any herder is the Project vicinity) as early as possible (minimum one-week notice) if there will be activities that might generate a lot of dust. • Communicate the grievance mechanism to allow sharing any complaints or concerns regarding air emissions during the construction phase.	**Minor**
	Minor	Nearby facilities' operation workers located within the project AoI	Low	**Minor**		**Negligible**
Gaseous emissions from vehicle and plant exhaust	Minor	Project construction workers	Medium	**Minor**	• Construction roads in the sites will be designated and made clear to the drivers with signage for directions and speed limits placed all along the roads. • Internal roads inside the project site will be compacted as it reduces vehicular power consumption. • Unnecessary usage of vehicles, plant and equipment will be minimised – No unnecessary idling. • Where practical, efficiently manage deliveries of equipment to the site to reduce the number of trips. • Exhaust emissions from Project generators and vehicles will be subject to acceptance checks for authorisation of use on site. This includes a pre-requisite requirement of site vehicles to ensure no black smoke before entering site and that any identified machinery or vehicles with black smoke will require maintenance and re-assessment before it is returned.	**Negligible**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
	Minor	Nearby facilities' operation workers located within the project AoI	Low	**Minor**	• Lorries and truck engines will be turned off while waiting on site to minimize gaseous emissions. Air-conditioned or heated shelters should be provided for drivers in designated waiting, loading and unloading areas to prevent drivers waiting in vehicles. • Regular maintenance of vehicles and equipment. • Emissions from machinery and equipment will be free from visible black smoke.	**Negligible**
VOC Emissions	Negligible	Project construction workers	Medium	**Minor**	• Hazardous materials stored and used on site with potential gas emissions (e.g. Volatile Organic Compounds) will be located in well-ventilated, but secure low-risk areas, away from major transport routes and away from the site boundary (where possible). • Volatile fuels and chemicals (including hazardous wastes) will be stored in sealed containers. On site storage of large quantities of volatile fuels will be avoided, equally prolonged exposure to direct sun and heat will be avoided. • Fires and material burning will not be allowed on the Project site. • Chemical storage areas will be purpose built and well maintained. A data log of all chemicals with MSDSs will be provided at the storage facility within easy access.	**Negligible**
Odour	Negligible	Project construction workers	Medium	**Minor**	• Adequate and sufficient sanitary facilities for site workers will be provided. • Effective cleaning and maintenance of toilets to be undertaken to avoid oduor dispersion and cleaning records/inspection sheets displayed in the toilets. • All septic tanks must be sealed and fully functioning. • Septic tanks must be operated and maintained according to manufacturer recommendations. • Sanitary waste will be removed from site by licensed contractors and disposed in wastewater treatment facilities approved by the applicable regulator.	**Negligible**

6.2.1.2 Operation Phase Impacts and Mitigation

The identification of aspects associated with the operation of the Project and the receptors that may be potentially affected has been used to identify potential impacts associated with air emissions. These are presented below.

***Note**: Details of the overall greenhouse gas (GHG) emissions during construction are provided in chapter 6.2.2.1 of this ESIA.*

AIR EMISSIONS FROM THE PLANT OPERATION

Operational activities associated with the Project will result in the emissions of gaseous pollutants, primarily from the operation of the CCGT power blocks. These emissions will occur under both simple and combined cycle operating modes using natural gas fuel during normal operations and using back-up fuel oil if the natural gas supply is interrupted. The plant will operate in combined/closed cycle for normal operations. In case of maintenance on the water/steam cycle there will be the option for the plant to operate in open/simple cycle mode.

Modelling Methodology

A detailed air quality dispersion modelling assessment has been undertaken to determine impacts associated with the proposed Hajr Two IPP Project. Dispersion modelling has been carried out using the United States (US) Environmental Protection Agency (EPA) Breeze AERMOD 13.1 dispersion model, five years of meteorological data from King Fahd International Airport (Dammam Airport) (2020 to 2024). Consideration has been given to the plant operating both during combined cycle and open / simple cycle modes and operating on natural gas and a back up fuel-oil. The full modelling report is included in **Appendix H**.

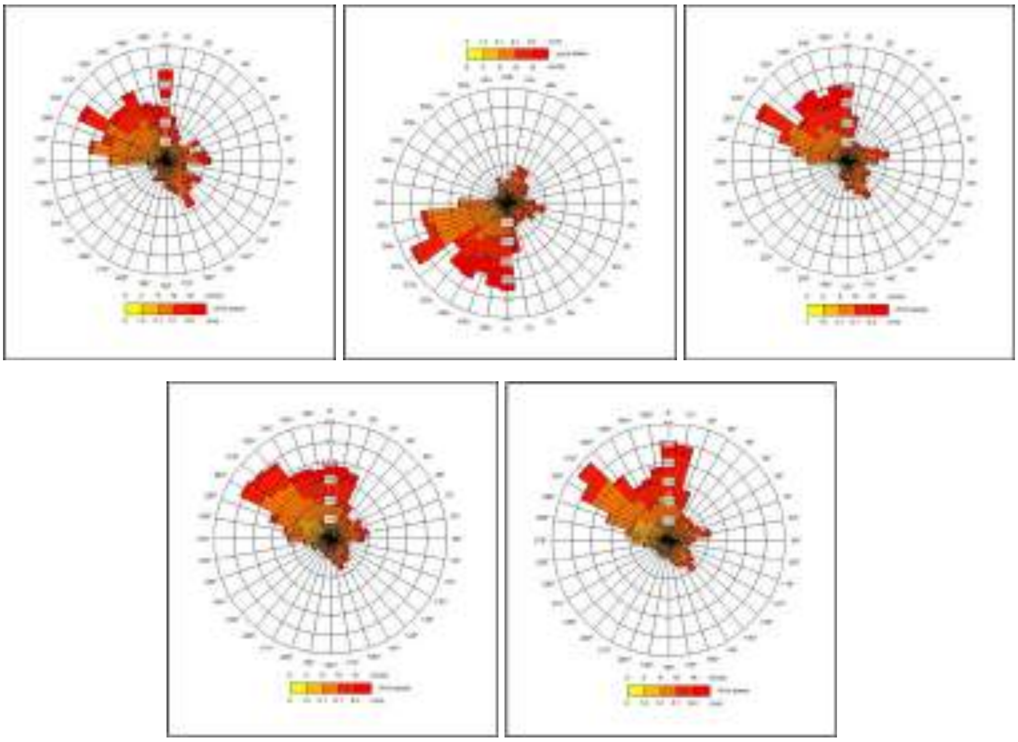


Figure 6-1 Wind from Dammam Airport (2020-2024)

The key pollutants considered in this assessment are nitrogen dioxide (NO_2) and carbon monoxide (CO) as these are the key pollutants emitted from the plant when operating on natural gas. Emissions of ammonia (NH_3) associated with the operation of the Selective Catalytic Reduction equipment when operating in combined cycle mode are also considered. Emissions of sulphur dioxide (SO_2) and particulate matter (PM_{10} and $PM_{2.5}$) are also anticipated when operating on the back-up fuel oil. Predicted concentrations have been compared with relevant standards and guidelines incorporated into applicable KSA law and also the WBG/IFC EHS Guidelines that reference the WHO ambient standards.

The modelling covered the receptors presented in the following table and figure. Considering the types of receptors and the industrial nature of the area, only the R3, R5, R9 and R10 were considered for long term exposure where there may be residents that spend long periods on time in these locations.

Figure 6-2 Air Quality Modelling Sensitive Receptor Locations

ID	Name	Locations
R1	Coast Guard Training Centre	
R2	Salt Mines	
R3	Qurrayah Saudi Aramco Beach	
R4	Qurrayah Sea Water Plant	
R5	Qurrayah Power Plant Housing	
R6	Qurrayah Power Station	
R7	Qurrayah IPP	
R8	Qurrayah Power Plant 2	
R9	Uqair Beach Aramco	
R10	Continent Hotel Al Uqair	

The air quality dispersion modelling assessment has been undertaken to determine impacts associated with the proposed Hajr Two emissions and also the cumulative impact of emissions from Hajr Two and the future planned SEC facility which will be developed on an adjacent plot as well as the existing baseline. The assessment covered the receptors identified during the ESIA surveys. The assessment for Hajr Two is included within this chapter while the cumulative impacts are summarised briefly in section 6.6 and detailed in **Appendix H**.The modelling was based on the assumption that the main stacks are at a height of 60m and the bypass stacks are at a height of 40m. The assessment has considered the following operational scenarios.

Table 6-6 Operational Scenarios

Operational Scenario	Fuel	Pollutants	Operational Mode	Emissions Via	Duration
Scenario 1	Natural Gas	NOx, CO, NH3	Combined	Main Stacks	Long Term and Short Term
Scenario 2	Natural Gas	NOx, CO	Simple	Bypass Stacks	Short Term only
Scenario 3	Back up Fuel Oil	NOx, CO, NH3, SO2, PM10, PM2.5	Combined	Main Stacks	Short Term only

Operational Scenario	Fuel	Pollutants	Operational Mode	Emissions Via	Duration
Scenario 4	Back up Fuel Oil	NOx, CO, SO2, PM10, PM2.5	Simple	Bypass Stacks	Short Term only

MODELLING RESULTS

The modelling results are summarised below and the detailed results are provided in **Appendix H**. The predicted modelling results present the worst-case meteorological conditions recorded during the 5 years of data. As per the IFC Thermal Power Plants EHS Guidelines, emissions should not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards and emissions from a single Project should not contribute more than 25% of the applicable ambient air quality standards to allow additional, future sustainable development in the same airshed.

NO_2 Modelling Results

The maximum predicted annual mean concentration with the background ambient air quality levels at all the receptors and for Scenario One – Operating in Combined Cycle on Natural Gas (Normal Operations) is compliant with the KSA air quality standards and IFC WBG standards and inline with the WHO interim Targets as shown in Table 6-7. The emissions contribute to less than 25% of these applicable ambient air quality standards. Therefore, significant impacts to air quality under this scenario are not expected.

Table 6-7 Predicted Annual Mean (Long Term) NO_2 Concentrations (mg/m^3)

Receptor / Scenario	Scenario 1
R1	0.09
R2	0.11
R3	0.13
R4	0.16
R5	0.24
R6	0.32
R7	1.08
R8	1.64
R9	0.27
R10	0.13
Maximum (% of the WHO Guideline)	**16.4%**
KSA AQS (µg/m^3)	**100**
WHO Guidelines (µg/m^3)	**10**

The maximum predicted 24-hour mean concentrations are in line with the WHO guidelines and contribute to less than 25% of these guidelines. Therefore, impacts to air quality are not expected to be significant. The results are presented in Table 6-8 and a visual representation of the contour at the receptors for scenario one is shown in the following table.

Table 6-8 Predicted 99th Percentile of 24-Hour Mean NO_2 Concentrations (mg/m^3)

Receptor / Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
R1	0.51	0.38	0.52	0.58
R2	0.60	0.43	0.57	0.67
R3	0.67	0.47	0.75	0.69
R4	0.95	0.58	0.98	0.86
R5	1.58	0.81	1.63	1.23
R6	2.21	1.13	2.23	1.7
R7	4.32	4.01	6.02	5.74
R8	3.12	2.59	3.47	3.99
R9	0.96	0.84	0.94	1.24
R10	0.53	0.54	0.54	0.77
Maximum (% of the guidelines)	**17.28%**	**16.04%**	**24.08%**	**22.96%**
WHO Guidelines (µg/m^3)	**25**			

The maximum predicted 1-hour mean concentrations are inline with the national and the WHO guidelines and less than 25% of both and are therefore insignificant. The 1-hour mean concentrations for scenario one are presented as contour plots in the following figure.

Table 6-9 Predicted 1-Hour Mean NO_2 Concentrations (mg/m^3)

Receptor / Scenario	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	100th	99.7th	100th	99.7th	100th	99.7th	100th	99.7th
R1	5.5	1.9	3.8	1.8	5.1	2.2	5.7	2.7
R2	5.3	2.1	3.8	2.1	5.2	2.3	5.6	3.3
R3	6.7	2.8	4.2	2.3	6.3	3.0	6.4	3.4
R4	5.8	3.0	4.2	2.4	5.8	3.1	6.0	3.7
R5	5.8	4.3	4.2	2.9	6.1	4.5	6.5	4.3
R6	7.1	5.0	4.4	3.4	6.8	5.6	7.0	5.0
R7	13.1	9.7	11.4	9.5	16.7	14.1	16.8	14.0
R8	14.3	9.6	11.2	6.5	17.3	10.5	16.5	10.2
R9	13.4	4.2	8.0	3.7	12.9	4.6	12.0	5.6
R10	10.9	2.6	6.9	3.7	9.7	3.1	10.5	5.5
Maximum (% of the standards and guidelines)	**7.15%**	**4.85%**	**5.7%**	**4.75%**	**8.65%**	**7.05%**	**8.4%**	**7.0%**
KSA AQS (µg/m^3)	**200**							
WHO Guidelines (µg/m^3)	**200**							
Presented as the 100th percentile for direct comparison with the WHO Guideline and as the 99.7th percentile for direct comparison with the National Standard which includes an allowance of 24 exceedances per year								

CO Modelling Results

The 99th percentile of 24-hour mean, 8-hour mean, 1 hour mean and 15-minute mean CO concentrations are presented in the tables below. The predicted impacts of the proposed Projects at all receptors are compliant with the standards and less than 25% of the standards at all locations and under all operational scenarios and are therefore considered insignificant.

Table 6-10 Predicted 99th Percentile of 24-Hour Mean CO Concentrations (mg/m³)

Receptor / Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
R1	2.4	1.0	2.2	0.9
R2	3.7	1.1	3.2	1.0
R3	4.3	1.2	3.5	1.1
R4	5.8	1.4	4.9	1.3
R5	9.1	1.7	7.5	1.6
R6	12.6	2.4	10.6	2.2
R7	17.9	7.7	16.8	7.1
R8	18.0	5.7	15.6	5.5
R9	5.5	2.2	4.4	1.9
R10	3.3	1.4	2.7	1.2
Maximum (% of the guidelines)	**0.45%**	**0.19%**	**0.42%**	**0.18%**
WHO Guidelines (µg/m³)	**4000**			

Table 6-11 Predicted 8-Hour Mean CO Concentrations (mg/m³)

Receptor / Scenario	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	100th	99.8th	100th	99.8th	100th	99.8th	100th	99.8th
R1	8.6	7.6	3.2	2.1	7.9	6.1	2.9	1.8
R2	11.7	8.0	2.8	2.3	10	7.2	2.5	1.9
R3	12.1	8.9	2.6	2.1	11	8.3	2.2	1.9
R4	12.3	10.9	3.4	2.8	12.2	8.9	3.4	2.5
R5	19.0	14.2	4.8	2.9	16.2	12.7	4.0	2.7
R6	25.3	19.2	7.0	3.7	22.1	16.6	5.8	3.5
R7	48.4	42.4	13.7	10.7	42.5	37.7	13.8	10.7
R8	41.5	38.6	12.9	12.5	35.4	34.9	12.1	11.6
R9	19.3	11.2	5.4	4.7	15.3	9.0	4.4	3.9
R10	11.4	9.6	4.0	3.1	8.9	7.4	3.3	2.7
Maximum (% of the standards and guidelines)	**0.48%**	**0.42%**	**0.14%**	**0.13%**	**0.42%**	**0.38%**	**0.14%**	**0.12%**
KSA AQS (µg/m³)	**10,000**							
WHO Guidelines (µg/m³)	**10,000**							
Presented as the 100th percentile for direct comparison with the WHO Guideline and as the 99.8th percentile for direct comparison with the National Standard which includes an allowance of 2 exceedances per year								

Table 6-12 Predicted Hourly Mean CO Concentrations (mg/m^3)

Receptor / Scenario	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	100th	99.9th	100th	99.9th	100th	99.9th	100th	99.9th
R1	36.3	20.3	10.5	8.3	28.1	14.0	9.1	6.7
R2	35.4	18.7	10.6	8.1	28.0	13.8	8.9	6.6
R3	44.0	24.0	11.7	7.0	36.0	16.6	10.2	6.2
R4	37.3	24.7	11.7	7.3	32.1	19.6	9.7	6.4
R5	42.3	37.0	10.2	6.7	35.3	32.0	10.6	6.6
R6	52.3	46.2	11.1	8.5	45.6	39.8	11.3	7.6
R7	88.4	66.4	19.3	17.8	86.6	62.1	19.2	17.8
R8	76.4	60.4	19.0	15.9	80.1	53.0	19.0	15.1
R9	86.3	51.4	21.8	17.6	70.4	44.3	19.1	14.7
R10	71.7	40.4	18.6	14.9	55.5	31.1	16.7	13.0
Maximum (% of the standards and guidelines)	**0.25%**	**0.17%**	**0.06%**	**0.04%**	**0.25%**	**0.16%**	**0.05%**	**0.04%**
KSA AQS (µg/m^3)	**35,000**							
WHO Guidelines (µg/m^3)	**40,000**							
Presented as the 100th percentile for direct comparison with the WHO Guideline and as the 99.9th percentile for direct comparison with the National Standard which includes an allowance of 1 exceedance per year								

Table 6-13 Predicted 15-Minute Mean CO Concentrations (mg/m^3)

Receptor / Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
R1	48.7	14.1	37.7	12.2
R2	47.4	14.2	37.6	12.0
R3	59.0	15.6	48.2	13.7
R4	49.9	15.7	43.0	13.0
R5	56.7	13.6	47.3	14.2
R6	70.0	14.8	61.1	15.1
R7	118.4	25.8	116.1	25.8
R8	102.4	25.4	107.3	25.4
R9	115.6	29.2	94.4	25.6
R10	96.0	24.9	74.3	22.3
Maximum (% of the guidelines)	**0.12%**	**0.03%**	**0.12%**	**0.03%**
WHO Guidelines (µg/m^3)	**100,000**			

NH_3 Modelling Results

There are no national standards or WHO Guidelines for ammonia. Ammonia concentrations have therefore been compared to the UK Environmental Assessment Levels for annual and hourly mean concentrations of 180µg/m^3 and 2500µg/m^3 respectively as presented in the following tables. The results are comliant with the standards and the process contributions are less than 1% of the relevant standard, therefore the impact with regards to annual and hourly NH_3 concentrations is considered to be insignificant.

Table 6-14 Predicted Annual Mean NH_3 Concentrations (mg/m^3)

Receptor / Scenario	Scenario 1
R1	0.008
R2	0.011
R3	0.012
R4	0.015
R5	0.022
R6	0.028
R7	0.092
R8	0.161
R9	0.027
R10	0.012
Maximum (% of the KSA AQS)	**0.089%**
UK Standards	**180**

Table 6-15 Predicted Hourly Mean NH_3 Concentrations (mg/m^3)

Receptor / Scenario	Scenario 1	Scenario 3
R1	1.06	0.08
R2	1.03	0.08
R3	1.27	1.0
R4	1.07	0.9
R5	1.26	1.1
R6	1.57	1.3
R7	2.60	2.5
R8	2.04	2.1
R9	2.48	2.0
R10	2.07	1.6
Maximum (% of the KSA AQS)	**0.10%**	**0.10%**
UK Standards	**2,500**	

SO_2 Modelling Results

The 24-hour mean concentrations under scenarios 3 and 4 are compliant with the KSA standards and with the WHO Interim Target 1 (125 mg/m^3). The process contributions from the proposed plant are greater than 25% of the National Standard and the WHO Interim Target 1 at a number of receptor locations.

The plant will operate primarily on natural gas, the back up fuel will only be used in the event of an interruption to the supply of natural gas. It is estimated that the plant will only operate for 30 days per year on the back up fuel. The concentrations presented in the table above represent the worst-case concentration over a five year period i.e. under the worst case meteorological conditions experienced in the five years considered. The plant is only likely to operate for a maximum of 30 days per year with the back up fuel in case of non-avalibiality of gas. Plant operation on back up fuel is therefore an infrequent event and it is unlikely that this would coincide with the worst-case meteorological conditions.

It should also be noted that at the time of the assessment, the actual sulphur content of the back up fuel was not known. The emissions of SO_2 were therefore calculated from the limit value (0.015% by volume at 15%O_2, dry), which is likely to be higher than the actual sulphur content. The actual concentrations experienced during a period of use of the back up fuel are therefore likely to be significantly lower than the values presented.

Taking into consideration the likely duration of the use of the back up fuel, the likely infrequent operation of the plant and the likely lower sulphur content, it is considered that the impact of the proposed plant of 24 hour mean SO_2 concentrations when operating on the back up fuel is likely to be insignificant.

Table 6-16 Predicted 24-Hour Mean SO_2 Concentrations (mg/m^3)

Receptor / Scenario	Scenario 3		Scenario 4	
	99th	99.2nd	99th	99.2nd
R1	17.8	25.3	6.3	7.4
R2	25.8	29.3	6.9	7.1
R3	28.2	31.8	7.3	7.4
R4	39.5	44.1	7.3	9.4
R5	58.2	65.4	10.5	10.6
R6	81.7	96.5	13.2	14.9
R7	125.0	137.7	29.7	29.9
R8	119.3	123.6	32.4	34.2
R9	34.1	40.5	14.4	14.7
R10	19.9	22.3	9.5	9.8
Maximum (% of the WHO Interim Target 1 and the national standards)	**100%**	**63.5%**	**25.9%**	**15.8%**
KSA AQS (µg/m^3)	**-**	**217**	**-**	**217**
WHO Interim Target 1	**125**	**-**	**125**	**-**
WHO Interim Target 1	**50**	**-**	**50**	**-**
WHO Guidelines (µg/m^3)	**40**	**-**	**40**	**-**
Presented as the 99th percentile for direct comparison with the WHO Standards and Guidelines which includes an allowance of 3-4 days exceedance per year and as the 99.2nd percentile for comparison with the National Standard which includes an allowance of 3 days exceedance per year				

The predicted 99.7th percentile of hourly mean SO_2 concentrations under scenarios 3 (combined cycle) and 4 (simple cycle) are presented in the following table. The results of both scenarios show that there will be no exceedances of the National Standard for hourly mean SO_2 concentrations. The process contributions during the operation of scenario 3 from the proposed plant are greater than IFC requirement of 25% of the relevant standards at some of the receptor locations.

The plant will operate primarily on natural gas, the back up fuel will only be used in the event of an interruption to the supply of natural gas. It is estimated that the plant will only operate for 30 days per year on the back up fuel. The concentrations presented in the table above represent the worst-case concentration over a five year period i.e. under the worst case meteorological conditions experienced in the five years considered. The plant is only likely to operate for a maximum of 30 days per year with the back up fuel and only when gas is not available, the operation of the plant on back up fuel is therefore an infrequent event and it is unlikely that this would coincide with the worst-case meteorological conditions.

It should also be noted that at the time of the assessment, the actual sulphur content of the back up fuel was not known. The emissions of SO_2 were therefore calculated from the limit value (0.015% by volume at 15%O_2, dry), which is likely to be higher than the actual sulphur content. The actual concentrations experienced during a period of use of the back up fuel are therefore likely to be significantly lower than the values presented.

Taking into consideration the likely duration of the use of the back up fuel, the likely infrequent operation of the plant and the likely lower sulphur content, it is considered that the impact of the proposed plant of hourly mean SO_2 concentrations when operating on the back up fuel is likely to be insignificant.

Table 6-17 Predicted 99.7th Percentile of Hourly Mean SO_2 Concentrations (mg/m^3)

Receptor / Scenario	Scenario 3	Scenario 4
R1	92.0	31.4
R2	98.5	29.9
R3	118.2	29.1
R4	148.1	26.8
R5	231.8	36.8
R6	291.1	51.1
R7	431.9	84.7
R8	374.7	98.4
R9	175.6	65.1
R10	118.0	68.9
Maximum (% of the KSA AQS)	**97.9%**	**22.3%**
KSA AQS (µg/m^3)	**441**	
Presented as the 99.7th percentile for direct comparison with the National Standard which includes an allowance of 24 exceedance per year		

The predicted 15 minute mean SO_2 concentrations under scenarios 3 (combined cycle) and 4 (simple cycle) are presented in the following table and compared to the WHO guidelines. The results of scenario 3 (combined cycle) indicate that there would be exceedances of the WHO guidelines for 10 minute mean SO_2 concentrations at R6, R7, R8, R9, and R10. The process contributions from the proposed plant are greater than IFC requirement of 25% of the WHO guidelines at all of the sensitive receptor locations. The results of scenario 4 (simple cycle) are compliant with the WHO guidelines but above the IFC requirement of 25% of the relevant standards at R6, R7, R8, R9, and R10.

The plant will operate primarily on natural gas, the back up fuel will only be used in the event of an interruption to the supply of natural gas. It is estimated that the plant will only operate for 30 days per year on the back up fuel. The concentrations presented in the table above represent the worst-case concentration over a five year period i.e. under the worst case meteorological conditions experienced in the five years considered. The plant is only likely to operate for a maximum of 30 days per year with the back up fuel and the operation of the plant on back up fuel is therefore an infrequent event and it is unlikely that this would coincide with the worst-case meteorological conditions.

It should also be noted that at the time of the assessment, the actual sulphur content of the back up fuel was not known. The emissions of SO_2 were therefore calculated from the limit value (0.015% by volume at 15%O_2, dry),

which is likely to be higher than the actual sulphur content. The actual concentrations experienced during a period of use of the back up fuel are therefore likely to be significantly lower than the values presented.

Taking into consideration the likely duration of the use of the back up fuel, the likely infrequent operation of the plant and the likely lower sulphur content, it is considered that the impact of the proposed plant of 15-minute mean SO_2 concentrations when operating on the back up fuel is likely to be insignificant.

Table 6-18 Predicted 15-Minute Mean SO_2 Concentrations (mg/m^3)

Receptor / Scenario	Scenario 3	Scenario 4
R1	315.9	98.6
R2	307.7	96.8
R3	392.7	110.5
R4	349.4	106.4
R5	396.2	119.3
R6	511.6	125.7
R7	962.1	178.5
R8	834.3	152.8
R9	761.9	205.3
R10	604.8	178.8
Maximum (% of the KSA AQS)	**192.4%**	**41.1%**
WHO Guideline (mg/m^3)	**500**	

PM_{10} Modelling Results

The results for both scenarios 3 and 4 indicate that there will not be any exceedances of the National Standard or WHO guideline for 24-hour mean PM_{10} concentrations at any of the sensitive receptors. The process contributions from the proposed plant are less than 25% of the National Standard and the WHO Target Level 1, 2 and 3 for scenario 3 and the WHO guidelines for scenario 4 at all of the sensitive receptor locations.

Table 6-19 Predicted 24-Hour Mean PM_{10} Concentrations (mg/m^3)

Receptor / Scenario	Scenario 3		Scenario 4	
	99th	96.7th	99th	96.7th
R1	2.2	1.6	0.9	0.6
R2	3.2	2.1	1.0	0.7
R3	3.5	2.6	1.1	0.7
R4	4.9	3.2	1.3	0.9
R5	7.5	5.0	1.6	1.3
R6	10.6	5.8	2.2	1.7
R7	16.8	13.3	7.1	4.8
R8	15.6	13.3	5.5	4.4
R9	4.4	2.8	1.9	1.4
R10	2.7	1.6	1.2	0.8
Maximum (% of the standards and guidelines)	**11.2%**	**3.9%**	**4.7%**	**1.4%**
KSA AQS ($\mu g/m^3$)	**340**			
WHO Guidelines ($\mu g/m^3$)	**45**			
Presented as the 99th percentile for direct comparison with the WHO Standards and Guidelines which includes an allowance of 3-4 days exceedance per year and as the 96.7th percentile for comparison with the National Standard which includes an allowance of 12 days exceedance per year				

The results for both scenarios 3 and 4 indicate that there will not be any exceedances of the National Standard or WHO guidelines for 24-hour mean $PM_{2.5}$ concentrations at any of the sensitive receptors.

Table 6-20 Predicted 24-Hour Mean $PM_{2.5}$ Concentrations (mg/m^3)

Receptor / Scenario	Scenario 3		Scenario 4	
	99th	96.7th	99th	96.7th
R1	2.2	1.6	0.9	0.6
R2	3.2	2.1	1.0	0.7
R3	3.5	2.6	1.1	0.7
R4	4.9	3.2	1.3	0.9
R5	7.5	5.0	1.6	1.3
R6	10.6	5.8	2.2	1.7
R7	16.8	13.3	7.1	4.8
R8	15.6	13.3	5.5	4.4
R9	4.4	2.8	1.9	1.4
R10	2.7	1.6	1.2	0.8
Maximum (% of the standards and guidelines)	**22.3%**	**38.1%**	**9.5%**	**13.7%**
KSA AQS (µg/m^3)	**35**			
WHO Guidelines (µg/m^3)	**15**			
Presented as the 99th percentile for direct comparison with the WHO Standards and Guidelines which includes an allowance of 3-4 days exceedance per year and as the 96.7th percentile for comparison with the National Standard which includes an allowance of 12 days exceedance per year				

Emissions from Emergency Diesel Generator

The Project will include a back-up diesel generator that will be used for emergency situations. The exhaust from the diesel generator will emit gaseous air pollutants from diesel fuel combustion which will consist of CO_2, CO, Particulate Matter (PM), NOx, SO_2 and hydrocarbons. The backup generators will not run parallel to the power plant, their operation is expected to be infrequent, only in case of emergency and they will be located within the power plant premises away from sensitive receptors that may be affected. The magnitude of potential impacts is assessed to be only negligible and is not anticipated to have significant air quality impacts, therefore, detailed assessment is not considered necessary.

Operational Vehicle Emissions

Operation of the Project will introduce a small number of commuter vehicles and delivery/removal vehicles along the local roads. The expected number of vehicles and their type are not available at the time of preparing this ESIA but are likely to be limited. Emissions from these vehicles will not result in discernible impacts on the local air quality and as such detailed assessment has not been conducted.

Table 6-21 Operation Phase - Air Quality Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Operational emissions of gaseous air pollutants	Minor	Nearby facility workers within the AoI	Medium	**Minor**	• During commissioning, the stack emissions will be tested to ensure that the control systems are operating correctly and that emission values comply with applicable national and IFC EHS standards/guidelines. • During operation there will be continuous monitoring of stack emissions, by CEMS systems, to ensure that the plant is operated efficiently and compliant conditions are maintained through appropriate process controls. • Regular scheduled maintenance activities will be undertaken to ensure that equipment is operating in its most effective manner, to reduce emissions. • A grievance mechanism will be established to allow local communities to make complaints relating to Project air emissions nuisance.	**Negligible**
		Project construction workers				
Emissions from emergency diesel generators	Minor	Nearby facility workers within the AoI	Medium	**Minor**	• Backup diesel generator will be used only during emergency only. • Low Sulphur diesel fuel will be used. • Implement a grievance mechanism and address any complaints received in a timely manner including implementing applicable corrective actions.	**Negligible**
		Project construction workers				
Emissions from operational vehicles	Minor	Nearby facility workers within the AoI	Medium	**Minor**	• Limit unnecessary usage of vehicles and avoid idling. • Emissions from vehicles will be free from significant black smoke - remedial measures shall be taken if this is observed. • Implement a regular maintenance program of vehicles and keep documentary evidence.	**Negligible**
		Project construction workers				

6.2.2 Climate Change Impacts & Adaptation

6.2.2.1 Construction Phase Impacts and Mitigation

GHG EMISSIONS

The stationary combustion sources used during the construction phase of the Project will primarily relate to temporary diesel generators. The construction phase of the Project will also necessitate an amount of mobile equipment/plant and vehicles to facilitate works. Equipment such as excavators, cranes, and other vehicles will be ample on the site and are expected to be used in most construction processes.

The estimated quantity of fuel required during the construction phase is 52,000 L/month. Using the Greenhouse Gas Protocol calculation tool for GHG Emissions from Stationary Combustion (World Resources Institute, 2015), the GHG emissions during construction were calculated and are summarised in Table 6-22 below.

The monthly GHG emissions, during the Project construction phase is estimated to be 139.63 tonnes of carbon dioxide equivalent (tCO2e). The annual estimate of GHG emissions during construction is 1,675.6 tCO2e. This will be less much less than the IFC threshold value of significance of 25,000 tCO2e per year. The construction period is expected to be over a period of 30 months, totalling around **50,266.8** tCO2e during the Construction period.

Table 6-22 Construction Phase GHG Emissions

Fuel Type	Volume of Fuel (L/month)	GHG Emissions (tonnes)			Total GHG (tCO_2e)
		CO_2	CH_4	N_2O	
Liquid Fossil (Diesel)	52,000	139.18	$5.64e^{-03}$	$1.13e^{-03}$	**139.63**
Monthly GHG emissions from fossil fuels (tCO_2e)					**139.63**
Annual GHG emissions from fossil fuels (tCO_2e)					**1,675.6**
Construction Period GHG emissions from fossil fuels (tCO_2e)					**50,266.8**

Scope 2 emissions (electricity use) are scoped out for impacts during construction as the site is not connected to the power grid supply.

GHG emissions are also expected for the construction of the associated facilities construction activities, however, these could not be assessed quantitatively.

VULNERABILITY OF THE PROJECT TO CLIMATE CHANGE – PHYSICAL RISKS

The construction of the Project and the associated facilities impacts expected due to the climate conditions are discussed below.

Increased Temperatures and Extreme Heat

Current trends in global warming are resulting in temperature increases worldwide, which are also expected to impact KSA. Historical meteorological records between 1991 – 2016 indicate that the mean annual temperature for 115 years was 24.7ºC (WBG, 2021). According to KSA First National Communication, general warming was reported all over the country since 1950 with a minimum of about 0.15ºC of warming in Tabuk, Makkah and Al Ahssa to a maximum of about 0.75ºC in Khamis Mushait and Wadi Al Dawasser.

Heatwaves can cause heat exhaustion, heatstroke, and dehydration, especially for outdoor workers. Increased temperatures or prolonged periods of extreme heat can also affect worker productivity and safety as workers may experience reduced concentration, fatigue, and slower reaction times, leading to an increased risk of accidents and injuries. These have been assessed under the occupational health and safety (OHS) section of this report and management measures defined.

Dust Storms

Dust storms can impact the construction workers that are exposed to such harsh weather conditions in the absence of shelter or proper mitigation. These have been assessed under the occupational health and safety (OHS) section of this report and management measures defined.

Flash Flood Risk

KSA's mean annual precipitation is expected to increase by 7% by 2050 (WBG, 2021). Climate change is predicted to increase both the frequency and the intensity of rainfall which will result in increased run-off flows. Intense rainfall that may potentially result is floods that can create physical hazards at construction sites, such as submerged debris, fast-moving drainage, and unstable ground. Workers may face an increased risk of slips, trips, falls, and other accidents, leading to injuries.

A project-specific flood risk study has been undertaken to characterise flow paths that contribute to the AoI. To determine the flood risk and ensure the required design considerations are implemented at an early stage of the Project, a hydrology and flood risk study was carried out (**Appendix M**). The risks and the required mitigations are summarised in section 6.2.4.1.

Table 6-23 Construction Phase – Climate Change Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Increase in GHGs emissions from on-site power generators, heavy machinery and vehicles	Minor	Global atmosphere	Medium	**Minor**	• Implement the gaseous air emissions mitigation listed in Table 6-5. • Manage energy and fuel demand through use of energy efficient equipment, monitoring fuel and electricity consumption and training the workforce on possible consumption reduction practices.	**Negligible**
Vulnerability of the Project to climate change	Minor	Project	Low	**Minor**	• Implement the measures presented in section 6.2.4.1. • Provide workers with appropriate PPE and safety training related to flood risks, dust storms, high temperature etc. • Monitor weather forecasts and be prepared to suspend work if there's a high risk of flooding or extreme heat. • Implement an emergency evacuation plan and conduct regular drills. • Elevate equipment and materials above expected flood levels, if any. • Ensure that electrical systems are properly grounded and protected from water exposure. • The EPC contractor will complete a risk assessment of extreme weather events (extreme heat, dust storms etc.) on workers and implement the necessary mitigation. • Provide access to medical facilities and first-aid equipment on-site.	**Negligible**

6.2.2.2 Operation Phase Impacts and Mitigation

GHG EMISSIONS FROM THE PLANT OPERATION

During operation, the Plant will run on a continuous supply of natural gas. Scope 1 emissions for the Project's operational phase were quantified using the GHG Calculation Tool developed by the Greenhouse Gas Protocol with specialized workings for GHG emissions from stationary combustion sources. The following table provides an overview of GHG emissions based on the yearly fuel usage along with the carbon intensity of power generation during the operational period (25 years).

Table 6-24 Estimates of GHG Emission from the Plant Operation

year	Period Dispatch (MWh)	Greenhouse Gas Emission (tonnes CO_2eq)	CO2 Intensity (gCO_2e/kWh)
ICOD			
ICOD1 (July to Sept. 2026)	1,054,044	544,564	517
ICOD2 (May to Sept. 2027)	6,418,656	3,270,313	510
Plant RTR (May 2028)	2,127,468	751,171	353
Operation			
2028	18,512,142	6,339,006	342
2029	18,732,668	6,480,646	346
2030	19,075,090	6,605,270	346
2031	17,668,777	6,121,767	346
2032	19,014,616	6,593,150	347
2033	18,896,547	6,549,793	347
2034	18,896,547	6,559,588	347
2035	18,001,134	6,224,494	346
2036	19,197,824	6,650,081	346
2037	18,494,945	6,385,211	345
2038	19,163,236	6,633,324	346
2039	18,043,261	6,251,175	346
2040	19,130,776	6,633,373	347
2041	19,014,390	6,597,197	347
2042	18,438,948	6,400,902	347
2043	19,095,590	6,632,833	347
2044	18,186,876	6,290,429	346
2045	19,111,106	6,617,153	346
2046	19,066,720	6,606,524	346
2047	19,171,118	6,646,799	347
2048	17,650,262	6,121,893	347
2049	19,187,210	6,637,368	346

year	Period Dispatch (MWh)	Greenhouse Gas Emission (tonnes CO_2eq)	CO2 Intensity (gCO_2e/kWh)
2050	18,959,001	6,563,643	346
2051	19,131,695	6,627,461	346
2052	19,122,591	6,628,085	347

The project is estimated to produce ±6.6MtCO_2/year. When this is compared to KSA's total emissions of 712Mt in 2020[15], the project represents ~0.57% of the national total. When compared to the country's energy sector emissions (~562 MtCO_2e in 2020) the Project represents ~0.73% of the country's energy sector processes and product use emissions.

The annual emissions of ±6.6MtCO2e/year significantly exceed the IFC threshold for GHG quantification (25,000tCO_2/year), for emissions that are within direct control of the facility within the study period.

The powerplant will be self-sufficient and therefore, power grid supply is not expected to be required under normal conditions, therefore, Scope 2 emissions (electricity use) is not assessed during operation. GHG emissions are not expected from the operation of the assotiated facilities and have therefore not been considered in the assessment.

GHG Emissions from the Operation of Backup Diesel Generators

The stationary combustion emission may result from the operation of backup diesel generators in emergency cases which are considered infrequent. The estimated quantity of fuel required during the operation phase for EDG and BSDG are 1,300 kg/h and 7,400 kg/h, respectively. The emissions will depend on the actual emergency situations where the operation of the diesel generator will be required. However, for reference, the hourly GHG emissions during the operation of the backup generators were calculated using the Greenhouse Gas Protocol calculation tool for GHG Emissions from Stationary Combustion (World Resources Institute, 2015). As shown in the table below, the GHG emissions will be insignificant considering the limited operation periods and compared to the IFC threshold value of significance of 25,000 tCO_2e per year.

Table 6-25 Estimates of GHG Emission in the Event of Backup Diesel Generators Operation

Fuel Type	Volume of Fuel (kg/hour) *	GHG Emissions (tonnes)			Total GHG (tCO_2e)
		CO_2	CH_4	N_2O	
Liquid Fossil (Diesel) for the EDG	1,183	3.479	1.409e-^{04}	2.817e-^{05}	3.48
Liquid Fossil (Diesel) for the BSDG	6,734	19.806	8.019e-^{04}	1.604e-^{04}	19.83
*Converted from kg/h to L/h assuming a density of 0.91 kg/L for diesel					

GHG Emissions from the Operation of Vehicles

Emissions from the operation of vehicles are also anticipated during the operational phase of the Project. Emissions are expected to be from the delivery vehicles to the Project site and those of the employees as well as equipment during maintenance; however, the impacts are not considered to be significant and have therefore been excluded from this assessment.

[15] https://www.climatewatchdata.org/countries/SAU?end_year=2020&start_year=1990

VULNERABILITY OF THE PROJECT TO CLIMATE CHANGE - PHYSICAL RISK

Future climate scenarios indicate an increase in the length of dry periods, and high aridity, rapidly depleting groundwater reserves, and projected temperature increases indicate that the frequency of dust storms and water stress is bound to increase. Greater rainfall variability may also result in prolonged droughts.

The assessment was carried out based on key projected climate trends for KSA are summarised below. This is based on data published by the World Bank Group, Climate Change Knowledge Portal, which is based on the Coupled Model Intercomparison Project, Phase 6 (CMIP6) models included in the IPCC's Fifth Assessment Report (AR5) (World Bank Climate Change Knowledge Portal, 2024).

Decreased Power Generation Capacity due to Cooling System Constraints

Water and air-cooling systems used at thermal plants become less efficient at higher temperatures, causing operators to curtail or shut down plant operations in response. Recent studies have demonstrated that an increase in the temperature of ambient air and cooling water affects the capacity of thermal power plants in the following respects:

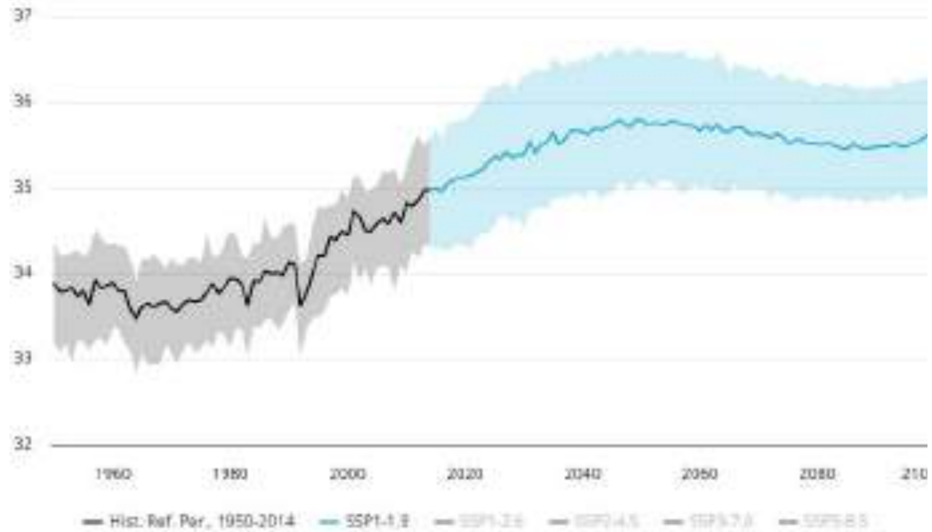
- Increased environmental temperatures result in a decreased thermal efficiency of thermal power plants;
- Elevated environmental temperatures also act to reduce the power load of thermal power plants by limiting condenser pressure;
- Increased environmental temperatures lead to an increased demand for cooling water and a lower cooling efficiency. Regulatory constraints on water abstraction during low environmental flow and temperature of return water also play into operational declines during temperature extremes.

The studies further indicate that a 1°C increase in ambient air temperature translates into a 0.8-1.2% increase in curtailment of thermal power plant operations during periods of peak electrical demand.

To assess the potential climate change risks during the Project's lifetime that is expected to be till 2052, the projected average maximum surface air temperature anomaly for Ash Sharqiyah, KSA (reference period 1995-2014) were extracted and are presented below.

- Under scenario SSP1-1.9, by 2052, the 10-90th percentile range of average maximum surface air temperature in the Project area is 35.01°C to 36.60°C (median 35.76°C) which represents a maximum 90th percentile increase of 0.61°C during the month of June.
- Under scenario SSP1-2.6, by 2052, the 10-90th percentile range of average maximum surface air temperature in the Project area is 35.05°C to 36.98°C (median 36.01°C) which represents a maximum 90th percentile increase of 1.43°C during the month of September.
- Under scenario SSP2-4.5, by 2052, the 10-90th percentile range of average maximum surface air temperature in the Project area is expected to reach 35.57°C to 37.28°C (median 36.36°C) which represents a maximum 90th percentile increase of 1.57°C during the month of September.
- Under scenario SSP3-7.0, by 2052, the 10-90th percentile range of average maximum surface air temperature in the Project area is expected to reach 35.05°C to 37.81°C (median 36.54°C) which represents a maximum 90th percentile increase of 1.69°C during the month of November.

- Under scenario SSP5-8.5, by 2052, the 10-90th percentile range of average maximum surface air temperature in the Project area is expected to reach 35.96°C to 38.41°C (median 37.08°C) which represents a maximum 90th percentile increase of 2.15°C during the month of September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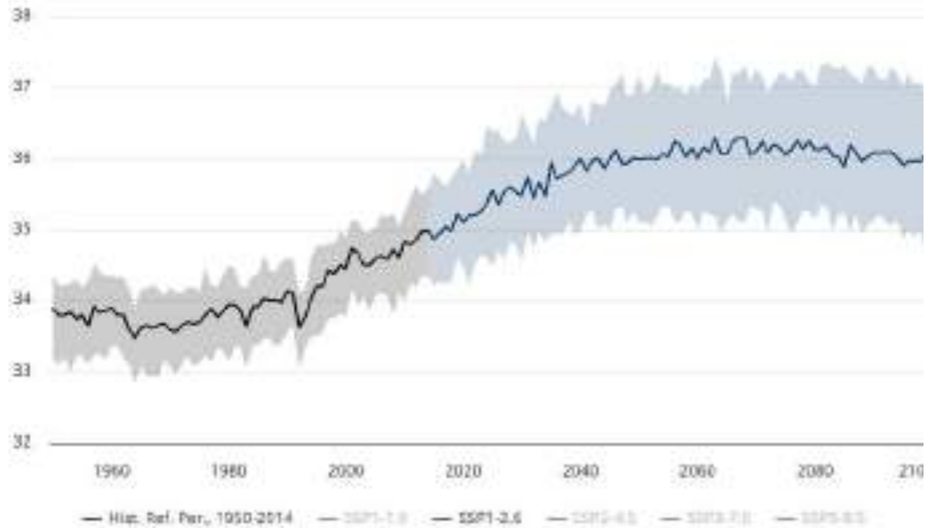
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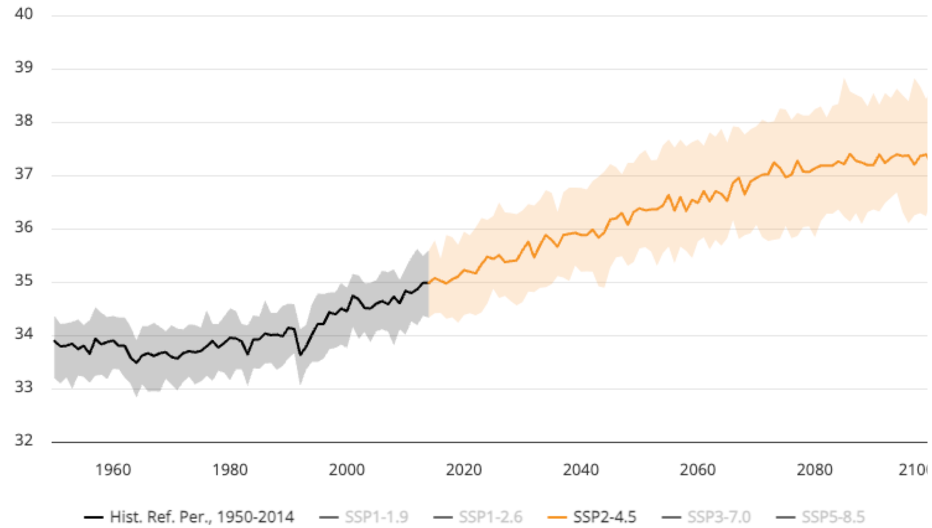
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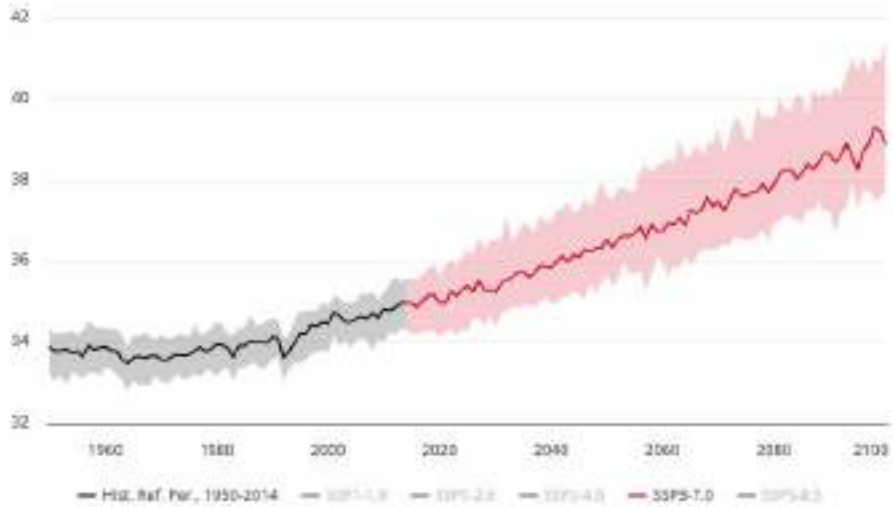
SSP3-7.0
SSP5-8.5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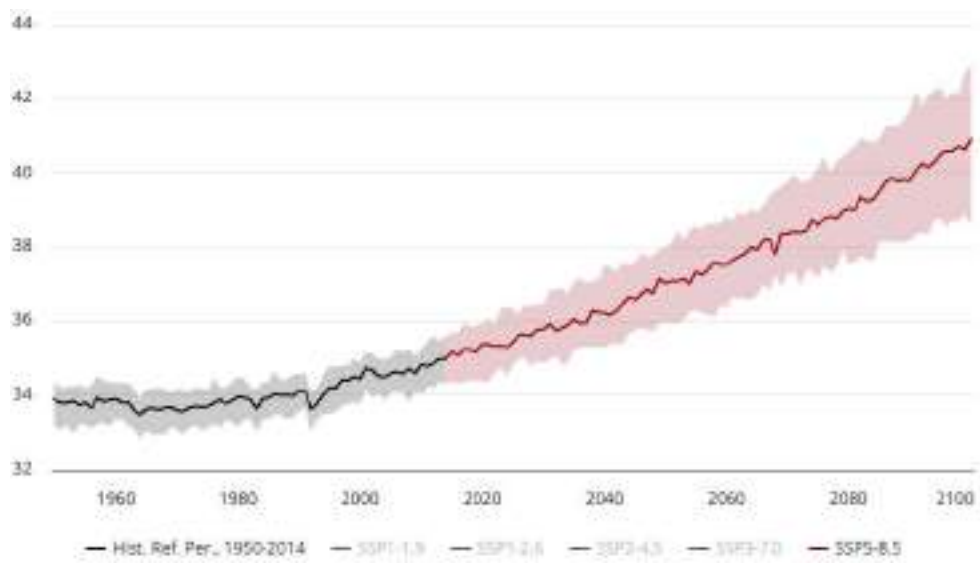


Figure 6-3 Projected Average Maximum Surface Air Temperature Anomaly for Ash Sharqiyah, KSA (reference period 1995-2014) For Each Scenario

The graphs below present the projected climatology of average maximum surface air temperature for Ash Sharqiyah during the Project lifetime. As per the projections under the worst-case scenario SSP5-8.5, the maximum 90th percentile temperature is forecasted to peak in August, reaching 39.96°C between 2020 and 2039. This temperature is expected to rise to 41.08°C between 2040 and 2059.

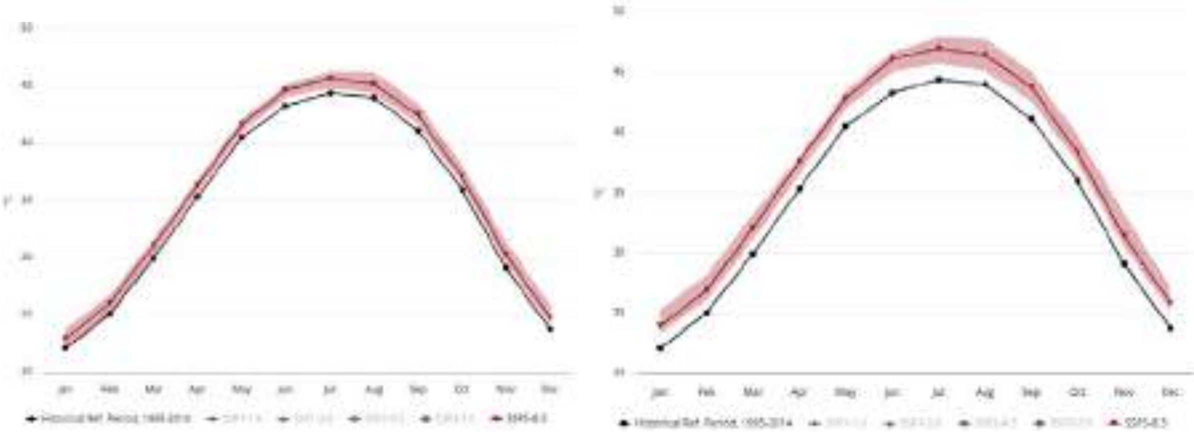


Figure 6-4 Annual Average Maximum Surface Air Temperature for 2020-2039 (left) 2040-2059 (right) for Ash Sharqiyah (Ref. Period: 1995-2014), SSP5-8.5, Multi-Model Ensemble

The thermal power plant in its entirety has been designed to endure high temperatures of up to 50°C, exceeding the projected temperature increases for Ash Sharqiyah. Given these projections, the potential impact of rising temperatures on the project's components and operation is **not expected**. The plant will be equipped with a fire protection system that features comprehensive fire detection and response facilities.

Forced Outage and Service Interruptions due to Damage from Climate-Related Hazards

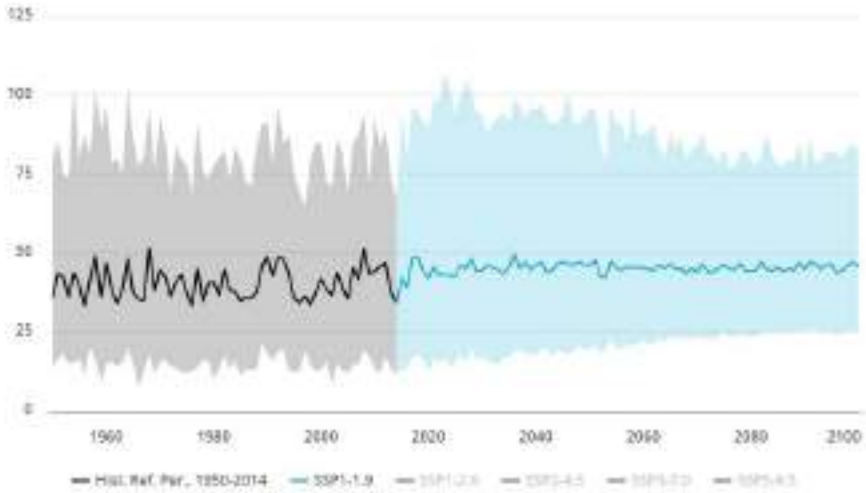
Climate-induced natural disasters, such as floods, droughts, high-intensity rainfall events can also interrupt power plant operations through severe damage to plant buildings, equipment and materials. Forced power outages resulting from natural hazards can therefore compound the risk of economic losses and heat stress to communities reliant on the power grid.

To assess the potential climate change risks during the Project's lifetime that is expected to be till 2052, the projected mean precipitation for Ash Sharqiyah, KSA (reference period 1995-2014) were extracted and are presented below.

- Under scenario SSP1-1.9, by 2052, the 10-90th percentile range of mean precipitation in the Project area is 18.11mm to 84.17mm (median 42.37mm).
- Under scenario SSP1-2.6, by 2052, the 10-90th percentile range of mean precipitation in the Project area is 9.53mm to 113.64mm (median 44.67mm).
- Under scenario SSP2-4.5, by 2052, the 10-90th percentile range of mean precipitation in the Project area is 14.18mm to 88.44mm (median 40.97mm).
- Under scenario SSP3-7.0, by 2052, the 10-90th percentile range of mean precipitation in the Project area is 10.00mm to 96.87mm (median 40.58mm).

- Under scenario SSP5-8.5, by 2052, the 10-90th percentile range of mean precipitation in the Project area is 13.76mm to 80.10mm (median 38.63mm).

For the period between 2040 and 2059, across all scenarios, the anticipated median (50th percentile) precipitation is expected to remain comparable to historical patterns, showing fluctuations without significant projected increases in the future. However, there is a decrease pattern observed overtime. Furthermore, precipitation levels are expected to peak in January, March, and November across all scenarios.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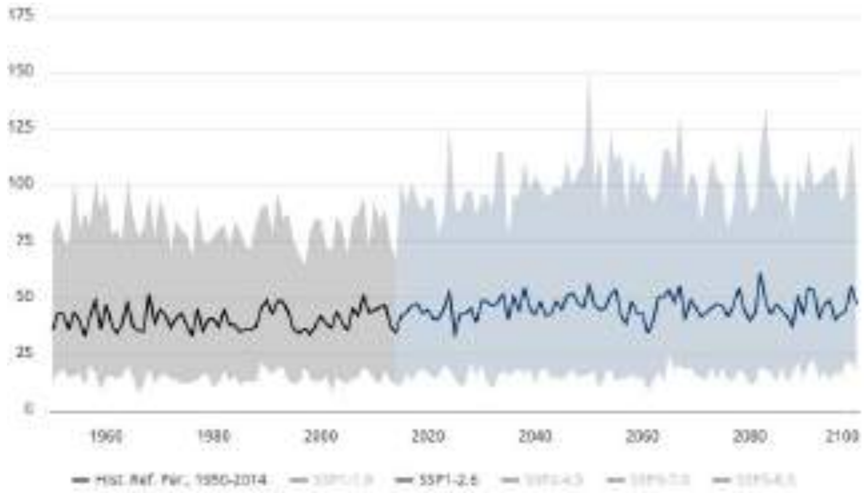
SSP1-1.9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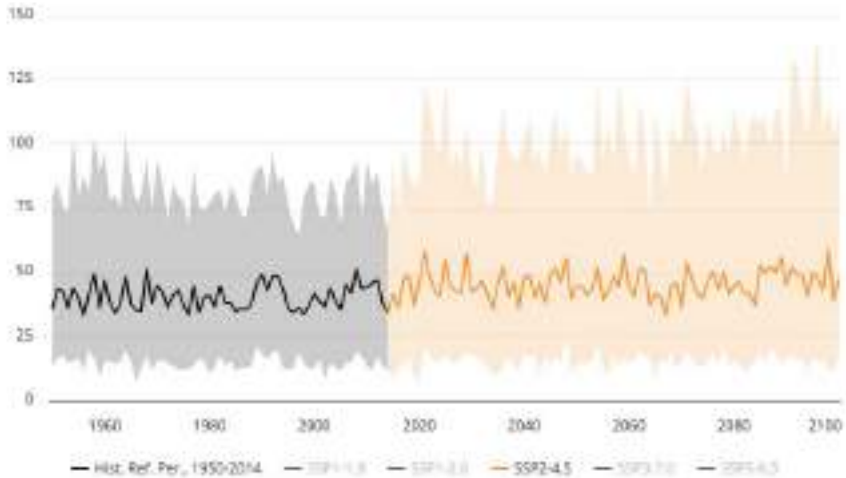
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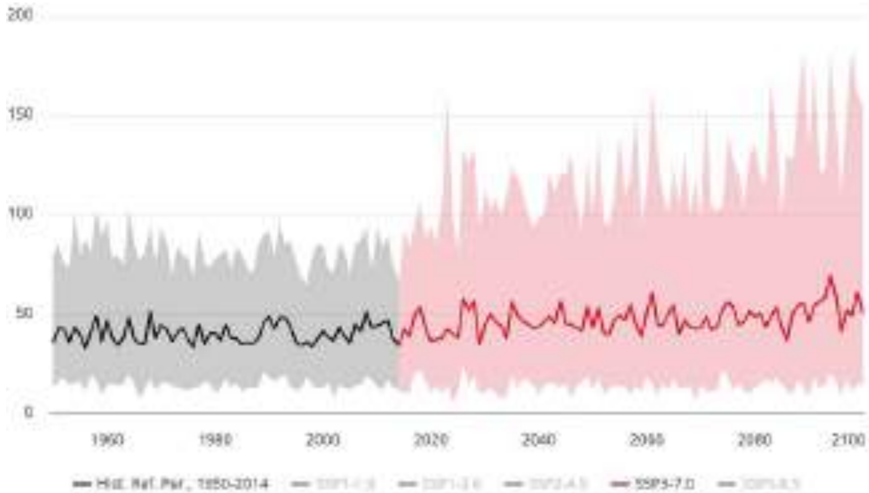
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SSP3-7.0

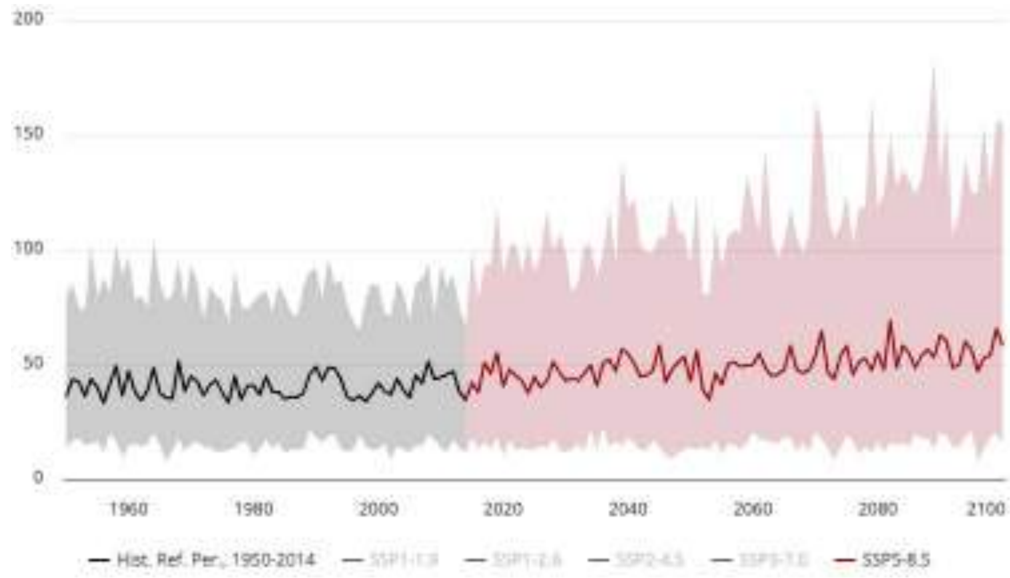


Figure 6-5 Projected Precipitation in Ash Sharqiyah, Saudi Arabia; (Ref. Period: 1995-2014), for Each Scenario, Multi-Model Ensemble

Considering the rainfall projections, significant impacts due to increased precipitation is not expected. In addition, the EPC contractor is committed to implementing the following safeguards to mitigate against service interruptions due to climate related extreme events:

- The facility will be designed to withstand the high temperatures and weather conditions of KSA.
- The EPC contractor will ensure no loss of operation for a flooding level with a return period of 1 in 100 years. Stormwater drainage systems will be designed to withstand the maximum discharge in the most extreme foreseeable precipitation events.

Health and Safety Incidents due to Extreme Heat Events

Acute physical climate risks relevant to the project include health and safety incidents amongst operational plant workers during periods of extreme heat. The incidence of substantially high temperatures could potentially impact on the wellbeing of workers, particularly those who will not operate within units with controlled temperatures. Workers stationed in the plant's exterior, for instance, will be prone to health effects such as dehydration, and heat stress, heat stroke, heat exhaustion, heat cramps, heat rashes and burns from contact with overheated surfaces.

These have been assessed under the occupational health and safety (OHS) section 6.2.15 of this report and management measures defined.

TRANSITION CLIMATE RISK

As per requirements of the Equator Principles IV, consideration of climate transition risks (as defined by the TCFD) is mandatory for all projects which are expected to have combined Scope 1 and 2 emissions of more than 100,000tCO2e annually. The annual Project emissions have been estimated at around ±6.6 MtCO2e per year, which is above the threshold.

The Paris Agreement came into force on 4th November 2016. The KSA signed and ratified the Agreement on 3rd November 2016 (UNTC, 2020). The overarching aim of the Paris Agreement is to limit the increase in global temperature increase to well below 2°C, with efforts to restrict the increase to 1.5°C. Following the launch of Vision 2030 in 2016, the Kingdom of Saudi Arabia has taken several steps towards a more sustainable future with establishing a number of initiatives to address the climate change issue. The KSA has committed to diversify the national energy mix used in electricity production while reducing the use of liquid fuel and have 50% of its power generated from renewable sources by 2030.

In 2021, the government inaugurated the Saudi Green Initiative (SGI) which unites environmental protection, energy transition and sustainability programs with the overarching aims of offsetting and reducing emissions, increasing the Kingdom's use of clean energy and addressing climate change. SGI is steering the implementation of a sustainable long-term climate action plan with three (3) overarching targets, one of which is reducing emissions. Beyond a domestic energy mix transformation, SGI is steering a range of ambitious initiatives that will reduce emissions including investing in new energy sources, improving energy efficiency, and developing a carbon capture and storage program.

In 2021, KSA submitted its Updated First Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC). This aimed to align with its sustainable development goals by implementing measures for economic diversification, focusing on:

- Greenhouse gas emission avoidance, reduction, and removal.

- Climate adaptation.
- Managing the impacts of response measures.

As part of reforms in its domestic energy sector, the KSA intends to boost the use of natural gas in its energy mix. By 2030, it aims for up to 50% of its electricity generation to be sources from natural gas, reducing the carbon intensity of domestic energy production.

While the project does not represent an addition to the country's renewable energy base, it serves the purpose of utilizing modernized, efficient and relatively clean combustion technology for thermal power generation. Given the opted technology is reliant on natural gas rather than coal or fuel oil, and on combined cycle generation rather than conventional steam power generation, and it aligns with the country's NDC commitments, it does not pose reputational risks pertaining to the development of non-renewable power generation with a large carbon footprint.

As part of the NDC commitments, KSA is planning to build upon its experience in the world's largest carbon capture and utilization plant as part of the National Circular Carbon Economy Program. The Project is also considering to be Carbon Capture land plot available for future implementation with up to 95% CO_2 capture to proactively address potential changes in emissions standards. The development of the Hajr Two IPP is in line with the KSA Vision 2030 and NDC commitments and therefore carries no climate transition risk in the short term.

The table below presents an overview of a preliminary review of the Projects compatibility with the Country's National Climate Commitments (NCC).

Table 6-26 Preliminary NCC Compatibility Review

Aspect	Applicability and Overview
List of "Universally Not-Aligned" with the Paris Agreement goals	These include the following Projects: • Mining of thermal coal • Electricity generation from coal • Extraction of peat • Electricity generation from peat The Project does not feature in the "Universally Not-Aligned" activities.
List of Projects aligned with the Paris Agreements	As a facility utilising natural gas as the main source of energy, the Project does not feature in the "Universally Aligned" activities.
Nationally Determined Contributions	The Project contributes to KSA's NDC commitments including: 1- Increasing power generation by natural gas. 2- Carbon Capture Utilization & Storage
Long Term Strategies	KSA has not yet developed its Long-Term Strategies yet. The project falls under the broader KSA energy and power development strategies under KSA Vision 2030, which aims to diversify the national energy mix used in electricity production, increase the share of natural gas (and renewable energy sources) to approximately 50% while reducing the use of liquid fuel. In theory, this would also tie into broader multi-lateral government agreements (such as the Paris Agreement) and the updated NDCs.

Aspect	Applicability and Overview
Low Carbon Pathway	While the project does not represent an addition to the country's renewable energy base, it serves the purpose of utilizing modernized, efficient and relatively clean combustion technology for thermal power generation. Because the opted technology is reliant on natural gas rather than coal or fuel oil, and on combined cycle generation rather than open cycle (except during kick-start and maintenance) and conventional steam power generation.
Carbon Lock-in	The Project demonstrates technical and economic carbon reduction readiness by having its Carbon Capture Infrastructure ready in terms of layout, stack design as well as interfaces with up to 95% CO_2 capture to proactively address potential changes in emissions standards. Therefore, the Project is committed to any requirement for future decarbonisation.

Given that KSA is committed to a reduction in the use of fossil fuels, it is expected that further strategies and policy will be implemented to promote energy efficiency and the use of clean, renewable energy. This could pose a risk to the long-term viability of the Project, particularly relating to any future limits / taxes on emissions that may imposed by any future changes to policy and legislation. However, considerring the Hajr Two IPP design is a more modern plant that operates on natural gas, it is likely to be at less risk.

Table 6-27 Operation Phase – Climate Change Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Increase in GHGs emissions from the Hajr Two IPP Project	Moderate	Global atmosphere	High	**Moderate**	• Implement energy efficiency measures to reduce the heating, cooling and power demands. • Implement and operate the Carbon Capture system as required to reduce the GHG emissions. • Use of high-performance monitoring and process control techniques, good design and maintenance of the combustion system so that the initially designed efficiency and GHG emission performance can be maintained. • Prior to operation, a GHG Management and Reporting Plan will be prepared to implement and monitor control measures to reduce emission of GHGs on an annual basis.	**Moderate**
Increase in GHGs emissions from back up power generators	Negligible	Global atmosphere	High	**Negligible**	• Implement the gaseous air emissions mitigation listed in Table 6-21. • Regular maintenance of the backup generators so that the initially designed efficiency and emission performance can be maintained.	**Negligible**
Vulnerability of the Project to climate change	Moderate	Project	Low	**Minor**	• Ensure the Project design and material selection takes into consideration climate change risks including increased temperatures and flood. • Stormwater drainage systems will be designed to withstand the maximum discharge in the most extreme foreseeable precipitation events to ensure no loss of operation for a flooding level with a return period of 1 in 100 years. • The plant will be equipped with a fire protection system that features comprehensive fire detection and response facilities. • Detailed design and procurement shall ensure that all equipment and machines shall allow continuous operation at rated power (or rated current), in the full range of site conditions, without exceeding applicable temperature and temperature rise limits or failing upon exceptional electric and electromechanical stresses. • The following mitigation measures shall be implemented to mitigate against heat-related medical conditions, for operational labour: – Workers assigned to operations in the exterior of the Plant's buildings and shaded areas will be provided with appropriate PPE (e.g., sun hats and cooling vests). – Shaded resting areas and adequate access to potable water will be provided for workers stationed outside of the Plant's buildings (e.g., guard houses). – Work locations (and duration, to the extent possible) will be restricted during periods of extreme heat to lessen the risk of heat-related health effects. Maintenance work within high-temperature units will be avoided during days with inordinately high temperatures.	**Negligible**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
					– Staff rooms on the plant's premises will be equipped with HVAC or fans to enable operations at workstations during periods of extreme heat. – Induction and refresher health and safety (H&S) trainings will include trainings on prevention of and first response to extreme heat exposure. The trainings will cover risk factors, mitigating PPE, first aid measures and nearest health centre for treatment of hyperthermia. – Further information and management plans to address workers welfare will be included in the Project H&S Plan.	

6.2.3 Noise and Vibration

6.2.3.1 Construction Phase Impacts and Mitigation

Noise will be generated by construction and propagated from the project site and the associated facilities to the surrounding areas via a range of processes. Pertinent construction activities at the project site in relation to noise are likely to include:

- Site preparation (e.g. earthworks, compaction);
- Civil works including trenching;
- Construction, mechanical and electrical installation; and
- Road compacting;
- Vehicles movement.

NOISE FROM CONSTRUCTION ACTIVITIES

The accumulation of noise from the above sources can introduce potential cumulative impacts when generated in tandem. All of these impacts may have a negative effect on the amenity of receptors within 2km of the Project boundary. The sensitive receptors within 2km from the Project boundary include the following

- Qurrayah Power Plant 2 is located approximately 650 m from the development footprint and the closest noise monitoring point in N3.
- Qurrayah IPP is located approximatly 100 m from the development site and the closest noise monitoring point in N1.

The types and number of the main plant and equipment that are likely to be used during construction has been provided by the EPC contractor in November 2024 and listed earlier in this report (section titled "Construction Equipment") is used in this assessment. Noise generation data for the anticipated plant and equipment used during the different construction stages has been obtained from 'British Standards (BS): Code of practice for noise and vibration on construction and open sites' where available. The type and number of equipment that will potentially be used during the construction stages and their respective noise levels are provided below.

Table 6-28 Noise Level of Proposed Construction Machinery

Equipment*	Number of Equipment	BS 5228-1:2009 Reference	SPL dB(A)
Civil Works			
Excavator	1	Table C.2 - #2	77
Dump Truck	1	Table C.2 - #30	79
Water Truck	1	Table C.4 - #91	78
Crane	1	Table C.4 - #43	70
Piling machine	1	Table C.3 - #8	88
HRSG Construction			
Crane	6	Table C.4 - #43	70
Trailer	2	Table C.4 - #75	79
Man lift	1	Table C.4 - #62	66
Diesel Generator	3	Table C.4 – #79	64

Equipment*	Number of Equipment	BS 5228-1:2009 Reference	SPL dB(A)
Air Compressor	1	Table C.5 – #5	65
Welding Machine	1	Table C.3 - #31	73
STG, GTG and Piping			
Crane	5	Table C.4 - #43	70
Trailer	1	Table C.4 - #75	79
Man lift	1	Table C.4 - #62	66
Diesel Generator	3	Table C.4 – #79	64
Air Compressor	1	Table C.5 – #5	65
Welding Machine	1	Table C.3 - #31	73
Electrical Works			
Crane	2	Table C.4 - #43	70
Trailer	1	Table C.4 - #75	79
Man lift	1	Table C.4 - #62	66
Dump Truck	1	Table C.2 - #30	79
Diesel Generator	2	Table C.4 – #79	64
Welding Machine	2	Table C.3 - #31	73
* Where the *BS5228-1:2009* does not include specific noise levels for certain equipment. Other appropriate types of equipment have been referenced from the Plant List.			

The cumulative noise levels from the Project activities during civil works have been calculated below. The calculations are conservative in that they assume all equipment will be operating in parallel for 50% of time throughout the working period without any noise attenuation or barriers.

<u>Civil Works</u>

The calculated noise for construction activities at the Project location during civil works are presented in the following table. The continued cumulative noise level as perceived at 10m distance from the source would be 86.2dB(A).

Table 6-29 Calculated Noise – Civil Works

Plant	BS 5228-1:2009 Reference	Noise at 10m dB(A)	On Time (%)	Overall noise with on time correction	Pressure (µPa)
Excavator	Table C.2 - #2	77	50	74.0	25059362
Dump Truck	Table C.2 - #30	79	50	76.0	39716412
Water Truck	Table C.4 - #91	78	50	75.0	31547867
Crane	Table C.4 - #43	70	50	67.0	5000000
Piling machine	Table C.3 - #8	88	50	85.0	315478672
Cumulative Source Noise Contribution at 10m db (A)				**86.2**	

A summary of the cumulative noise during civil works at the identified receptors are provided in the following table.

Table 6-30 Summary of Civil Works Cumulative Noise at the Sensitive Receptors Upon Applying a Basic Assessment of Distance Propagation and Ground Absorbance

Sensitive Receptor	Distance from Noise Source (m)	Noise Level dB(A) at Receptor after Distance Propagation and Ground Absorbance	Baseline Noise Level dB(A) at sensitive Receptor	Cumulative Noise Level dB(A)	Δ
R-1	650	42.9	50.72	51.4	0.68
R-2	100	63.2	53.90	63.7	9.8

Noise generation during civil works is inevitable, and based on the calculations above, noise levels will remain within the national standards stipulated in the executive regulations for noise at industrial receptors during daytime (70 dB(A)) and night-time (65 dB(A)) as no outliers are observed. However, noise levels at the most sensitive receptor (R-2) will increase to approximately 9.8 dB(A) compared to the existing baseline noise levels, exceeding the 3 dB(A) IFC standard and potentially resulting in nuisance particularly at this receptor.

<u>HRSG Construction</u>

The calculated noise for activities at the Project location during HRSG Construction are presented in the following table. The continued cumulative noise level as perceived at 10m distance from the source would be 80.9dB(A).

Table 6-31 Calculated Noise – HRSG Construction

Plant	BS 5228-1:2009 Reference	Noise at 10m dB(A)	On Time (%)	Overall noise with on time correction	Pressure (μPa)
Crane	Table C.4 - #43	70	50	67.0	5000000
Trailer	Table C.4 - #75	79	50	76.0	39716412
Man lift	Table C.4 - #62	66	50	63.0	1990536
Diesel Generator	Table C.4 – #79	64	50	61.0	1255943
Air Compressor	Table C.5 – #5	65	50	62.0	1581139
Welding Machine	Table C.3 - #31	73	50	70.0	9976312
Cumulative Source Noise Contribution at 10m db (A)				**80.9**	

A summary of the cumulative noise during HRSG construction at the identified receptors are provided in the following table.

Table 6-32 Summary of HRSG Construction Cumulative Noise at the Sensitive Receptors Upon Applying a Basic Assessment of Distance Propagation and Ground Absorbance

Sensitive Receptor	Distance from Noise Source (m)	Noise Level dB(A) at Receptor after Distance Propagation and Ground Absorbance	Baseline Noise Level dB(A) at sensitive Receptor	Cumulative Noise Level dB(A)	Δ
R-1	650	37.6	50.72	50.9	0.2
R-2	100	57.9	53.90	59.4	5.5

Noise generation during HRSG construction is inevitable, and based on the calculations above, noise levels will remain within the national standards stipulated in the executive regulations for noise at industrial receptors during daytime (70 dB(A)) and night-time (65 dB(A)) as no outliers are observed. However, noise levels at the most sensitive receptor (R-2) will increase to approximately 5.5 dB(A) compared to the existing baseline noise levels, exceeding the 3 dB(A) IFC standard and potentially resulting in nuisance particularly at this receptor.

STG, GTG & Piping

The calculated noise for construction activities at the Project location during STG, GTG and piping are presented in the following table. The continued cumulative noise level as perceived at 10m distance from the source would be 79.1dB(A).

Table 6-33 Calculated Noise – STG, GTG and Piping

Plant	BS 5228-1:2009 Reference	Noise at 10m dB(A)	On Time (%)	Overall noise with on time correction	Pressure (µPa)
Crane	Table C.4 - #43	70	50	67.0	5000000
Trailer	Table C.4 - #75	79	50	76.0	39716412
Man lift	Table C.4 - #62	66	50	63.0	1990536
Diesel Generator	Table C.4 – #79	64	50	61.0	1255943
Air Compressor	Table C.5 – #5	65	50	62.0	1581139
Welding Machine	Table C.3 - #31	73	50	70.0	9976312
Cumulative Source Noise Contribution at 10m db (A)				**79.1**	

A summary of the cumulative noise during STG, GTG and piping at the identified receptors are provided in Table 6-23 below.

Table 6-34 Summary of STG, GTG and Piping Cumulative Noise at the Sensitive Receptors Upon Applying a Basic Assessment of Distance Propagation and Ground Absorbance

Sensitive Receptor	Distance from Noise Source (m)	Noise Level dB(A) at Receptor after Distance Propagation and Ground Absorbance	Baseline Noise Level dB(A) at sensitive Receptor	Cumulative Noise Level dB(A)	Δ
R-1	650	35.8	50.72	50.9	0.18
R-2	100	56.1	53.90	58.1	4.25

Noise generation during STG, GTG and piping construction is inevitable, and based on the calculations above, noise levels will remain within the national standards stipulated in the executive regulations for noise at industrial receptors during daytime (70 dB(A)) and night-time (65 dB(A)) as no outliers are observed. However, noise levels at the most sensitive receptor (R-2) will increase to approximately 4.25 dB(A) compared to the existing baseline noise levels, exceeding the 3 dB(A) IFC standard and potentially resulting in nuisance particularly at this receptor.

Electrical Works

The calculated noise for construction activities at the Project location during electrical works are presented in the following. The continued cumulative noise level as perceived at 10m distance from the source would be 80.6dB(A).

Table 6-35 Calculated Noise – Electrical Works

Plant	BS 5228-1:2009 Reference	Noise at 10m dB(A)	On Time (%)	Overall noise with on time correction	Pressure (µPa)
Crane	Table C.4 - #43	70	50	67.0	5000000
Trailer	Table C.4 - #75	79	50	76.0	39716412
Man lift	Table C.4 - #62	66	50	63.0	1990536
Dump Truck	Table C.2 - #30	79	50	76.0	39716412
Diesel Generator	Table C.4 – #79	64	50	61.0	1255943

Plant	BS 5228-1:2009 Reference	Noise at 10m dB(A)	On Time (%)	Overall noise with on time correction	Pressure (µPa)
Welding Machine	Table C.3 - #31	73	50	70.7	9976312
Cumulative Source Noise Contribution at 10m db (A)				**80.6**	

A summary of the cumulative noise during electrical works at the identified receptors are provided in Table 6-26 below.

Table 6-36 Summary of Electrical Works Cumulative Noise at the Sensitive Receptors Upon Applying a Basic Assessment of Distance Propagation and Ground Absorbance

Sensitive Receptor	Distance from Noise Source (m)	Noise Level dB(A) at Receptor after Distance Propagation and Ground Absorbance	Baseline Noise Level dB(A) at sensitive Receptor	Cumulative Noise Level dB(A)	Δ
R-1	650	37.3	50.72	49.2	0.19
R-2	100	57.6	53.90	59.1	5.24

Noise generation during civil works is inevitable, and based on the calculations above, noise levels will remain within the national standards stipulated in the executive regulations for noise at industrial receptors during daytime (70 dB(A)) and night-time (65 dB(A)) as no outliers are observed. However, noise levels at the most sensitive receptor (R-2) will increase to approximately 5.24 dB(A) compared to the existing baseline noise levels, exceeding the 3 dB(A) IFC standard and potentially resulting in nuisance particularly at this receptor.

It is to be noted that the above calculations do not account for any acoustic barriers between the noise source and the sensitive receptors. Topography, any buildings, acoustic enclosures and fence lines between the project and the receptors will act as an acoustic barrier and reduce the noise impact on the receptor. The predicted noise impacts will largely depend on the location of the activities with respect to these receptors. In addition, these receptors are located outside the Hajr Two site but within the AoI of the development area, these receptors are expected to remain within the AoI for the duration and lifetime of operation of the respective facilities. Therefore, noise impacts at these receptors may not occur.

Construction noise will have a localised extent, contained within the project footprint. The duration of the impact will be short considering individual noise emission events relative to the duration of the construction activities. The frequency of occurrence is high as noise emissions will likely occur daily, but noise emissions are reversible once the activity ceases.

Noise Impacts on Site Workers

Site workers will be exposed to varying levels of noise depending on their specific roles and activities being conducted. This may relate to exposure to noise in areas that are considered ‘high’ (e.g. above occupational health and safety guidelines). Without mitigation, noise impacts to the workforce could results in health impacts, for example hearing damage. However, it is expected that construction workers will adhere to Projects health and safety requirements including use of adequate PPEs.

Noise Impacts at Accommodation Facilities

The construction workforce will live in accommodation facilities that may potentially be located at the Hajr Two Temporary Site Installation Area; however this has not been confirmed yet. This will potentially expose the workers to construction phase noise levels especially in the event that workers are required to work in shifts (day and night).

IMPACTS FROM VIBRATION

The threshold of perception of vibration by human beings are typically in the range between 0.14mm/s to 0.3mm/s (BS 5228). Impacts from exposure to vibration is expected to be considerable beyond these values with potential to cause disturbance, startle, cause annoyance or interfere with work activities. Considerring the distance between the closest receptor and the project site is approximately 100m, vibration from construction activities and construction traffic movements would be of **medium sensitivity**.

NOISE FROM MOVEMENT OF CONSTRUCTION VEHICLES

In addition to the noise caused directly by construction activities, an indirect increase in road traffic noise is expected from trucks transporting building materials to and from the site. Transportation of workers and other site staff will also add to vehicular traffic. Noise from the transport of materials is heavily dependent on the number of trucks, the size of trucks, road surface and the route taken (in terms of which receptors are affected). The flow of vehicles in the local area is not constant, but the main road to the east of the Project site had generally low flow during the site visit.

The construction phase will result in the presence of larger vehicles (HGV’s) and other more specialised equipment. As a major Project in the local area requiring hundreds of construction staff, associated equipment and deliveries, there will be a noticeable increase in vehicles at the site and along key access routes. This will influence noise levels and impacts to receptors in the adjacent corridors along these roads, in addition to existing impacts from existing vehicle flows. Considering the current proposed access road to the Project site, the facilities along this road are expected to be subject to adverse traffic noise impacts.

Table 6-37 Construction Phase – Noise and Vibration Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Noise impacts due to onsite construction activities	Moderate	Qurrayah IPP (R-2) workers	Medium	**Moderate**	• Consideration of noise fences, or other methods to attenuate construction noise, will be required close to non-mobile equipment such as generators or at boundaries for key receptors that may have higher assessed impacts. • The EPC Contractor will, at all times, carry out all work in such a manner as to keep any disturbance from noise to a minimum (by phasing noisy works). • Acoustic covers on machine engines to remain closed at all times as applicable. • Where practical, electrically powered plant will be preferred to mechanically powered alternatives. • All mechanically powered plant, diesel engine vehicles and compression equipment will be fitted with noise control equipment (exhaust silencers, mufflers) as available from the manufacturer. • The highest noise emitting activities will be undertaken in a central site area, or within an enclosed structure. For example, fabrication of materials will be carried out away from the site boundaries and or within structures. • Careful planning of the sequence of work in order to minimise the effects of noise to surrounding areas. • Careful handling of materials and waste such as lowering rather than dropping items. • Items of plant on site operating intermittently will be shut down in the intervening periods between use. • Nighttime construction works will be avoided as much as practicable to prevent noise impact at nearest noise sensitive receptors. Where unavoidable, night work permits (if applicable) will be obtained from the relevant authorities. • Notice will be provided to the sensitive receptors as early as possible (minimum one-week notice) of periods of nosier works in regard to certain construction and commissioning activities and for how long such activities will be likely to last in accordance to the SEP. • The impacted receptors will have access to a grievance mechanism in accordance with the Project SEP in order to make any complaints regarding noise during the construction phase. • A Noise Management Plan will be prepared for implementation by the EPC Contractor.	**Minor**
	Negligible	Nearby facilities workers (other than R-2)	Medium	**Minor**		**Negligible**
	Moderate	Construction workers	Medium	**Moderate**	• Identify workers who may be exposed to elevated noise levels (equal to or exceeding 80dB(A)) and brief them of occupational risks from noise exposure. • Workers potentially exposed to high noise shall be trained to identify situation when PPE is required to be worn and how to effectively utilise the PPE. • Provide noise reduction PPE to workers, enforce their use and ensure replacement in case of damage.	**Minor**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
					• Respond to noise related complaints from workers or receptors and take corrective and preventive actions as necessary. • Use hierarchy of control to reduce impacts on workers (in the order of physical removal of noise source, replace with quieter options, isolate workers from high noise sources, changes to work methodology, use of PPE). • These mitigation measures shall be incorporated to the applicable occupational H&S plan being developed by the EPC Contractor and implemented on-site.	
Noise impacts due to ground vibration	Minor	Qurrayah IPP (R-2)	Medium	**Minor**	• Wherever practical, all vibratory generating equipment and activities shall be sited away from the Project boundary and the temporary accommodation facilities. • Vibrating equipment/machinery will be switched off when not in use. • Operators of vibrating hand-held machinery (if any) will be provided with appropriate PPE (e.g. protective gloves and earmuffs/plugs) and be given suitable breaks from using such equipment to reduce the impacts of vibration. • Workers potentially exposed to high vibration shall be trained to identify situation when PPE is required to be worn and how to effectively utilise the PPE.	**Negligible**
	Minor	Construction workers	Medium	**Minor**		**Negligible**
	Negligible	Nearby facilities workers (other than R-2)	Medium	**Negligible**		**Negligible**
Impacts due to vehicular movement	Minor	Residential areas within 50m of Project access roads	High	**Minor**	• A Construction Logistics Plan will be prepared to manage the sustainable delivery of goods and materials and cut down on vehicle movements as far as practicable. • Delivery vehicles will be prohibited from waiting outside the site with their engines running (consideration of driver waiting room with heating/AC). • Ensure any applicable permits are in place for deliveries to the site and for any works performed outside normal working hours. • Review vendor specifications and consider noise generation when selecting site equipment & vehicles, in particular heavy vehicles (as far as practical). • The movement of heavy vehicles during the night will be avoided wherever practical. • Where available in country, audible reversing alarms with broadband noise (white noise) will be preferred over tone alarms (beeping), to limit external disturbance to communities. • Where construction vehicles will be operating in close proximity to the accommodation camps, the need for trucks to reverse will be minimized as far as practicable. This is so as to reduce the frequency at which disturbing but necessary reverse warnings sirens will be used. • Speed limits established in the Traffic Management Plan will be adhered to.	**Negligible**
	Minor	Commercial areas within 50m of Project access roads	Medium	**Minor**		**Negligible**
	Minor	Construction workers	Medium	**Minor**		**Negligible**

6.2.3.2 Operation Phase Impacts and Mitigation

PROJECT SIMPLE AND COMBINED CYCLE OPERATIONS

The operation of the plant will typically result in a continuous low-level humming noise due constant and relatively stable operational processes such as rotating equipment, air intake, emissions release and water treatment. As such, impacts are likely to be discernible at the receptor locations in proximity to the site, especially the nearby industrial facilities. The main source of noise is anticipated to be emitted from the gas turbines, HRSG's, steam turbines, stack emissions, fans, water pumps, ventilation units, switchgear equipment, etc. Noise levels may increase during transient (start-up) operation.

Noise modelling was conducted as part of the operational noise impacts assessment to predict the potential noise egress from the proposed Hajr Two IPP Project and the potential effect on the receptors. The methodlogy and results are summarized below and the detailed report is provided in **Appendix I**. The cumulative impact with the nearby Qurrayah SEC Planned CCGT project was also modelled and is discussed breifly in section 6.6 and **Appendix I**.

Methodology

By considering the source noise levels, the area of acoustic or non-acoustic enclosures (where available) and the intervening distance to the receptor, a noise model was constructed using proprietary software IMMI2023 using the methodology outlined in ISO9613 (ISO 9613-2 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation") which describes a detailed procedure to calculate sound levels from point/line/area sources.

One order of reflection is included in the noise model. The general calculation method considers the following attenuation corrections:

- Geometric divergence
- Air absorption
- Reflecting obstacles
- Screening
- Vegetation
- Ground reflections

The following global parameters are included in the noise model:

- Temperature 10^{o}C; relative Humidity 70%;
- Light downwind propagation towards the receptor;
- Ground attenuation factor 0;
- Hard Reflection of all on-site buildings;
- One order of reflection effects of on-site buildings.

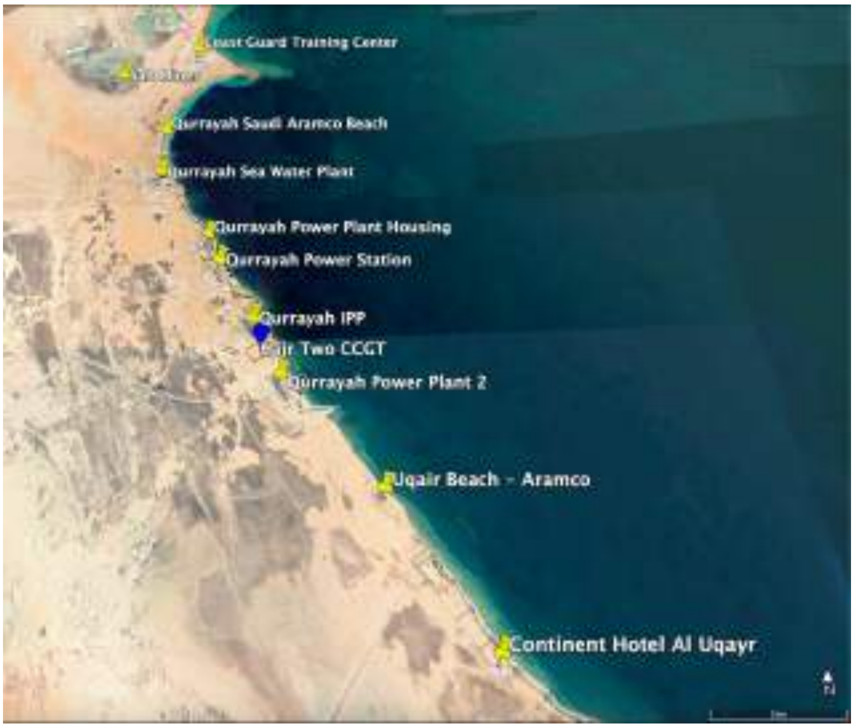
ISO 9613-2 computes long-term average sound levels including downwind conditions (favourable propagation of sound with significant positive wind from source to receiver). In addition, 'negative ground attenuation' has been disregarded as per ISO/TR 17534-3:2015' (Acoustics — Software for the calculation of sound outdoors — Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1). Further software corrections for mean height were included in accordance with 'Erlass Thüringen Ministerium Für, Energie und Naturschutz Erfurt', 1st October 2015. The topography model was obtained from the (Space) 'Shuttle Radar Topography Mission', (SRTM), at 30m resolution.

Noise attenuation from on-site buildings/significant plant has been included in the noise model. The extensive list of noise generating equipment together with the associated sound power levels data provided by the Client in February 2025. The major noise sources include:

- Gas Turbines and Generator sets
- Heat Recovery Steam Generator (HRSG)
- Steam Turbines and Generator sets
- 45m high exhaust bypass stacks and 60m high main stacks
- Ancillary Equipment including cooling tower as well as water treatment plants, pumps, transformers etc.

The modelling covered the receptors presented in the following table and figure.

Figure 6-6 Noise Modelling Sensitive Receptor Locations

ID	Name	Locations
Qurrayah Power Plant Housing	Residential	
Qurrayah IPP	Industrial	
Qurrayah Power Plant 2	Industrial	
Qurrayah Sea Water Plant	Industrial	
Qurrayah Saudi Aramco Beach	Leisure	
Qurrayah Power Station	Industrial	
Continent Hotel Al Uqayr	Hotel	
Uqair Beach - Aramco	Leisure	
Salt Mines	Industrial	
Coast Guard Training Centre	Industrial/ Education	

<u>Modelling Results</u>

The noise modelling results of the single and combined cycles compared to the national and IFC standards are presented in the following tables. Scenarios with predicted exceedances are shown in red.

Table 6-38 Calculated Noise Levels from Simple Cycle at Nearby Receptors

Receptor	Noise Levels, $L_{Aeq,T}$ dB (rounded)	IFC Noise Limits		National Noise Standards	
	Simple Cycle Operation	$L_{Aeq,T}$ dB		$L_{Aeq,T}$ dB	
		Day	Night	Day	Night
Power Plant Housing	44	55	45	55	45
Qurrayah IPP	67	70	70	70	65
Qurrayah Power Plant 2	62	70	70	70	65
Qurrayah Sea Water Plant	34	70	70	70	65
Qurrayah Saudi Aramco Beach	37	70	70	70	65
Qurrayah Power Station	46	70	70	70	65
Continent Hotel Al Uqayr	30	55	45	55	45
Uqair Beach - Aramco	43	70	70	70	65
Coast Guard Training Center	34	70	70	70	65
Salt Mine	34	70	70	70	65

Table 6-39 Calculated Noise Levels from Combined Cycle at Nearby Receptors

Receptor	Noise Levels, $L_{Aeq,T}$ dB (rounded)	IFC Noise Limits		National Noise Standards	
	Combined Cycle Operation	$L_{Aeq,T}$ dB		$L_{Aeq,T}$ dB	
		Day	Night	Day	Night
Power Plant Housing	45	55	45	55	45
Qurrayah IPP	68	70	70	70	65
Qurrayah Power Plant 2	63	70	70	70	65
Qurrayah Sea Water Plant	35	70	70	70	65
Qurrayah Saudi Aramco Beach	37	70	70	70	65
Qurrayah Power Station	48	70	70	70	65
Continent Hotel Al Uqayr	30	55	45	55	45
Uqair Beach - Aramco	43	70	70	70	65
Coast Guard Training Center	34	70	70	70	65
Salt Mine	35	70	70	70	65

The results indicate that all the receptors comply with the IFC/KSA day and night-time limits except for the Qurrayah IPP which slightly exceeds the national standards at night. As the Qurrayah IPP is operational at night and generate noise levels that are most likely above 65 dBA within the plant and is affected by other nearby industrial sites, noise levels from the Hajr 2 IPP site are unlikely to be perceptible for the site workers at the Qurrayah IPP industrial site during night-time operations and therefore the impact is considered to be minor.

Impacts from Vehicle Movement

The operation phase of the Project will entail limited traffic movement along the main access roads to the Plant primarily for transportation of operational staff and delivery of materials such as chemicals as well as vehicles for disposal of waste materials from the Plant. During operation fewer number of staff will be required, estimated to be around 100 employee which is significantly less compared to construction phase. In general, magnitude of potential impacts from noise due to vehicular traffic during operation is expected to be negligible.

NOISE IMPACTS TO OPERATIONAL WORKERS

Operational staff workers will be exposed to varying levels of noise depending on their specific roles and activities being conducted. This may relate to exposure to noise in areas that are considered ‘high’ (e.g. above occupational health and safety guidelines). Type of staff that are more likely to be affected as a result of elevated noise levels will include technicians and supervisors working in open areas of the Plant.

Without mitigation, noise impacts to the workforce could results in health impacts, for example hearing damage. However it is expected that the operational Health and Safety requirements will stipulate strict adherence to the use of PPEs for hearing protection, especially at high noise areas. As such, magnitude of potential impacts on operational workers have been qualitatively assessed to be moderate.

Table 6-40 Operation Phase – Noise and Vibration Impacts and Mitigation

<table>
<tr><th>Impact</th><th>Impact Magnitude</th><th>Receptor</th><th>Sensitivity</th><th>Significance before Mitigation</th><th>Mitigation</th><th>Residual Significance</th></tr>
<tr><td rowspan="3">Noise from operation of Hajr Two IPP various Plant equipment and operational units</td><td>Moderate Adverse</td><td>Nearby facility workers within the AoI</td><td>Medium</td><td>Minor</td><td rowspan="2">Regular scheduled maintenance activities will be undertaken to ensure that equipment is operating in its most effective manner, so that the initially designed performance and noise levels can be maintained.
Ensure good design of the noise control within the plant and the noise generating components to ensure noise levels are reduced to the extent possible and ensure compliance with noise standards at the nearby facilities and existing receptors.
Monitor noise at receptors and implement a grievance mechanism to allow local receptors to make complaints relating to noise nuisance.</td><td>Minor</td></tr>
<tr><td>Negligible</td><td>Receptors Outside the Qurrayah Complex</td><td>Medium</td><td>Negligible</td><td>Negligible</td></tr>
<tr><td>Major</td><td>Operation workers</td><td>Medium</td><td>Moderate</td><td>Ensure operational workers are aware of the risks from exposure to noise via appropriate training programs.
Align with the IFC Thermal Power Plants EHS guidelines in for occupational health and safety risks:
– Provision of sound-insulated control rooms with noise levels below 60 dBA;
– Design of generators to meet applicable occupational noise levels; and
– Identify and mark high noise areas and require that personal noise protecting gear is used all the time when working in such high noise areas (typically areas with noise levels >85 dBA).</td><td>Minor</td></tr>
<tr><td>Impacts due to vehicular movement</td><td>Negligible</td><td>Nearby industrial receptors</td><td>Low</td><td>Negligible</td><td>Timely maintenance of operational vehicles as per manufacturer instructions.
Ensure speed limits at Plant access roads and public roads are adhered to by drivers.
Avoid delivery and shipment of materials during nighttime hours.
Delivery vehicles will be prohibited from waiting outside the site with their engines running (consideration of driver waiting room with heating/AC).
Ensure any applicable permits are in place for deliveries to the site and for any maintenance works performed outside normal working hours.
The movement of heavy vehicles during the night will be avoided wherever practical.
Where available in country, audible reversing alarms with broadband noise (white noise) will be preferred over tone alarms (beeping), to limit external disturbance to communities.</td><td>Negligible</td></tr>
</table>

6.2.4 Hydrology, Surface Water Drainage and Flood Risk

6.2.4.1 Construction Phase Impacts and Mitigation

WATER RESOURCE USAGE

During the construction phase, water will be sourced from municipality-approved suppliers and transported to the site by trucks. The Project is expected to use an estimated 350m^3/day for washing, cleaning, sanitary purposes etc.

Additionally, approximately 25,500m^{3}of water will be required for the concrete as well as 1m^3 of water per 1m^3 concrete will be needed for washing/cleaning the mixer trucks, concrete pumps & equipment etc.

It is understood that the EPC Contractor will purchase potable water from a qualified water supply company and purify the water through a qualified drinking water purification equipment for the staff. The drinking water will be tested by a KSA accredited laboratory and approved by SFDA meeting the required safety and quality standards.

Due to the short-term duration of the construction activities, impacts on water resources are not considered significant. However, where the water is sourced from the neighbouring towns, the EPC Contractor will be required to engage licensed suppliers and obtain relevant permits (if required) to ensure that the project demand for water does not create a shortage for local communities or an increase in the price of water. Therefore, mitigation is required to reduce the pressure on this scarce resource and water infrastructure in the area.

FLOOD RISK

The Hajr Two IPP CCGT development site is located in an area with no identifiable surface water sources on the site and due to the relatively flat topography of the project site, no obvious drainage channels were identified.

A project-specific flood risk study has been undertaken to characterise flow paths that contribute to the AoI. To determine the flood risk and ensure the required design considerations are implemented at an early stage of the Project, a hydrology and flood risk study was carried out (**Appendix M**).

Bahrain Airport, located approximately 70 km from Hajr Two IPP CCGT development, was used for rainfall and climate dataset covering the period from 2005 to 2023. In consideration of climate change impacts, and a 10% climate change allowance has been adopted for design considerations. In addition, projections for sea level rise include a medium-term increase of 0.30 m between 2041 and 2060 (IPCC, 2024) and an extreme high sea level rise of 1.29 m MSL by 2060 (HR Wallingford, 2020). Additionally, wave set-up is estimated at 0.14 m (HR Wallingford, 2020). Based on these factors, the assumed sea water discharge level for a 1% AEP event is projected to be 1.73 m ASL. A 10% increase in rainfall was applied to the estimate to account for increased rainfall intensity due to climate change.

The results of flood depth and velocities at the project sites are shown on the following figures.

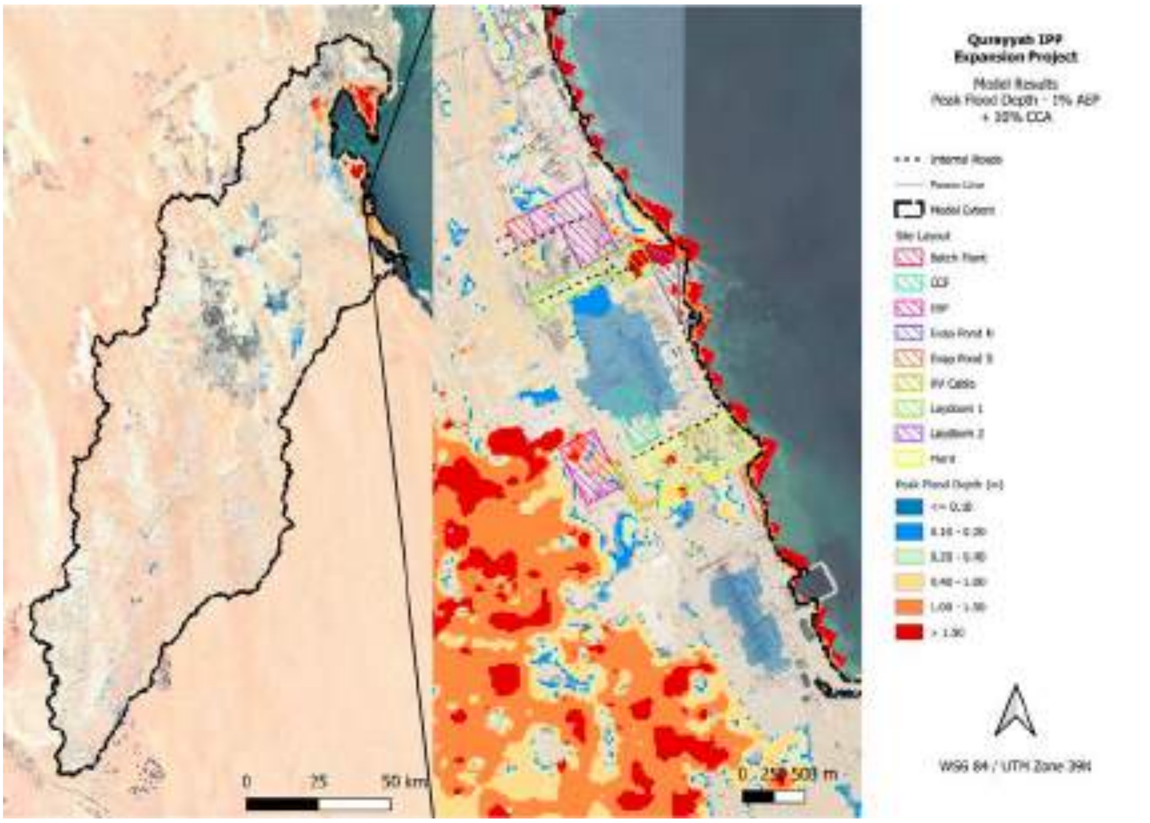


Figure 6-7 Baseline Flood Depth Results, 1% AEP Event + 10% Climate Change (white arrows indicating general direction of flow) (Worley Consulting, 2025)

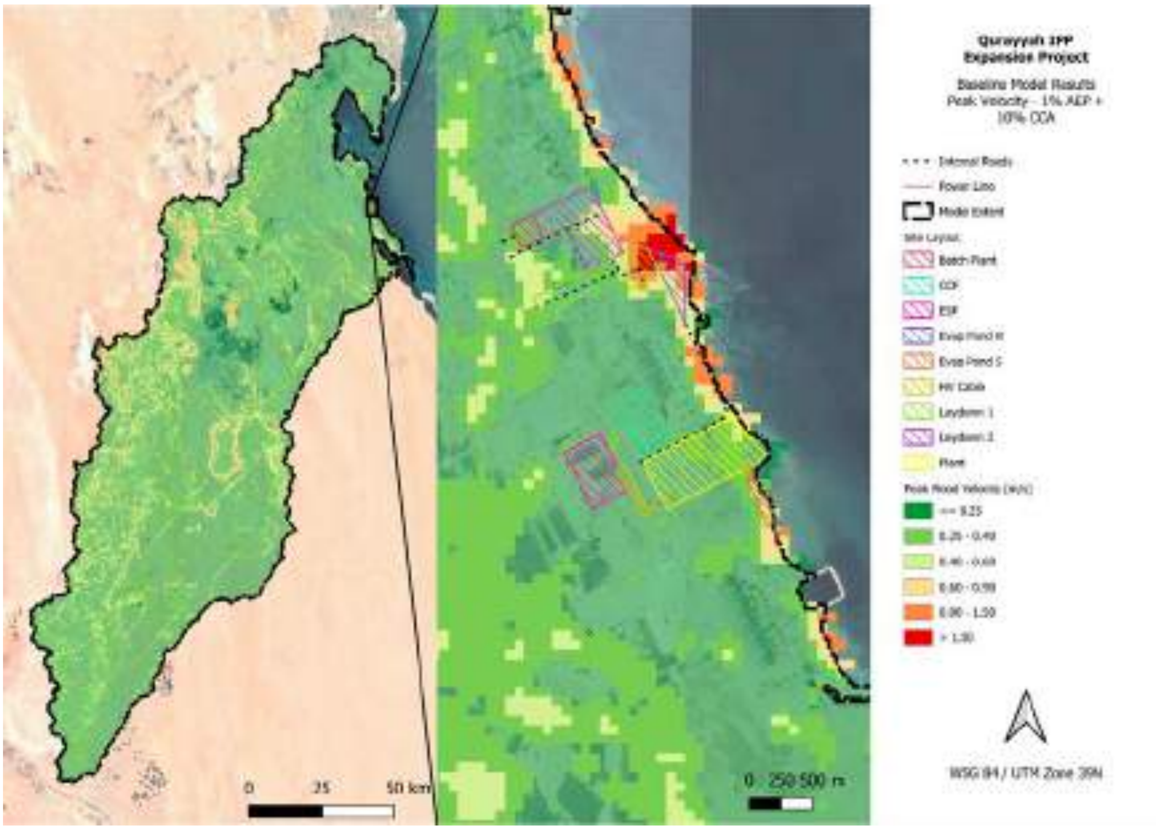


Figure 6-8 Baseline Flood Velocity Results, 1% AEP Event + 10% Climate Change (white arrows indicating general direction of flow) (Worley Consulting, 2025)

Baseline flood modeling results indicate that the site is affected by sabkha flooding, flooding from direct rainfall and accumulation of water within depressions. To mitigate these risks, the following measures are proposed:

Hajr 2 CCGT Plant Location: Increasing the level of the Hajr 2 CCGT Plant and ESF to a minimum Finished Ground Level (FGL) of +3.5 m MSL. Modelling results show flooding depths up to 0.2 m within the northern area of the QIPP expansion plant (Hajr 2 CCGT Plant). With sufficient grading between the different plants and appropriate onsite drainage measures, it is anticipated that the flood depths in this area will be further minimised.

The access road between the exiting QIPP site and the QIPP expansion plant area (Hajr 2 CCGT Plant) has been modelled at 3.5 m to prevent accumulation of water between the two areas. Suitable grading of the road joining other parts of the network will be required.

Scour / coastal protection of the platform from sea level rise by installing of coastal protection, where not present, along the coastline between the QIPP area to the north of the site and QCCP area to the south using riprap or concrete.

ESF Location: The ESF is located within the area of the sabkha, however modelling results show FGL of +3.5 m MSL prevents water accumulation and reduces flood depths to less than 0.1 m. A depression is present between the proposed project ESF and the existing ESF to the north, producing flood depths up to 8 m and velocities below 0.4 m/s. As water levels are below the FGL and velocities are low impacts at the ESF facility, these are not considered likely to present a risk with the recommended minimum FGL of +3.5 m MSL.

Future Carbon Capture Plot: This area is not at risk of flooding under the baseline scenario (1% AEP +10% CCA), no mitigation measures are recommended at this stage.

HV cable corridor: Assignment of exclusion zones or backfill to protect the HV cable corridor affected by water accumulation in depressions. Modelling results show an increase in flooding depths, to 1.2 m, where the HV Cable joins the ESF, a result of the 3.5 m FGL for the ESF. The observed velocities are below 0.25 m/s, however, to reduce flooding depths it is recommended that suitable grading of the ESF boundaries is undertaken.

The modelling results also indicated that no mitigation measures are required for the Power Cable connecting the HV Area to the Plant.

It is recommended that coastal protection is incorporated/continued, into the QIPP expansion areas located adjacent to the engineered channel.

Laydown Area 1: It is recommended to be raised on a platform to a level of 3.5 m FGL to protect the area against flooding. Suitable grading at the platform edges will be required. If raising and grading is not suitable, consider this area an exclusion zone.

Laydown Area 2: A maximum flood depth of 1.3 m is evident across the Laydown Area 2. This is evident in localized depressions along the north and east border. Exclusion zones are recommended for these localized depressions.

Batching Plant: No flooding is observed at the Batch Plant; therefore no mitigation measures are recommended.

Internal roads: These should be graded to a level that is consistent with the surrounding topography to mitigate against flood risk.

Evaporation Pond North: The model indicates that a maximum flood depth of 2.7 m is present along the northern boundary of Evaporation Pond North. It is recommended that the surface of the evaporation pond is at a minimum level of 3.5 m, however, this does not represent the base of the pond. Consideration of these factors are recommended as part of the detailed design phases.

The top of Evaporation Pond North (assumed to be full of water) is at a minimum level of +3.5 m MSL. No scour / coastal protection has been included within the BOQ, as satellite imagery indicates coastal protection is present along the eastern boundary of the pond and the northern site of the pond is bounded by the engineered outfall channel, which is assumed to have coastal protection already in place, consistent (+3.5 m MSL) with the existing coastal protection at the existing QIPP.

Evaporation Pond South: No flooding due to direct rainfall runoff is observed at the South Evaporation Pond and therefore no mitigation measures are recommended. Some flooding is observed along the coastline. However, it is deemed likely that this is a function of the interaction between the HV outlet boundary and the coastline. Consideration of these factors are recommended as part of the detailed design phases.

Coastal Flood: Modelling results indicate a maximum water height of around 2 m MSL along the coastline. A platform elevation exceeding this value, including an appropriate freeboard, and appropriate coastal defense can be considered suitable based on the information available. However, the effectiveness of the current coastal defenses cannot be confirmed, and therefore its suitability for mitigation purposes. Further investigation looking at the efficacy of the coastal defenses, as well as its design is recommended.

An increase of 0.5 m, giving a total water level of 2.96 m MSL (including storm surge) is still below the FGL of +3.5 m MSL for the plant and the substation and therefore no additional mitigation measures are considered to be required for long term sea level rise.

Overall, site grading and relocation of vulnerable areas are key recommendations, with additional studies needed for coastal defenses.

The Concept Mitigation scheme and the model results after mitigation are shown on the following figures.

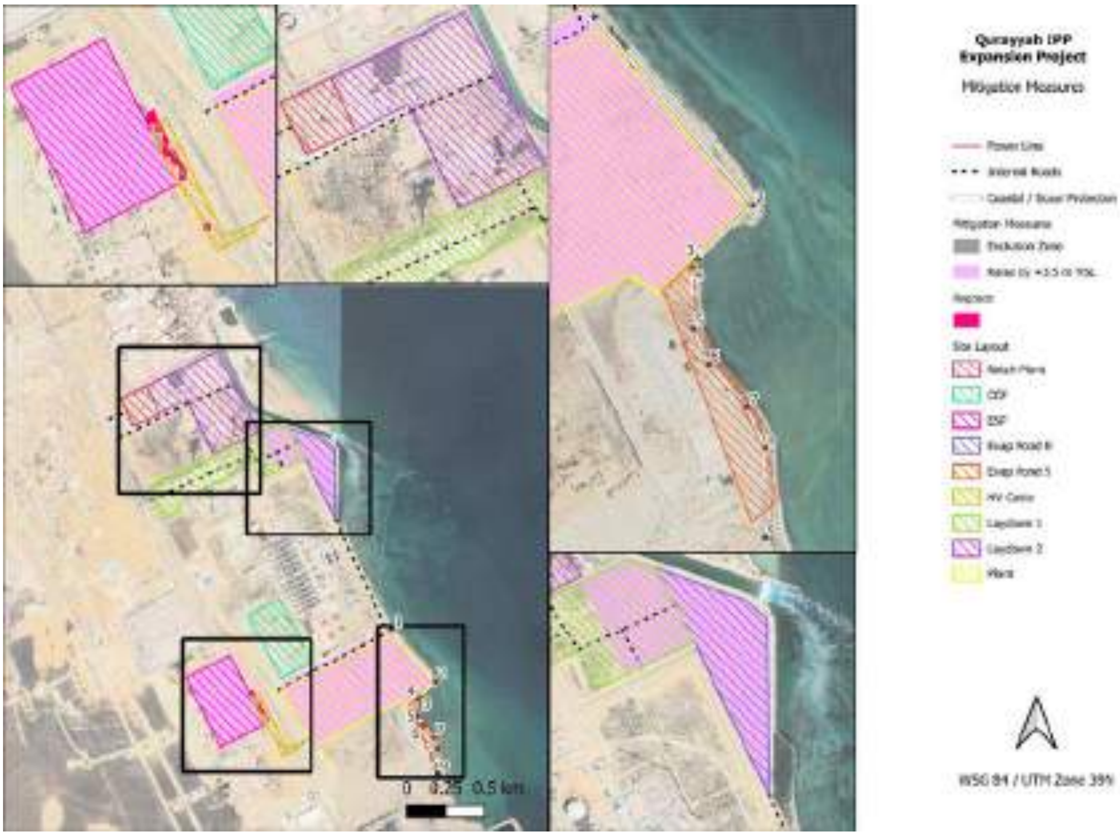


Figure 6-9 Concept Mitigation Scheme

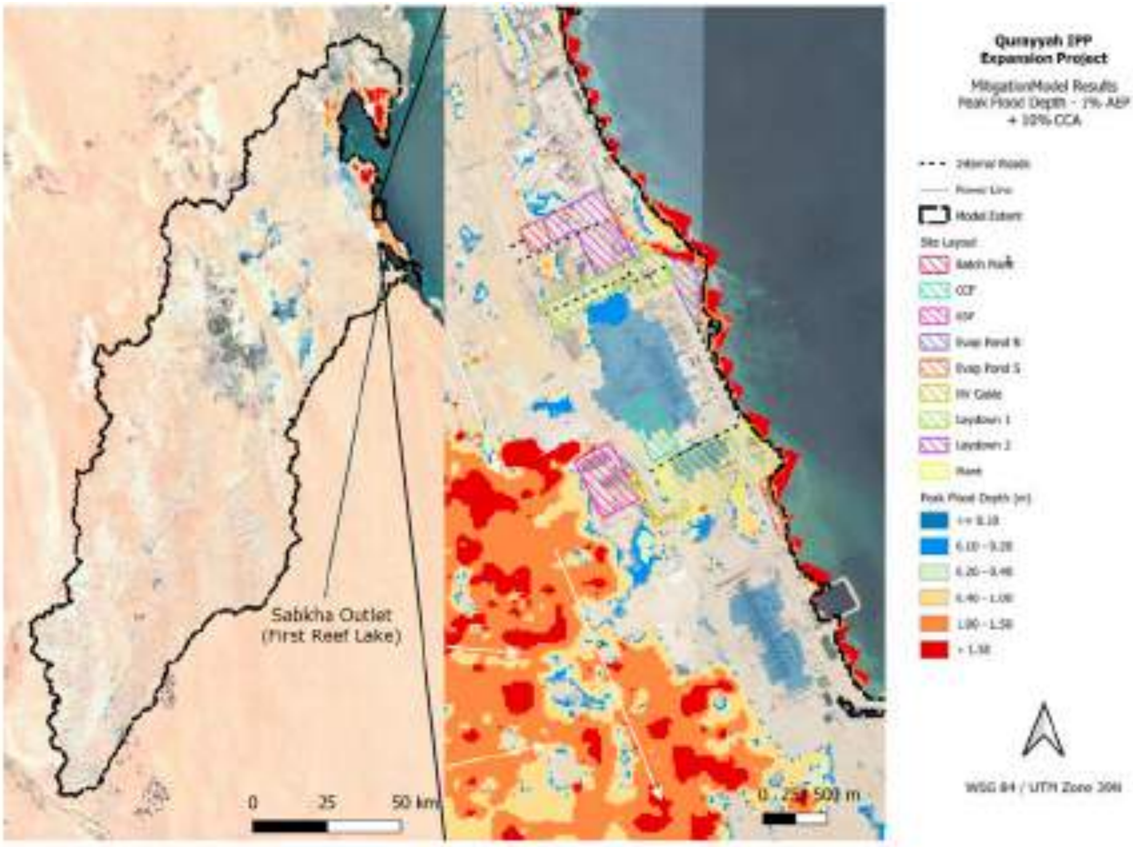


Figure 6-10 Regional model mitigation flood depth results, 1% AEP event + 10% CCA (white arrows indicating general direction of flow)

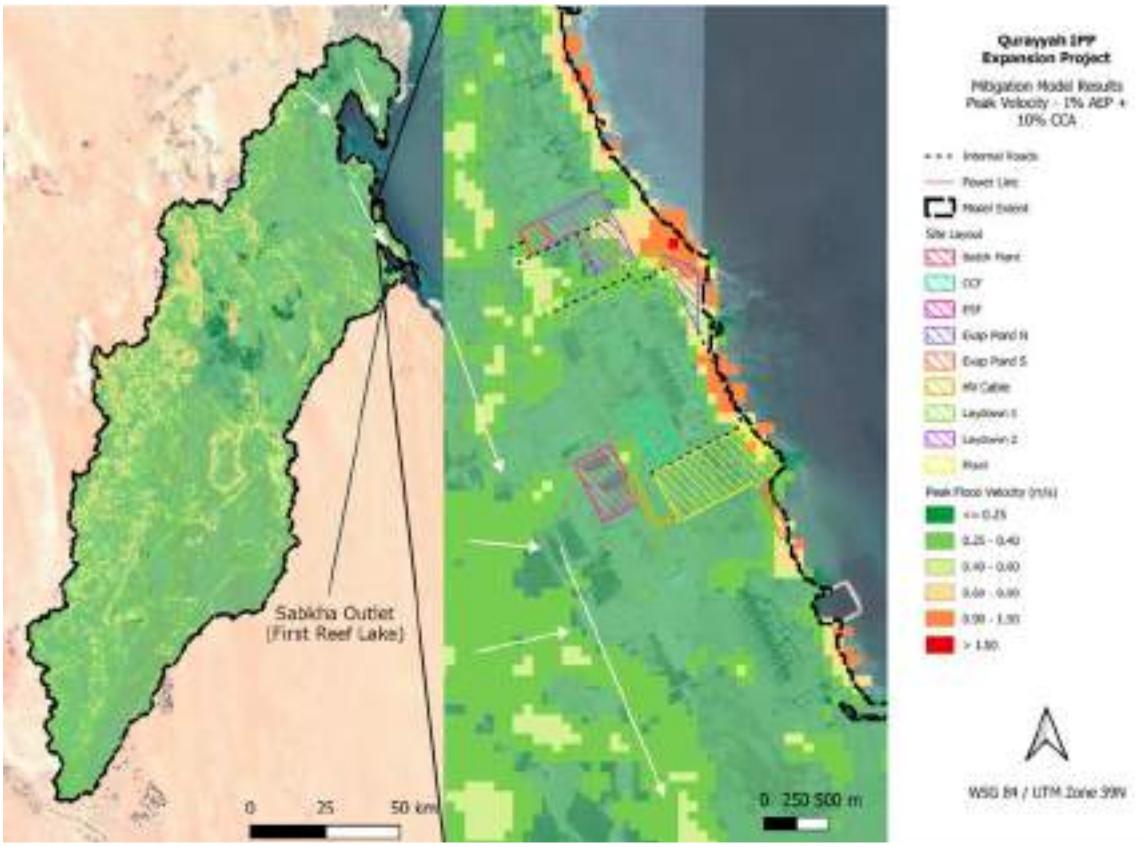


Figure 6-11 Regional model mitigation flood velocity results, 1% AEP event + 10% CCA (white arrows indicating general direction of flow)

In addition, the risk of a storm surge was also modelled. The results indicated that the mitigation measures recommended for the baseline model using the "Extreme High Sea Level" (1.73 m) are considered to be protective of increased sea levels associated with the storm surges.

Long Term Sea Level Rise has also been modelled with a medium term (2041-2060) sea level rise of 0.3 m in line with the project design life (25 years). The projected long term (2081-2100) sea level rise is 0.8 m, therefore 0.5 m higher than the modelled value.

Sensitivity modelling results indicate with the additional 0.5 m of sea level rise, a platform level of +3.5 m MSL is not sufficient to protect Laydown Area 1, Evaporation Pond North and South or the Plant area from flooding and will therefore need further consideration.

Table 6-41 Construction Phase - Hydrology and Surface Water Drainage and Flood Risk Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Water resource use	Minor	Water resource	High	**Moderate**	• No water will be purchased from suppliers who source their water from wadi gravels for use to prevent abstraction from unsustainable resources. • The EPC Contractor will engage licensed water suppliers and obtain relevant permits to ensure that the Project demand for water does not create a shortage for local communities or an increase in the price of water. • Use water-efficient equipment and machinery at the accommodation and welfare facilities that minimize water consumption while maintaining performance. • Install water meters to monitor water usage on-site. Regularly review and report water consumption data to identify areas for improvement and track progress in reducing water usage. • Regularly inspect and maintain water-related systems to ensure their proper functioning and prevent leaks or inefficiencies. • Raise awareness among construction workers about the importance of water conservation and the specific measures being implemented to reduce water consumption. • Ensure dust suppression is carried out through spraying water and prevent overuse and ponding of water.	**Minor**
Flood Risk	Moderate	Project	Low	**Minor**	• Establish the stormwater and drainage system prior to construction activities to safeguard equipment and workers as well as to reduce soil erosion and sedimentation impacts from rainfall events. • To the extent possible, ensure site stormwater drainage during construction mimics the existing natural drainage route to surrounding areas. • Implement and delineate exclusion zones or backfill to protect laydown areas. • Implement the mitigation measures of the hydrology and flood risk study summarized above and detailed in Appendix M for the applicable areas.	**Negligible**

6.2.4.2 Operational Phase Impacts and Mitigation

WATER USE

The estimated water quantities required for the operation and maintenance activities is approximately 400,000 m^3 per year. Considering the plant's process water will be from the RO plant, impacts on the availability of natural water resources is not expected during operations. In addition, the project design considers recirulating second stage RO reject water, cycle blowdown water as well as evaporative cooling blowdown, providing a significant reduction of raw water consumption.

Therefore, this impact is not assessed any further. General good industrial practice will be implemented:

- The O&M employees will be trained on how to minimise water consumption and ensure they have an understanding of the water issues in the region.
- Mechanisms and management practices to further reduce the volume of water required in the plant will be explored, if possible.

WATER REUSE

The Water concept in this plant will be to reduce effluent emissions and to recover as much as possible the water in the Power Plant. There will be several treatment plants with the objective to treat and recycle effluents.

The reused water will be as follows:

- HRSG: blowdown water as well as other drains from steam-water cycle such as steam condensate, will be collected and treated in the boiler blowdown treatment plant. After the treatment, water will be reused in the desalinated water tank for the production of demineralised and service water.
-
- Non-seawater effluents such as evaporative cooler blowdown and Water Treatment Plant clean drains, will be collected and treated in a dedicated wastewater treatment plant. Following the pre-treatment,, the treated water will be sent to the raw water tank, which will be used for the production of demineralised and service water.

ALTERATION OF SITE DRAINAGE AND FLOOD RISK

It is generally not expected that the operational phase of the project will result in significant impacts to hydrology or flow rates as a result of the hardstanding surfaces, as the project stormwater drainage design shall consider flood risk for the duration of the project.

Therefore, it is expected that stormwater drainage systems will be designed to withstand the maximum discharge in the most extreme foreseeable precipitation events in line with the hydrology and flood risk study provided in **Appendix M**. Impacts due to altering the natural drainage and stormwater flow within the project footprint is not anticipated to affect the project during operation and is not assessed any further.

The Project OESMP will include measures for ensuring the drainage and stormwater collection systmes are regularly maintained and are clear of any debris that may block the water flow.

6.2.5 Marine Ecology

6.2.5.1 Construction Phase Impacts and Mitigation

DIRECT DISTURBANCE TO AND LOSS OF MARINE FLORA AND FAUNA

During the construction phase, several activities may directly affect marine habitats and ecology. These include the excavation of a trench for the intake and outfall pipelines, which involves digging into the seabed to install the necessary infrastructure. Additionally, side casting will occur, where the material excavated from the trench is deposited onto the adjacent seabed. This process can temporarily disrupt the local marine environment by increasing sedimentation and resulting in the loss of habitats that are located within the direct project footprint.

The project is situated approximately 8 km from the Gulf of Salwah, placing it outside the anticipated impact zone during construction activities. As a result, no direct adverse effects on the marine flora and fauna within the gulf are expected.

The marine ecology survey has confirmed that the project area primarily consist of non-sensitive habitats dominated by sand and sediments. However, seagrass beds were identified along the parallel intake and outfall pipeline alignments, as shown on the habitat map (Figure 5-20). The seagrass beds are composed of *Halophila stipulacea* and *Cymodocea serrulata*, both of which are typical of soft-bottom environments and are known to contribute to sediment stabilization. Both species are listed as species of Low Concern on the IUCN Red List and are not considered nationally protected. Nonetheless, their presence within the project footprint warrants consideration.

Pipeline trenching and associated construction activities are expected to lead to the direct loss of seagrass within the trench footprint. Based on preliminary assessments, the estimated area of seagrass loss is approximately 0.59ha (to be refined at the detailed design stage by the EPC Contractor, based on final pipelines' construction corridor). While this represents a localized disturbance, the broader ecological impact is anticipated to be minor, given the limited extent of the affected area, the widespread nature of these seagrass species in the region, and their relatively resilient growth patterns.

TEMPORARY INCREASE IN SUSPENDED SOLIDS

The marine survey water analysis indicated that turbidity was low and below the threshold, suggesting minimal suspended particulate matter in the water column, however, it is anticipated that the marine construction activities may elevate sedimentation and turbidity levels in the surrounding waters. According to national water quality standards for industrial waters, turbidity should not exceed 5 NTU (approximately ±5 mg/L of suspended solids). The sediment dispersion modeling indicates that these standards will generally be maintained, except in areas immediately surrounding dredging operations, where localized exceedances are expected within few hundred meters of the dredger. In this zone, suspended sediment concentrations may temporarily rise above the threshold due to direct disturbance.

Sedimentation if severe and continuous can have significant negative impacts on seagrass by reducing light availability, smothering plants, and altering habitat conditions. During trenching and the installation of the intake and outfall pipelines, there is the potential for impacting water quality due to an increase in suspended sediment and sediment deposition causing reduced water clarity. However, given the coarse-grained nature of the sediments in the project area, the potential for widespread dispersion of fine sediments during trenching and side casting activities is limited. The low percentage of fine particles (<0.075 mm) suggests that any sediment plumes generated during construction are likely to settle rapidly, reducing the risk of prolonged turbidity and sediment smothering of adjacent seagrass beds.

As a result, the impact of sediment dispersion on seagrass, particularly *Halophila stipulacea* and *Cymodocea serrulata*, is expected to be localized, minor, and temporary. Both species have demonstrated resilience to short-term sedimentation events, and natural recovery is anticipated once construction activities cease and water clarity stabilizes. Nevertheless, mitigation measures, such as silt curtains and controlled excavation practices, should still be implemented to further minimize any temporary disturbance and support habitat recovery.

VESSEL STRIKES AND ANCHORING

Vessel anchoring during construction has the potential to impact the marine environment, particularly in areas where seagrass may be present within the anchoring footprint. The project is located approximately 8 km from the Gulf of Salwah, placing it outside the anticipated direct impact zone. While indirect impacts could arise depending on the final marine vessel routes, these routes have not yet been confirmed, and it is uncertain whether the gulf will be used. Within the project footprint, seagrass is limited in extent, and the absence of large marine mammals in the area suggests that the risk of vessel collisions with megafauna is negligible. Overall, the environmental impact from vessel anchoring and related activities is expected to be minimal. Potential impacts can be further reduced by using divers to microsite anchor points and avoid direct contact with seagrass, ensuring minimal disturbance outside the direct project area.

Additionally, the absence of megafauna sightings in the area suggests that vessel strikes are unlikely to be a significant concern. Given the lack of large marine mammals in the vicinity, the risk of vessel collisions with megafauna is considered to be negligible. Thus, the overall environmental impact from vessel anchoring and associated activities is not expected to be significant.

EFFECTS OF UNDERWATER NOISE ON MARINE ECOLOGY

Offshore vessel movement, excavation and pipeline installation for the intake and outfall are expected to generate increased underwater noise levels, which could potentially affect marine mammals and fish, leading to displacement. The effects of underwater noise from human activities on marine mammals have been well-documented and include behavioral changes, acoustic interference (masking), temporary or permanent shifts in hearing thresholds, and increased stress. While construction noise could disrupt or displace marine fauna, the industrial character of the area, the temporary nature of the activities, and the absence of megafauna sightings at the site suggest that the impacts of underwater noise are unlikely to be significant.

SPILLS AND DISCHARGES

Marine organisms are highly sensitive to oil and diesel spills, with diesel being particularly toxic. While small diesel spills in open water typically dissipate rapidly, causing no significant harm, fish kills have been reported in confined, shallow water environments. Since diesel floats on the surface, benthic habitats and subtidal biota are generally less affected.

In the event of a spill or leak, the potential risk will be assessed, and mitigation measures will be outlined in the construction management plans that will be developed by the EPC Contractor. These measures will reduce the likelihood of accidental discharges and ensure that any potential environmental impact is minimized.

INTRODUCTION OF INVASIVE SPECIES

The introduction of invasive species through ballast water, carried by vessels poses significant ecological risks. Ballast water can transport a variety of marine species, including bacteria, small invertebrates, and larvae, which may establish themselves in new environments, outcompete native species, and disrupt local ecosystems. These invasive species can transform habitats, harm native and endangered species, and cause economic damage, especially to fishing industries, while potentially impacting public health through harmful algal blooms.

To minimize the risk of invasive species introduction, vessels will be obligated to implement anti-fouling and pest control measures, with certificates provided to obtain the necessary coast guard permits. Furthermore KSA has committed to managing ballast water through international conventions such as the United Nations Convention on the Law of the Sea (UNCLOS) and the Ballast Water Management Convention. Compliance with these regulations, including ballast water management plans and vessel monitoring, will be enforced at both port and vessel levels to prevent the spread of invasive species.

Table 6-42 Construction phase Marine Ecology Impacts and Mitigation

<table>
<tr><th>Impact</th><th>Impact Magnitude</th><th>Receptor</th><th>Sensitivity</th><th>Significance before Mitigation</th><th>Mitigation</th><th>Residual Significance</th></tr>
<tr><td rowspan="3">Direct disturbance to and loss of marine habitats, flora and fauna and infaunal communities</td><td>Minor</td><td>Seagrass</td><td>Medium</td><td>Minor</td><td rowspan="3">To compensate for the anticipated loss of seagrass habitat due to trenching and marine construction activities, a biodiversity and habitat enhancement strategy is proposed. Given that the impacted seagrass species (Halophila stipulacea and Cymodocea serrulata) are resilient and the area of loss is relatively limited, the plan focuses on enhancing nearby marine habitats to support ecological recovery and biodiversity uplift.
As direct seagrass transplantation may have limited feasibility in coarse sediment environments, the project proposes the installation of an artificial reef structure that will provide habitats for fish and macroinvertebrates as well as corals and sponges. The marine-grade concrete reef structures are designed to provide protective spaces for reef fish, settlement surfaces for corals and invertebrates, and to promote local biodiversity.
Monitoring of reef colonization and seagrass recovery will be conducted biannually for at least two years to assess the effectiveness of the offset.</td><td>Minor</td></tr>
<tr><td>Minor</td><td>Marine flora and fauna</td><td>Low</td><td>Minor</td><td>Negligible</td></tr>
<tr><td>Minor</td><td>Infaunal communities</td><td>Low</td><td>Minor</td><td>Negligible</td></tr>
<tr><td>Temporary Increase in Suspended Solids</td><td>Minor</td><td>Marine flora and fauna</td><td>Low</td><td>Minor</td><td>Sedimentation arising from construction will have a reduced impact with increasing wave action, and will be exacerbated during hot, calm conditions. If feasible within the project schedule, excavation should be avoided from June – August when the impacts of increased sedimentation will be greatest.
Trenching work should be halted during rough sea conditions that cause a reduction in control of the work (e.g., loss of material being raised from the seabed to the surface).
Restoration of the site by removing accumulated sediments at the end of the construction period, if required.
If feasible based on the selected trenching equipment and methods, use silt curtains to contain sediment plumes during dredging, particularly in low-current, shallow water areas. Ensure curtains are properly aligned with water flow and anchored securely. Avoid use in deep water or areas with high currents, as they may become ineffective or damaged.
Use special backhoe attachments designed to minimize sediment loss into the water column during dredging around the outfall. While this may reduce dredging efficiency and increase costs, it helps to prevent fine sediment release, protecting sensitive areas from sediment deposition.
Monitoring is required during the construction activities that release sediment. Details to be developed in the environmental monitoring plan (Table 7-1).</td><td>Negligible</td></tr>
<tr><td rowspan="2">Impacts of vessel strikes and anchoring</td><td>Negligible</td><td>Marine habitats</td><td>Low</td><td>Negligible</td><td rowspan="2">Adhere to marine navigation rules, using only predetermined routes, and develop and implement a Vessel and Navigational Safety Management Plan that includes anchor systems and management. If possible, the plan should aim to avoid the use of Khalij Salwa if feasible, alternatively ensure that a trained marine mammal observer (MMO) is present on board to monitor and respond to any mammal sightings during operations.
Comply with speed restrictions and establish a daily reporting protocol for marine megafauna sightings to update vessels in the area.
Micro-site vessel grounding and anchorage to avoid seagrass and develop a mooring plan that minimizes mooring numbers and prevents damage to seagrass.
Remove temporary moorings post-excavation while leaving permanent ones for operational needs.
Ensure vessels are equipped with propeller guards and are well-maintained.
Develop and approve a site-specific emergency response plan before commencing works.</td><td>Negligible</td></tr>
<tr><td>Negligible</td><td>Marine flora and fauna</td><td>Low</td><td>Negligible</td><td>Negligible</td></tr>
</table>

<table>
<thead>
<tr><th>Impact</th><th>Impact Magnitude</th><th>Receptor</th><th>Sensitivity</th><th>Significance before Mitigation</th><th>Mitigation</th><th>Residual Significance</th></tr>
</thead>
<tbody>
<tr><td>Effects of Underwater Noise on Marine Ecology</td><td>Negligible</td><td>Marine flora and fauna</td><td>Low</td><td>Minor</td><td>• Consider alternative work methods or sequencing to prevent simultaneous high noise and vibration activities.
• Use well-maintained equipment and vessels that meet current noise emission regulations.
• Ensure all vessels adhere to speed restrictions.
• Implement soft start procedures when construction activities pause for more than one hour.</td><td>Negligible</td></tr>
<tr><td>Spills and Discharges</td><td>Negligible</td><td>Marine flora and fauna</td><td>Low</td><td>Minor</td><td>• Ensure all temporary facilities are located away from the marine environment, with adequate bunding for storage of oils, chemicals, and construction materials.
• Develop a method statement for fuelling marine vessels without spillage.
• Create and implement a Marine Pollution Contingency Plan outlining spill response procedure for managing unexpected discharges into the marine environment.
• Use biodegradable oils and lubricants, and ensure all chemicals meet relevant standards.
• Store spill kits near all marine activities and vessels, with personnel trained in their use.</td><td>Negligible</td></tr>
<tr><td rowspan="2">Introduction of Invasive Species</td><td>Minor</td><td>Marine flora and fauna</td><td>Low</td><td>Minor</td><td rowspan="2">• Obtain the required coast guard permits.
• Conduct ballast water exchange in compliance with international conventions, including UNCLOS and the IMO International Convention for the Control and Management of Ships' Ballast Water.
• The EPC Contractor will develop and implement a Project-specific Ballast Water Management Plan.
• All construction vessels must maintain a logbook of recent locations visited, with vessels from areas with marine pest outbreaks excluded from use.
• Use vessels with approved anti-fouling solutions in place.
• Prohibit the use of anti-fouling agents in cooling systems during vessel operation.</td><td>Negligible</td></tr>
<tr><td>Minor</td><td>Infaunal communities</td><td>Low</td><td>Minor</td><td>Negligible</td></tr>
</tbody>
</table>

6.2.5.2 Operation Phase Impacts and Mitigation

ROUTINE DISCHARGE OF BRINE AND THERMAL EFFLUENT

To assess the impacts of salinity and temperature, HR Wallingford conducted marine brine and thermal plume dispersion modeling, summarised in section 6.2.5.2 and detailed in **Appendix K**.

The discharge of brine and heated water into the marine environment can impact local ecosystems by altering salinity and temperature levels beyond natural variations. Elevated salinity can affect the marine organisms, potentially reducing biodiversity and disrupting ecological balance. Increased water temperatures may lead to thermal stress on seagrass, fish, and other marine life, influencing reproduction and survival rates. Additionally, changes in water density and circulation patterns could affect nutrient distribution and oxygen levels.

The marine survey indicated that seagrass is located approximately 150 m inshore of the diffuser. Therefore, the marine modelling assessed the brine and thermal effect in these areas. The results predicted excess salinities of about 1 g/l at the seagrass, 150 m inshore of the diffuser. This is less than 2% of the ambient seawater salinity. In addition, thermal dispersion patterns including the new outfalls are predicted to be similar to the existing patterns. As a result, the operation of the Project and the neardby SEC facility are not predicted to increase near-bed ΔT values at the seagrass, 150 m inshore of the diffuser. Therefore, the impact of brine and thermal effluent is considered to be negligible.

DISCHARGE OF DEBRIS FROM MAINTENANCE OF INTAKE PIPELINES

Hard-shelled fouling species such as oysters, mussels, tube worms, and barnacles, along with soft-bodied organisms like sponges, hydrozoans, and tunicates, can accumulate on the intake pipeline walls, reducing the inner diameter and altering surface roughness, which affects hydraulic performance. These organisms enter as larvae, settle, and grow by feeding on suspended organic matter (plankton and particulate organic material) carried by the continuous seawater flow. As a result, routine maintenance and cleaning of the pipeline are required. Non-routine discharges of organic material during macro-fouling removal may cause localized impacts near the intake. The impact remains low in significance due to the organic nature of the material and its limited area of influence.

ENTRAINMENT AND IMPINGEMENT OF FAUNA

There is the potential for impingement and entrainment of marine organisms and fauna at the inlet intake riser in the intake system. Entrainment refers to when organisms are small enough to enter the intake system. Entrainment mainly affects aquatic species small enough to pass through the chosen size and shape of the intake screen (e.g. plankton, fish eggs and larvae).

The IFC EHS Guidelines for Thermal Power Plants suggests that intake water velocity of 0.152m/s for conventional intake structures is generally considered suitable for the management of debris. Whilst the US EPA determines that if the intake velocity is ≤ 0.15m/s, the intake facility is deemed to have met impingement mortality performance standards. Therefore, designing intake structures to operate within these thresholds would mitigate impingement impacts. The current design includes an intake velocity of 0.15m/s. It is also anticipated that the intake structure will be fitted with bar and mesh screens. The fauna that is entrained into the plant will be monitored during the first 2 years to assess whether any species greater than least concern had been drawn into the plant. If they have then a review process will be undertaken to identify suitable mitigation measures to minimise this impact.

Table 6-43 Operation Phase Marine Ecology Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Routine discharge of brine and thermal effluent	Minor	Marine flora and fauna	Low	**Minor**	• Ensure an optimised outfall design and diffuser arrangement are implemented to ensure compliance with the national standards for salinity and thermal effluent. • Long-term continuous monitoring of marine water quality in areas adjacent to the outfall to establish compliance to national regulations. Monitoring will include turbidity, salinity and pH.	**Negligible**
Discharge of Debris from Maintenance of Intake Pipelines	Negligible	Marine flora and fauna	Low	**Negligible**	• Record keeping for each cleaning event. • The design of the system shall be such that loss of organic and inorganic material released during maintenance operations is minimised.	**Negligible**
Entrainment and impingement of fauna	Minor	Least Concern marine flora and fauna	Low	**Minor**	• Maintain intake velocity to <0.15m/s • The design of the inlet intake will prevent impingement and entrainment of marine organisms and fauna e.g. through use of bar and mesh screens. • The emergency response plan for the plan must include response to jellyfish bloom and other marine environmental risks (including harmful algal bloom). The fauna that is entrained into the plant will be monitored during the first 2 years to assess whether any species greater than least concern had been drawn into the plant. If they have then a review process will be undertaken to identify suitable mitigation measures to minimise this impact.	**Negligible**
	Moderate	Endangered *Stegostoma fasciatum*	Medium	Moderate		Minor

6.2.6 Marine Water Quality

6.2.6.1 Construction Phase Impacts and Mitigation

RELEASE OF SEDIMENT DURING DREDGING OF THE AT THE INTAKE AND OUTFALL

During trenching and the installation of the intake and outfall pipelines, there is the potential for impacting water quality due to an increase in suspended sediment and sediment deposition causing reduced water clarity. Therefore, a sediment dispersion study (**Appendix K**) has been undertaken by HR Wallingford in June 2025 to identify the potential impacts of the construction activities and proposed dredging methods on water quality and nearby infrastructure.

The proposed construction methodology and seabed composition along the intake/outfall pipe routes are not yet known. We assume that trenches will be dredged and then backfilled after the outfall and intake pipes are installed. The dredging and backfilling operations may release fine sediment into suspension.

Potential fine sediment release rates were based on typical trench cross sections for the proposed pipe diameters, assuming that the bed material consists largely of sand, with approximately 10% fine material, and that the trenching works are carried out using a small/medium backhoe. The bed composition is not known, but is estimated from limited geotechnical surveys carried out for sites further north. We emphasise that specific surveys along the pipeline routes will be needed to confirm the suitability of the release rates assumed.

Dispersion was assessed assuming constant release of fine sediment from four representative points along the pipeline routes:

- a short distance from the shore, in the shallows;
- near the intake heads;
- at the offshore end of the outfall trench.

Simulations were run for:

- 7 days of largely southward drift current conditions
- 7 days containing period of both northward and southward drift current conditions

Rates of fine sediment release during back-filling of the trench (after installation of the pipelines) are likely to be similar to those during dredging by the backhoe. Therefore, only the dredging phase has been simulated.

The loss rate from the construction activities of 1 kg/s was used as an average rate. As is standard for this type of study, only fine sediment is modelled (particle size diameter of less than 63 μm). Coarser fractions released from placement and reclamation activities are assumed to fall rapidly to the bed, close to the point of release, and are not represented in the modelling.

Contour plots of maximum predicted increases in depth-averaged suspended sediment concentration are shown in the following figures. The maximum plume footprints extend further for the release point furthest offshore, due to the faster currents in this area.

At the plume's maximum extent, depth average concentrations fall within 5 mg/l of background concentrations within a few hundred metres of the trench. According to national water quality standards for industrial waters, turbidity should not exceed 5 NTU (approximately ±5 mg/L of suspended solids). The sediment dispersion modeling indicates that these standards will generally be maintained. However, based on the results of the three release points tested, depth-averaged concentrations at the QIPP intakes could be increased by around 6 mg/l above normal background levels for a few days during trenching. These concentrations should be interpreted in the context of the natural variations in suspended sediment concentrations for the site as it is possible, for instance, that increases in suspended sediment concentrations of the same magnitude may occur as a result of storm events.

For the conditions tested, increases in fine sediment concentrations are predicted to be negligible at the other existing intakes.

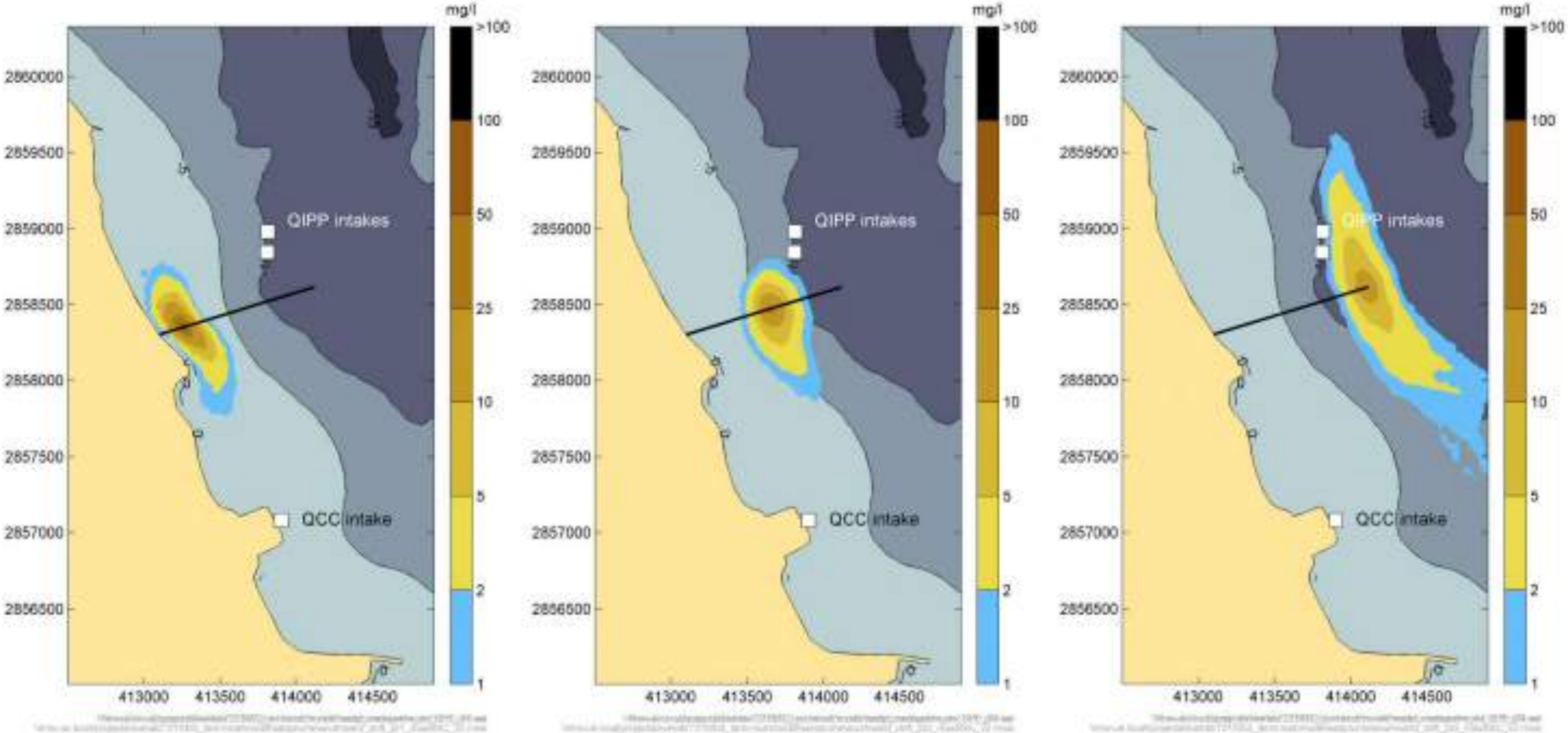


Figure 6-12 Maximum predicted increases in depth-averaged suspended sediment concentration from trenching during 7-days with largely southward drift current conditions

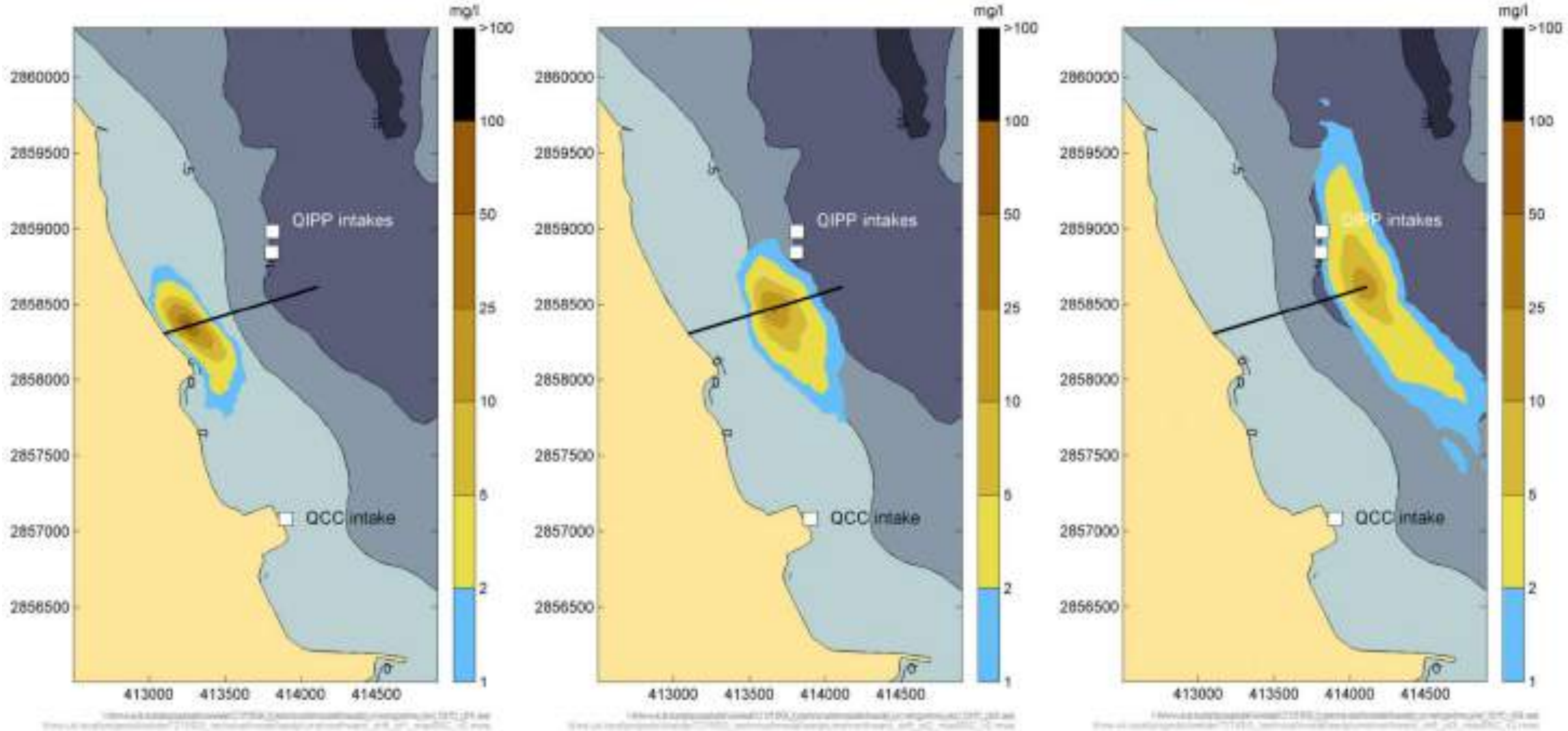


Figure 6-13 Maximum predicted increases in depth-averaged suspended sediment concentration during trenching with both northward and southward drift current conditions

Contour plots of the deposition at the end of each simulation are shown in the following figures. The overall deposition footprints extend further for the release point furthest offshore, due to the faster currents in this area. Deposit thicknesses after 7 days typically fall below 2 mm within 1 km of the trench. Based on the results of the three release points tested, deposit thicknesses at the existing QIPP intakes could be increased by up to 5 mm during trenching. For the conditions tested, deposition is predicted to be negligible at the other existing intakes.

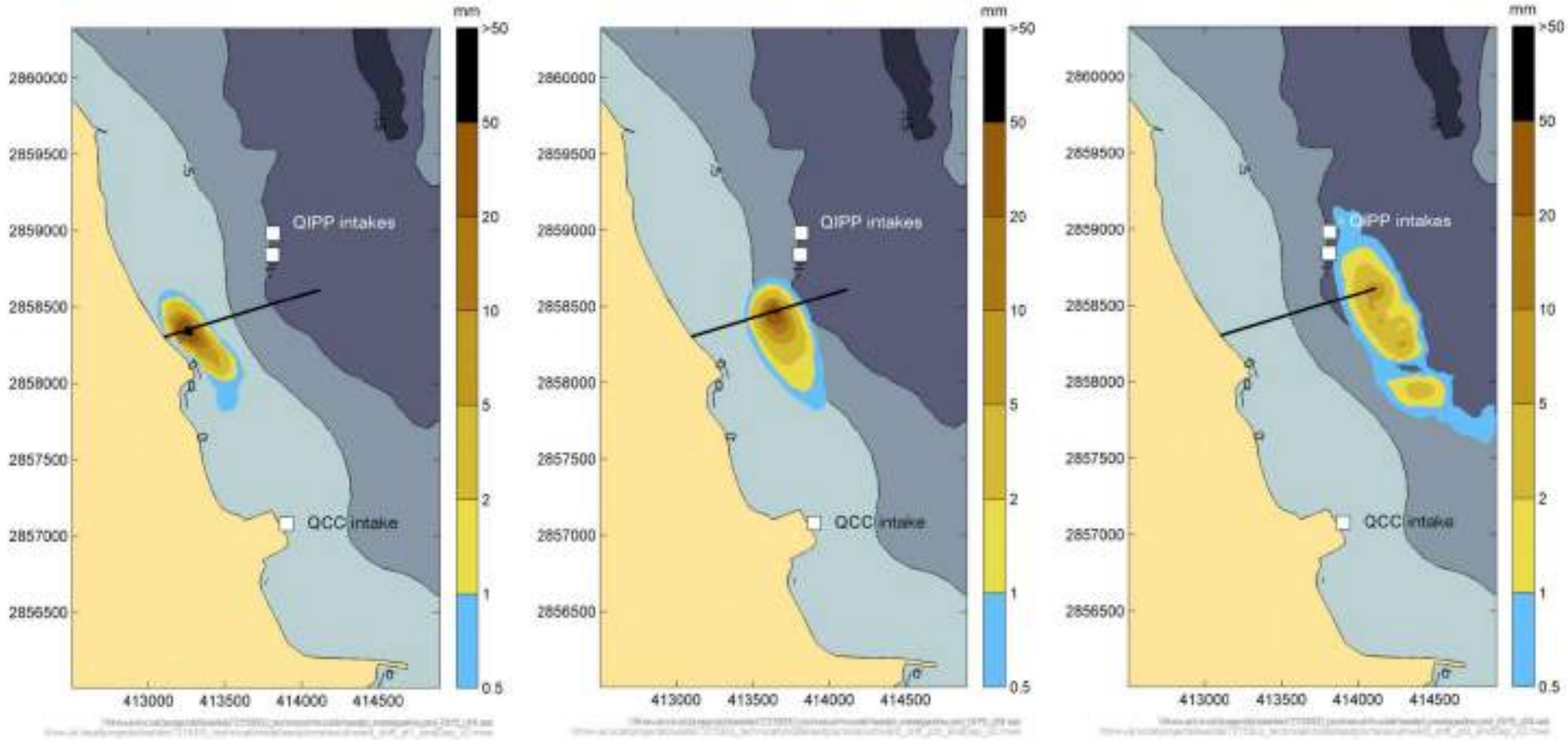


Figure 6-14 Predicted fine sediment deposition from trenching during 7-days with largely southward drift current conditions

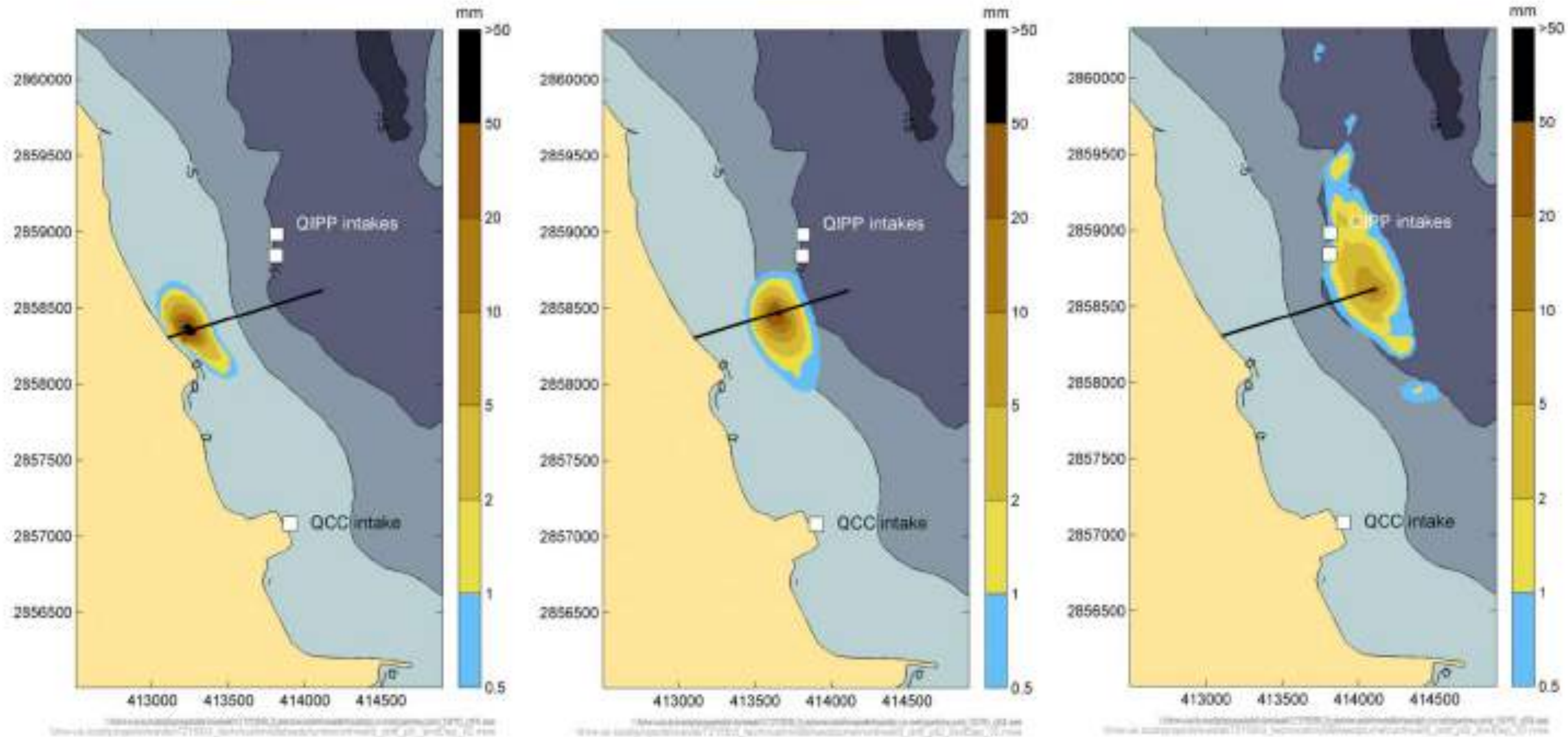


Figure 6-15 Predicted fine sediment deposition during 7-days trenching with both northward and southward drift current conditions

Degradation of Sediment Quality

During trenching and the installation of the intake and outfall pipelines, there is the potential for the release of suspended sediments into the water column, some of which is likely to be fine material. The subsequent settlement (deposition) of this suspended sediment has the potential to impact the quality of underlying sediments through changes in both physical and chemical characteristics. Sediment type in receiving areas would be altered through an increase in the deposition of fine material. However, how this affects the physical and chemical quality of the sediment depends on existing sediment type and the thickness of the deposit.

The marine survey (**Appendix J**) indicated that the intake and outfall alignement is composed mostly of flat sediments with shell fragments and flat sedimentary rocks rather than fine silt. The sediment across the surveyed area is predominantly coarse-grained and carbonate-rich, with a low proportion of fine particles (silt and clay), such coarse sediments are less prone to resuspension and typically settle quickly after disturbance. Although dredging in these conditions is less likely to create long-lasting turbidity plumes, impacts are anticipated to be short-term and localized. Accordingly, taking into consideration the size of the trench and the type of sediments, the impact on sediment quality is not expected to be significant.

In addition, the Project area is not considered to be sensitive. Based on the scale of the trench, the nature of the sediments, and reusing the same sediments to cover the trenches to the extent possible, the magnitude of impact is expected to be negligible as the extent of changes to sediments is expected to be low. Macroinvertebrates are expected to recolonize as the habitat reaches an equilibrium and stabilizes.

Spills, Discharges and Runoff

There is the potential for unplanned discharges and runoff and accidental spills and leaks from terrestrial machinery and plant and marine vessels during construction and installation activities causing contaminants to enter the marine environment, leading to degraded water quality. Where the potential for an accidental spill or leak is concerned, the assessment is based on the risk of a spill or other accidental pollution event occurring. This is considered in relation to control and mitigation measures that will be implemented through the relevant management plans during construction.

The site will be graded for levelling to facilitate building structures and foundations and utilities. This will result in altering the existing natural drainage in the site and change the water runnoff and flow which could discharge into the sea. During construction, the presence of fuels and chemical storage areas could introduce the risk of pollution to the runoff/downstream drainage areas in the event of a significant rainfall events, where a pathway for runoff is directed to these areas and a pathway for drainage is directed to groundwater. Instances of pollution could potentially result from the wash off-of surface pollutants, particularly during the first flush of rainfall.

Dewatering effluent

Dewatering may be required in areas with a shallow water table where deep excavations are planned. However, this activity will be temporary, infrequent, and strictly limited to the excavation period, ceasing immediately upon completion. Extracted water will be conveyed through a network of flexible hoses to a sedimentation pond or tank, where suspended solids will settle before discharge into the marine environment.

The discharge point will be located at the shoreline, away from seagrass habitats, thereby avoiding direct ecological impacts. Water quality will be tested prior to discharge to ensure it meets applicable regulatory standards.

Although there is a potential for adverse impacts on marine water quality if non-compliant effluent is released, such risks are considered minimal under normal operating conditions. The dewatered effluent is expected to be similar in quality to ambient seawater and will be subject to daily monitoring to ensure compliance before any discharge occurs.

Table 6-44 Construction Phase Marine Water Quality Impacts and Mitigation

<table>
<tr><th>Impact</th><th>Impact Magnitude</th><th>Receptor</th><th>Sensitivity</th><th>Significance before Mitigation</th><th>Mitigation</th><th>Residual Significance</th></tr>
<tr><td>Release of sediment during dredging of the at the intake and outfall</td><td>Minor</td><td>Water Quality</td><td>Low</td><td>Minor</td><td rowspan="2">• Sedimentation arising from construction will have a reduced impact with increasing wave action, and will be exacerbated during hot, calm conditions. If feasible within the project schedule, excavation should be avoided from June – August when the impacts of increased sedimentation will be greatest.
• Trenching work should be halted during rough sea conditions that cause a reduction in control of the work (e.g., loss of material being raised from the seabed to the surface).
• Restoration of the site by removing accumulated sediments at the end of the construction period, if required.
• Based on the selected trenching equipment and methods, use silt curtains to contain the side cast material and sediment plumes during dredging, particularly in low-current, shallow water areas. Ensure curtains are properly aligned with water flow and anchored securely. Avoid use in deep water or areas with high currents, as they may become ineffective or damaged.
• Use special backhoe attachments designed to minimize sediment loss into the water column during dredging around the outfall. While this may reduce dredging efficiency and increase costs, it helps to prevent fine sediment release, protecting sensitive areas from sediment deposition.
• Monitoring is required during the construction activities that release sediment. Details to be developed in the environmental monitoring plan (Table 7-1).</td><td>Negligible</td></tr>
<tr><td>Degradation of sediment quality</td><td>Negligible</td><td>Sediment Quality</td><td>Low</td><td>Minor</td><td>Negligible</td></tr>
<tr><td>Impacts of spills and discharges and run off in the event of a significant rain events</td><td>Minor</td><td>Water Quality</td><td>Low</td><td>Minor</td><td>• Ensure all temporary facilities are located away from the marine environment and areas prone to flooding, with adequate bunding for storage of oils, chemicals, and construction materials.
• Ensure appropriate site drainage when undertaking groundwork to avoid risk of contaminated run off.
• Use barriers (e.g., drip trays) to minimise impacts from spills or other potential leaks.
• Do not refuel except at a dedicated refuelling area with the provision of spill kits.
• Works with hazardous liquids must be performed over an area of hard standing to avoid seepage to groundwater in the event of a spill.
• Develop a method statement for fuelling marine vessels without spillage.
• To mitigate the risk of spillage during marine vessel fuelling and protect nearby intake systems, a method statement should be developed for the use of properly maintained fuelling equipment, designated fuelling areas with containment barriers, and controlled flow rates with automatic shutoff mechanisms. Staff should be trained in safe fuelling procedures and emergency response, and spill response kits should be readily available.
• Create and implement a Marine Pollution Contingency Plan outlining spill response procedure for managing unexpected discharges into the marine environment.
• Use biodegradable oils and lubricants, and ensure all chemicals meet relevant standards.
• Store spill kits near all marine activities and vessels, with personnel trained in their use.</td><td>Negligible</td></tr>
</table>

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Release of sediment during dredging of the at the intake and outfall	Minor	Water Quality	Low	**Minor**	• Sedimentation arising from construction will have a reduced impact with increasing wave action, and will be exacerbated during hot, calm conditions. If feasible within the project schedule, excavation should be avoided from June – August when the impacts of increased sedimentation will be greatest. • Trenching work should be halted during rough sea conditions that cause a reduction in control of the work (e.g., loss of material being raised from the seabed to the surface). • Restoration of the site by removing accumulated sediments at the end of the construction period, if required. • If feasible based on the selected trenching equipment and methods, use silt curtains to contain sediment plumes during dredging, particularly in low-current, shallow water areas. Ensure curtains are properly aligned with water flow and anchored securely. Avoid use in deep water or areas with high currents, as they may become ineffective or damaged. • Use special backhoe attachments designed to minimize sediment loss into the water column during dredging around the outfall. While this may reduce dredging efficiency and increase costs, it helps to prevent fine sediment release, protecting sensitive areas from sediment deposition. • Monitoring is required during the construction activities that release sediment. Details to be developed in the environmental monitoring plan (Table 7-1).	**Negligible**
Degradation of sediment quality	Negligible	Sediment Quality	Low	**Negligible**		**Negligible**
Impacts of spills and discharges and run off in the event of a significant rain events	Minor	Water Quality	Low	**Minor**	• Ensure all temporary facilities are located away from the marine environment and areas prone to flooding, with adequate bunding for storage of oils, chemicals, and construction materials. • Ensure appropriate site drainage when undertaking groundwork to avoid risk of contaminated run off. • Use barriers (e.g., drip trays) to minimise impacts from spills or other potential leaks. • Do not refuel except at a dedicated refuelling area with the provision of spill kits. • Works with hazardous liquids must be performed over an area of hard standing to avoid seepage to groundwater in the event of a spill. • Develop a method statement for fuelling marine vessels without spillage. • To mitigate the risk of spillage during marine vessel fuelling and protect nearby intake systems, a method statement should be developed for the use of properly maintained fuelling equipment, designated fuelling areas with containment barriers, and controlled flow rates with automatic shutoff mechanisms. Staff should be trained in safe fuelling procedures and emergency response, and spill response kits should be readily available. • Create and implement a Marine Pollution Contingency Plan outlining spill response procedure for managing unexpected discharges into the marine environment. • Use biodegradable oils and lubricants, and ensure all chemicals meet relevant standards. • Store spill kits near all marine activities and vessels, with personnel trained in their use.	**Negligible**
Impacts of dewatered effluent discharge into	Minor	Water Quality	Low	**Minor**	• The dewatering effluent will be properly managed in accordance with a Dewatering Management Plan, to be developed by the EPC Contractor. The plan will include a detailed step-by-step method statement outlining the procedures for pumping tests and dewatering activities. It will cover methods of effluent collection, treatment, and disposal; designated discharge locations; and a comprehensive monitoring plan specifying the parameters to be monitored, monitoring locations, and frequency.	**Negligible**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
the marine environment					• Dewatering activities will be minimized wherever feasible to reduce environmental impact. • EPC Contractor personnel will receive training to recognize signs of potential contamination, such as hydrocarbon odors or visible staining. In the event contamination is suspected, discharge to the marine environment will be immediately suspended. • The sedimentation pond or tank will be regularly maintained to ensure optimal performance in settling suspended solids before discharge. • Accumulated sludge will be removed routinely and transported off-site by a licensed waste management contractor. • A discharge permit will be obtained from NCEC. The permit application will include the dewatering system's design configuration, estimated daily flow, maximum discharge rate (in liters/second or m^3/hour), and the proposed discharge point located below the spring low water mark. • Water quality monitoring will be conducted using handheld meters to measure pH, conductivity, turbidity, and dissolved oxygen (DO). These parameters will be monitored at least twice daily to verify compliance with NCEC marine discharge standards. • A contingency plan will be developed to manage non-compliant dewatered effluent and ensure it is not discharged into the marine environment.	

6.2.6.2 Operation Phase Impacts and Mitigation

The discharge of brine and heated water into the marine environment can impact local ecosystems by altering salinity and temperature levels beyond natural variations. Elevated salinity can affect the marine organisms, potentially reducing biodiversity and disrupting ecological balance. Increased water temperatures may lead to thermal stress on seagrass, fish, and other marine life, influencing reproduction and survival rates. Additionally, changes in water density and circulation patterns could affect nutrient distribution and oxygen levels. Therfore, proper outfall design and dispersion modeling are essential to mitigate these impacts and ensure compliance with environmental standards.

Outfall dispersion and recirculation were assessed using the hydrodynamic model for representative summer conditions. Each test was run for 60 days, with statistical analysis carried out on the final 30 days (to allow for the development of the plumes). The test conditions include periods of typical and stronger Shamal (northerly) winds, and calmer periods.

The new Al Hajr IPP and Qurayyah Expansion outfalls were represented in the hydrodynamic model with coupling of the near-field mixing regions, to include the effects of the diffusers' mixing and dilution. Concept design of the Qurayyah Expansion outfall diffuser is beyond the present scope, but it was assumed that the outfall will be designed to give the same level of dilution as the new Al Hajr IPP outfall.Dispersion modelling results are presented as contour maps of 95th percentile and average ΔT and ΔS.

The study considered the Hajr Two CCGT Project along with existing operational plants in the project vicinity to assess cumulative impacts. these include the following:

- Qurayyah Steam Power Plant (QPP)
- Qurayyah Combined Cycle Power Plant (QCC)
- Qurayyah Independent Power Project (QIPP1 & QIPP2)

Additionally, the modeling incorporateed the planned SEC CCGT Project (Qurrayah Expansion), which is located near the Hajr Two CCGT. The following figure presents the locations of existing outfalls and the Hajr Two CCGT proposed outfall, as well asthe SEC outfall location.

Figure 6-16 Locations of the Outfalls that will be considered in the Marine Modelling (QCC, further south, not shown)

Hydrodynamic Model

Hydrodynamic and dispersion modelling was carried out using TELEMAC-3D, a widely used finite element model well-suited for complex coastlines. HR Wallingford applied its existing Gulf of Bahrain model—developed and refined over 20 years—for the study, updating it to reflect recent changes. The model covers 200 km x 115 km with fine mesh resolution in key areas. Bathymetric data near Al Hajr was sourced from hydrographic charts and older design surveys. While no new field data were collected, the model has been calibrated and validated in nearby regions using ADCP data. Local bathymetric surveys are recommended for future detailed design.

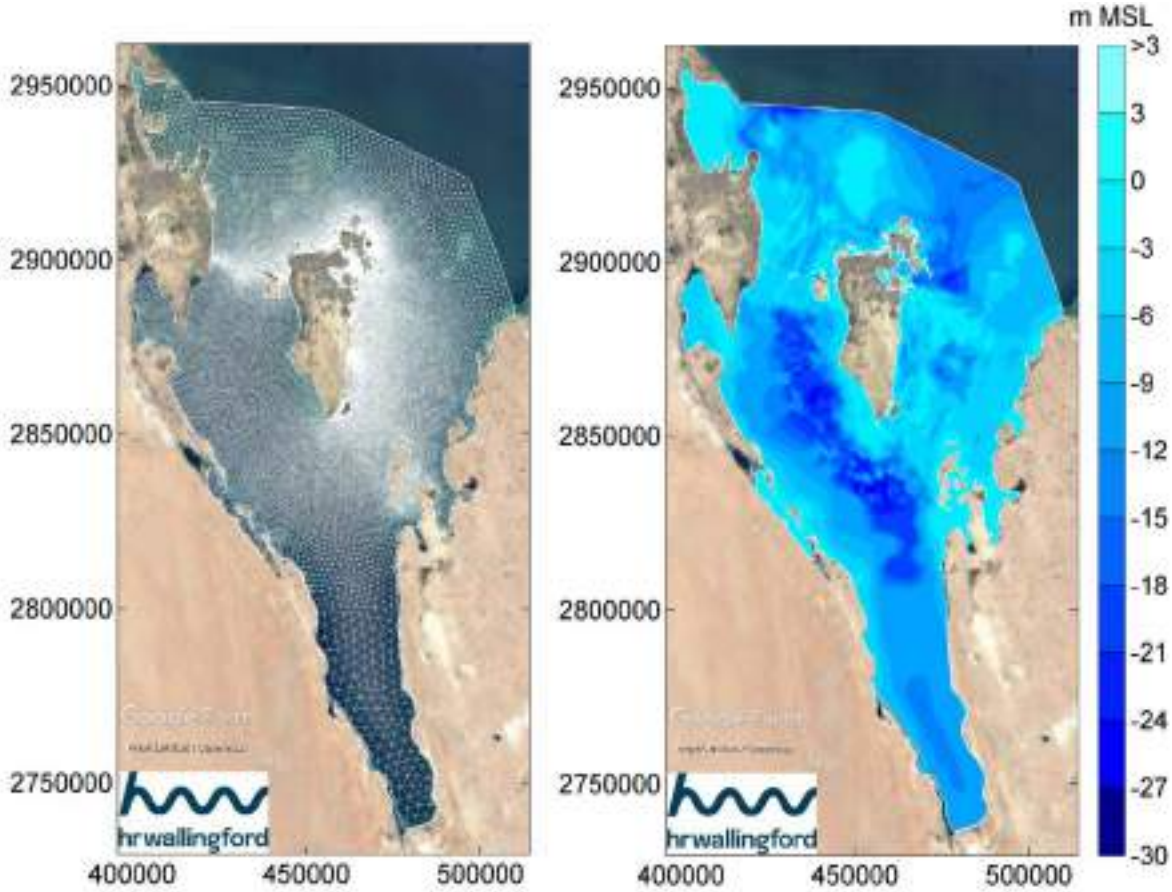


Figure 6-17 Overall Model Mesh and Bathymetry

<u>Thermal Dispersion Results</u>

Predicted thermal dispersion patterns are shown in the following figure. It can be seen that:

- The existing operational plants produce large thermal plumes that extend through the shallow waters along the coast.
- The existing discharges are predicted to generate excess temperatures above the environmental limit (+4°C) over a wide area, with a surface footprint of 17 km^2 (95^{th} percentile) for the conditions tested.
- The assumed parameters for the new Al Hajr and Qurayyah Expansion result in no additional heat at the new outfalls. The additional flows from the new outfalls are predicted to slightly deflect the existing plumes, but the resulting changes in the thermal plume patterns are small, and the exceedance areas are predicted to be similar with the two new plants operating.

Existing Thermal Plumes from Operational facilities **With new Al Hajr and Qurayyah Expansion IPP**

Surface

Bed

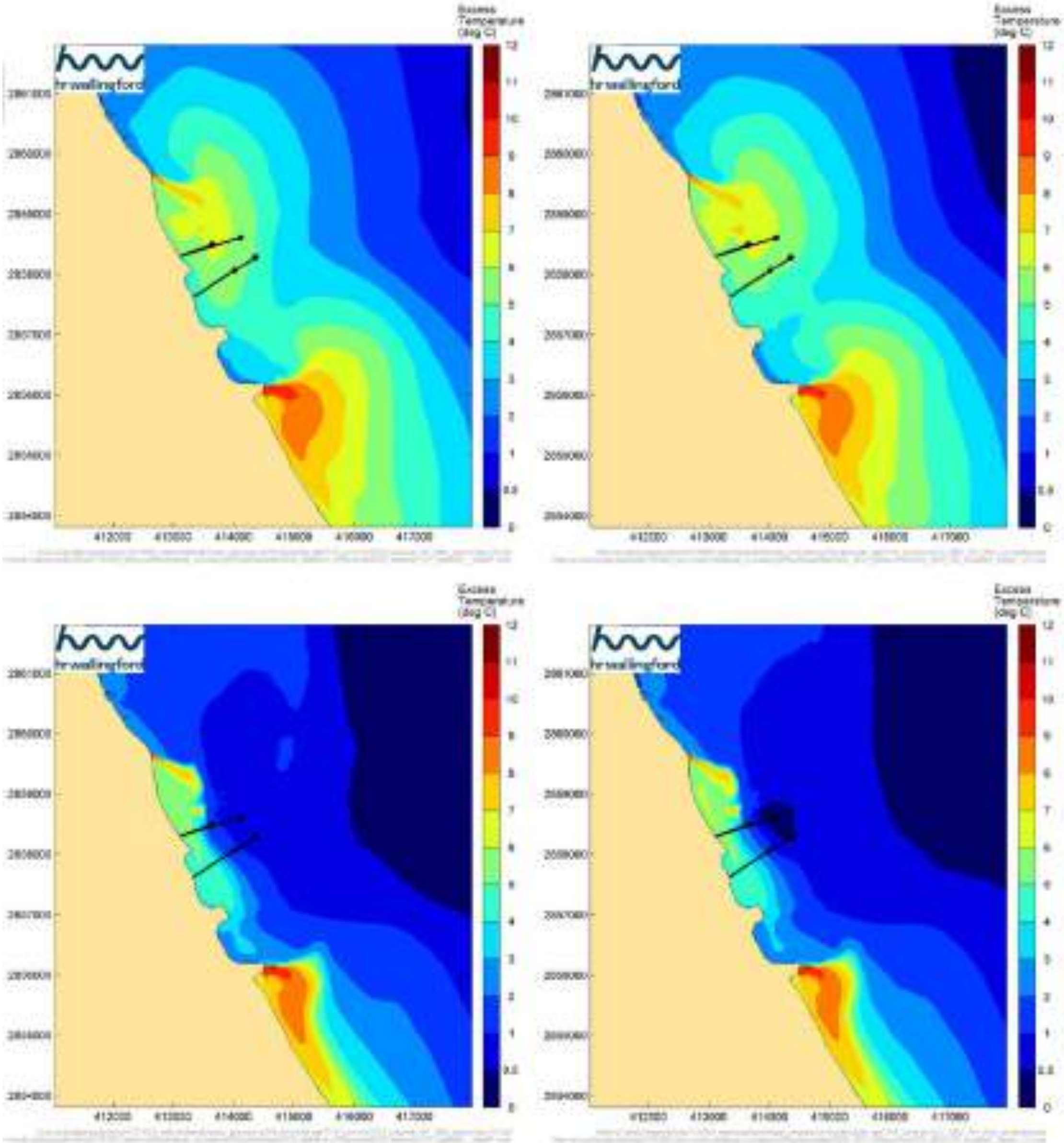


Figure 6-18 Predicted 95th Percentile ΔT, Summer

Black lines show the Hajr Two and Qurayyah Expansion IPP intake and outfall pipelines

<u>Brine Dispersion Results</u>

Predicted brine dispersion patterns are shown in the following figure. It can be seen that:

- Due to their salinity, the new Al Hajr and Qurayyah Expansion IPP discharges form dense plumes, with concentrations generally highest near the seabed.
- The derived diffuser configurations are predicted to generate sufficient dilution to reduce salinities to within the NCEC's environmental limit (+1.8 g/l), taken as a 95th percentile.
- Concentrations in the wider plume fall below 0.5 ppt (as a 95th percentile) within about 3 km of the new outfalls.

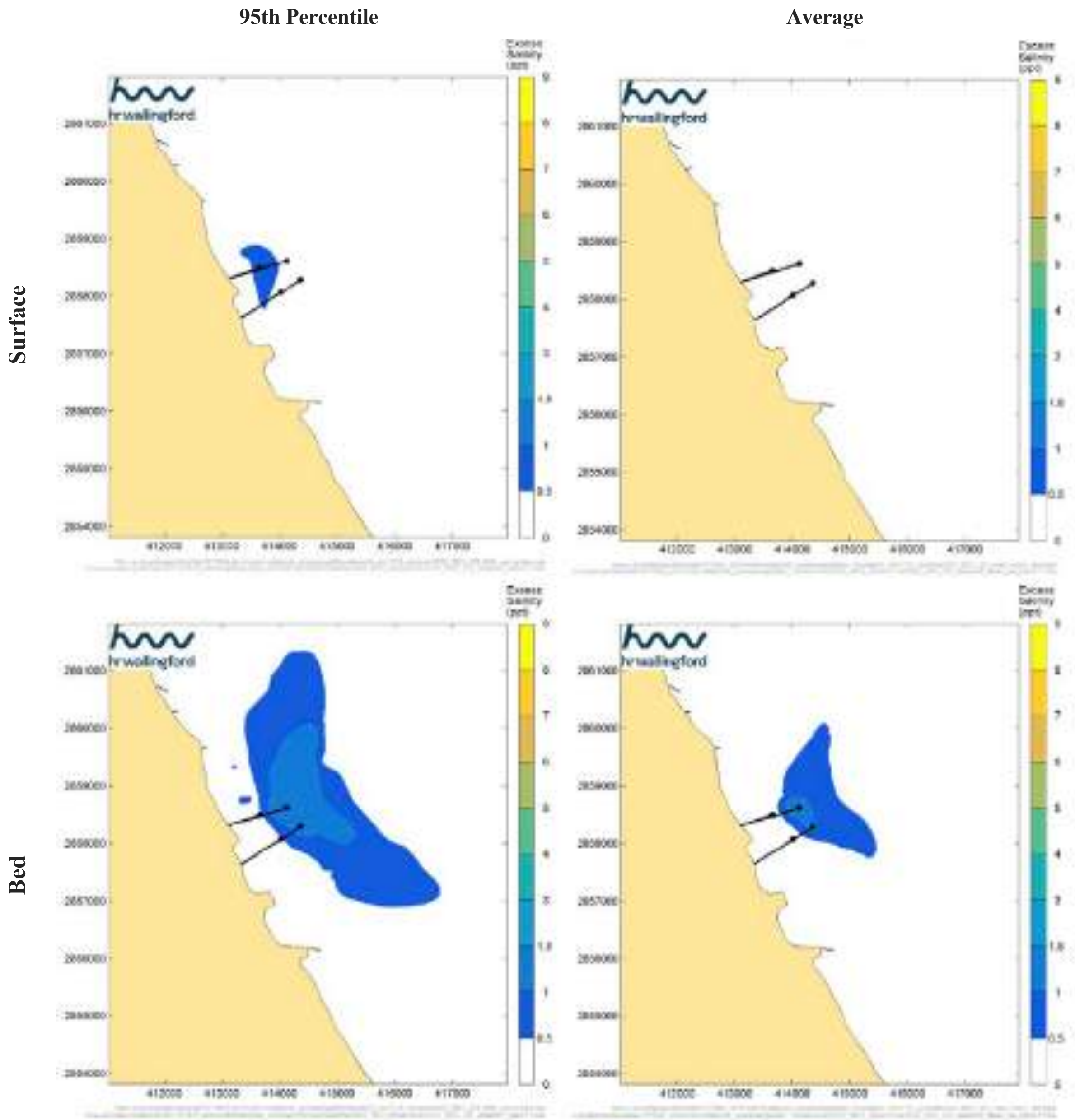


Figure 6-19 Predicted 95th Percentile and Average ΔS, Summer

Black lines show the Hajr Two and Qurayyah Expansion IPP intake and outfall pipelines

The final modeling results determine that the outfall design was optimised to ensure compliance with the national standards of excess salinity (ΔS) to remain below 3% of background salinity and excess temperature (ΔT) to remain within +5°C at the edge of the defined mixing zone. Therefore the impacts from brine and thermal plumes are considered to be insignificant.

CHLORINE LEAKS

Double-wall chlorination pipes will be installed externally along the intake pipelines. However, external pipelines pose a risk of fracture and potential chlorine release into the sea if not properly monitored and maintained. Additionally, the connection points between the chlorination and intake pipelines are vulnerable areas that could lead to uncontrolled leaks if not maintained. Proper design measures must be in place, to ensure these connection points are adequately protected against damage or leakage.

As per the EPC Contractor, to ensure environmental safety, regular monitoring will be required through maintenance and water quality analysis at multiple locations to detect any presence of chlorine in marine water. Leak detection measures will include:

- Visual inspection by divers during shock dosification
- Monitoring for sudden changes in chlorine pressure and flow
- Frequent testing of water at the pumping station to detect chlorine after injections

TREATED CHEMICAL AND DE-OILED WASTEWATER

Chemical and de-oiled wastewater will be treated in a wastewater treatment plant and discharged with brine from RO plant and cooling tower blowdown through the outfall to the sea only after confirming compliance with applicable quality standards which is the wastewater treatment plant design basis. In case of extreme conditions like malfunctioning of wastewater treatment plant for both working and standby equipment, one of the following alternatives will be applied as per finalised design during detailed engineering.

i. Wastewater flow during the extreme conditions where the quality of the wastewater does not meet applicable standards will be sent to intermittent storage tank for collection by tankers (authorised third party) if decided to be treated outside of the plant or sent back to the wastewater treatment plant if the extreme conditions are short term and wastewater treatment plant is back to operation and discharged with brine from RO plant and cooling tower blowdown through the outfall to the sea only after confirming compliance with applicable quality standards.

ii. The effluent will be diverted to a lined evaporation pond for safe containment.

While potential impacts on marine water quality could occur due to accidental discharge, pond overflow, or flooding (considering the close proximity of the proposed evaporation pond options to the marine environment), these are unlikely under normal conditions. This is due to the planned monitoring systems, engineering controls, and the fact that the evaporation pond is a tertiary (last-resort) option, to be used only if other alternatives are not feasible. To mitigate risks, the wastewater treatment plant will be properly maintained and equipped with automated dosing and alarms, water quality will be monitored prior to discharge, and any exceedances will trigger system checks and corrective actions. If the evaporation pond option is selected, it will include HDPE lining, leak detection, flood protection, and perimeter security, with contingency and emergency response plans in place to manage unexpected events.

Table 6-45 Operation Phase Marine Water Quality Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Impact on water quality from routine discharge of brine effluent	Moderate	Marine Water Quality	Low	**Minor**	• Long-term continuous monitoring of marine water quality in areas adjacent to the outfall to establish compliance to national regulations. Monitoring will include turbidity, salinity and pH.	**Negligible**
Impact of Chlorine leaks	Moderate	Marine Water Quality	Low	**Minor**	• Ensure the design and construction of the pipelines and the connection points between the chlorination and intake pipelines are tightly sealed and double walled to prevent leaks in the event of damage. • Regular maintenance of the pipelines. • Visual inspection by divers during shock dosification. • Monitoring for sudden changes in chlorine pressure and flow. • Frequent testing of water at the pumping station to detect chlorine after injections.	**Negligible**
Impact of Treated Chemical and De-oiled Wastewater	Moderate	Marine Water Quality	Low	**Minor**	• Maintain the wastewater treatment plant in operational condition with proper dosing and pH adjustment equipment. Use automated dosing systems with alarms to prevent over/under-dosing of chemicals. • Monitor water quality before discharge through the outfall to ensure full compliance with the standards. • Investigate any incidents where treated effluent fails to meet the required standards and must be managed through the selected alternative solution as indicated above (third-party collection offsite, retreatment after the treatment plant is opertaing to the standard or divert to the evapotation pond). Following such events, inspect and maintain the wastewater treatment plant to ensure continued effective operation. • Line the pond with high-density polyethylene (HDPE) and install leak detection systems If the evaporation pond option is selected. • Construct flood mitigation required for the evaporation pond with sufficient freeboard to manage risks as per the hydrology and flood risk study provided in **Appendix M**. • Implement erosion control measures. • Secure the pond perimeter to prevent unauthorized access. • Prepare a contingency plan as part of the emergency preparedness plan in case of spills, leaks, or discharge exceedances. • Equip the facility with response kits and trained personnel.	**Negligible**

6.2.7 Soil, Geology and Groundwater

6.2.7.1 Construction Phase Impacts and Mitigation

EXCAVATION AND SOIL EROSION AND COMPACTION

The project's construction phase will entail excavation, backfilling and grading in order for the construction of access roads and foundations for buildings and containment structures. Mass excavation activities could result in the destabilization of erosion-prone soils and loss of soil fertility from the displacement of topsoil. Similarly, the presence of heavy loads, construction equipment and compaction activities in particular to provide soil structural stability for the structures and the access roads after the removal of soils will have direct impacts to surface soils thereby changing soil characteristics within the project site.

It is expected that majority of the soil excavated within the site will be used within the project site for backfilling and levelling purposes. The EPC contractor will ensure that excavated soil is stockpiled in a way to separate topsoil from deep soil and backfilled in order to maintain original conditions.

In the absence of mitigation, this impact can be characterized as negative, direct and minor, as the effects of soil compaction, soil erosion and topsoil displacement will be localized and fall mainly within the Project area, and no steep slopes are present on site.

POLLUTION FROM ACCIDENTAL LEAKS OR SPILLAGE

Soil and groundwater will be susceptible to contamination from various sources during construction activities. Storage and usage of fuel, chemicals and temporary sanitary provision will introduce risks associated with spills and leaks to ground. Improper methods of storing, transferring, and handling of these products can result in spillage to the ground and result in soil contamination.The risk of accidental spillage and leakage of such liquids are often attributable to the site and temporary compounds and storage areas of the construction site, as well as during the transportation of such materials on and off the site. If contamination reaches groundwater, the spread of pollution could occur rapidly and prove difficult to control due to groundwater migration.

Construction of the Project will involve activities that generate solid and some hazardous waste, as well as liquid wastes including concrete washout wastewater. If not managed properly, waste and wastewater generated during these activities pose a threat to the quality of site soils. Of particular concern is the management of liquid hazardous waste streams generated during the construction phase and its handling. This includes substances such as concrete washout, paint, used oils, expired chemicals and/or other residues. If the temporary storage and handling of such waste on the construction site is inadequate prior to being removed for disposal, the risk of soil and groundwater contamination increases.

IMPACT OF DEWATERING

Dewatering may be necessary in areas with a shallow water table where deep excavations are required. However, this activity will be infrequent, temporary, and strictly limited, ceasing immediately upon completion of excavation. The extracted water is conveyed via a network of flexible hoses to a sedimentation pond or tank, where suspended solids are allowed to settle before the water is discharged into the marine environment through a shoreline pipe. Water quality will be analyzed prior to discharge to ensure compliance with applicable water quality standards.

While the use of pumps is essential for dewatering, improper management could lead to oil spills and potential contamination of groundwater. Therefore, strict mitigation measures must be implemented to prevent such risks.

However, significant groundwater impacts are not anticipated due to the following factors:

- There is no principal aquifer in the vicinity of the dewatering works, minimizing the potential for widespread contamination.
- No groundwater abstraction for commercial, agricultural, or human consumption exists in the area, eliminating risks to public health.
- The dewatering activities are localized and confined to a small area, further reducing the likelihood of broader environmental consequences.

The EPC Contractor will develop a Dewatering Management Plan, detailing dewatering locations, methods, and monitoring protocols to track any potential impacts and ensure compliance with environmental standards.

Table 6-46 Construction Phase - Soil and Groundwater Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Land degradation due to soil erosion or compaction	Minor Adverse	Soil integrity	Low	**Minor**	• Vehicle movements and parking will be restricted to defined access routes, demarcated working areas and parking bays. • Design and establishment of storm-water drainage systems and erosion control measures to maintain the function of working areas in high rainfall and flash flood conditions. • Prevention of engineering-induced flooding and gullies by avoiding impeding flow of any natural surface water drainage. • Ensure an erosion risk assessment is carried out and the necessary control measures are implemented. This may include locations where soil compaction may be a particular consideration, measures for construction through soft ground, considering the use of load-bearing materials, measures for working in areas of fragile and sensitive soils etc. • Soil-handling activities will be suspended when it is anticipated that further handling will damage the soil and seedbed, e.g., due to any persistent heavy rain.	**Negligible**
Pollution from Accidental Leaks or Spillage	Minor Adverse	Soil and groundwater quality	Low	**Minor**	• Storage of all hazardous liquid materials such as fuels and chemicals on an impermeable base with liners and/or secondary containment bund with enough capacity to hold 110% of the bulk storage container and 25% of the total volume of the multiple containers. • No storage of hazardous chemicals, oils or fuels is permitted within 100m of wadis or water drainage. • The EPC Contractor will maintain an inventory of all potentially hazardous materials and chemicals used and stored on-sites and maintain Material Safety Data Sheets (MSDS) at point of material storage. • Store all chemicals/materials according to manufacturer's instructions and MSDS. This includes consideration/assessment of compatibility with other substances. • The chemical storage areas will have effective ventilation and be sheltered from rain/sun. Segregated storage areas will be provided to allow for separation of any incompatible chemicals. • All mobile equipment using oils or fuels will have drip trays underneath to capture any oil leaks or drips. • The EPC Contractor and sub-contractors will provide induction training and Toolbox Talks (TBTs) relating to the management, transportation and handling of hazardous materials. • The Contractor will develop and implement an Emergency Response Plan (ERP) and Spill Response and Contingency. • Relevant personnel to be trained on emergency and spill response, containment, material handling and storage procedures. • All spills and leaks will be reported promptly to the Construction Manager and investigated to confirm the cause and put in place appropriate corrective/preventative actions. The spill or leaks incidents will be documented with evidence of investigation and close out. • Spill kits shall be available at chemical storage areas and fully stocked with appropriate absorbent materials. • Availability of suitable containment and spill clean-up materials/equipment at specific locations within the project site (e.g. where refueling is to take place).	**Negligible**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
					• No vehicle or machinery maintenance or repair will be carried out on sites. • Refueling and maintenance of vehicles/equipment will be within a dedicated and approved area, on impermeable surface and with drip trays and spill clean-up materials. • Any fuel transport vehicles and its equipment to be maintained and routinely inspected to ensure the tank, pumps, pipe work and the vehicle itself are free from leaks and fit for purpose-No equipment will be placed in service until deficiencies are corrected. • Emergency drills will be held with staff to practice timely and effective spill response. • Implement regular maintenance program of vehicles and equipment to minimise leaks or mechanical failures and keep document evidence. • Washing equipment, machinery and vehicles will only be permitted in designated areas, with impermeable surfaces and dedicated drainage systems that lead to separate treatment facilities and/or lined evaporation ponds. • Washout of concrete trucks will be performed in designated areas only at the batching plant or any other approved concrete washout areas. Such areas will be away from the Project sites and will otherwise be designed with adequate holding capacity and located away from storm water drainage or other storm water flow paths. • The Contractor will obtain applicable permits to store hazardous materials in accordance with national regulations. • The implementation of the project CESMP and associated Waste Management Plan and Procedures to ensure that solid and liquid waste are stored properly to prevent spills and leaks. • Implementation of good housekeeping practices during construction activities including procedures and requirements for proper handling, storage, and transport of hazardous materials and waste. • The EPC Contractor and sub-contractors will provide induction training and Tool Box Talks (TBTs) relating to the management, transportation and handling of wastes. • Wastewater storage tanks shall be installed above ground for visual inspection withing bunding of 110% the capacity of the wastewater tank. • Wastewater storage tanks will be regularly inspected and will be equipped with a level gauge to monitor any leaks and ensure the tanks are emptied to avoid over-flowing.	
Impact of dewatering	Minor	Soil and groundwater quality	Low	**Minor**	• Dewatering effluent shall be properly managed, and a dewatering management plan will be developed by the EPC Contractor. The Plan will include a detailed, step-by-step method statement to describe the pumping tests and dewatering procedures, including methods, effluent collection and disposal method and treatment, discharge locations and monitoring plans. Monitoring plans will include detail on the parameters to be monitored, the location of monitoring and the frequency of monitoring. • Dewatering to be kept to a minimum where possible. Monitoring of the ground stability will be undertaken during construction during dewatering activities and for a period post construction. • Use clear warning signs at the dewatering location also use signs for the pipes and cables above or under the ground. • EPC Contractor staff to be provided with training to identify signs of potential contamination (smell of hydrocarbons, staining).	**Negligible**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
					• If contaminated soils are observed during construction activity, the identified contaminated soil will be excavated separately, and stored or disposed of in accordance with the waste management plan as hazardous waste, to avoid cross-contamination. • Ensure the pumps are placed within bunding to prevent leaks and spills into the excavated area and groundwater. • Inspect the pumps and the bunds daily to detect leaks and spills. • Avoid refueling the pumps near the open excavation (to the extent possible). If this is inevitable, ensure refueling is done over an impermeable bund. • Ensure regular maintenance of the dewatering pumps, away from the open excavation (to the extent possible). If this is inevitable, ensure maintenance is done over an impermeable bund. • Store any needed chemicals and oils away from the pumping location in a designated impermeable area with bunds of 110% capacity of largest container. • Provide spill kits close to dewatering pumps. • Store the removed topsoil and excavated soil in a designated area away from sources of contamination to allow for future reinstatement of the sedimentation pond areas.	

6.2.7.2 Operational Impacts and Mitigation

Specific direct impacts to soil and groundwater are not expected during the operational phase as the project will be static and will not have direct interactions with these environmental parameters i.e. geology, soil integrity and groundwater. Potential risks of concern during the operational phase are expected to in the absence of proper management and storage of hazardous materials/wastes/wastewater, chemicals and fuels and sanitary provision.

SOIL AND GROUNDWATER CONTAMINATION

During the operational phase the potential for uncontrolled releases to soils from a number of sources is possible. Such releases have the potential to occur during transportation, handling, and storage as well as during cleaning activities and accidental spillages to the ground. Potential contamination sources will likely include:

- Bulk storage of diesel for the emergency generator;
- Stored operational phase chemicals;
- Waste oils (e.g. oily sludge, spent maintenance oils);
- The use of solvents/cleaning fluids;
- Potentially contaminated storm-water;
- Accidental release of untreated wastewater;

Additionally, natural and unplanned hazards such as extreme rainfall events and fire can lead to the generation of excessive storm-water and spill-over of contaminated water, which can result in the pollution of exposed soil.

Potential operational impacts have been assessed taking into account that majority of the area within the plant will be paved limiting the chances of seepages to soil or below ground. The plant will be designed with dedicated areas for storage of potential sources of contaminants such as fuel and chemicals. Drainage systems with collection sumps will be in place to collect spilled materials without causing risk of pollution to the environment.

Chemical and de-oiled wastewater will be treated through a dedicated wastewater treatment plant and discharged to the sea with brine and cooling tower blowdown, only after meeting water quality standards. In extreme cases, such as plant malfunction, two alternatives are planned:

1- Store the wastewater in an interim tank for offsite treatment or return it to the treatment plant once it resumes operation.

2- Divert the wastewater to a lined evaporation pond for safe containment.

While potential impacts on marine water quality could occur due to accidental discharge, pond overflow, or flooding as per selected methodology indicated above, these are unlikely under normal conditions. This is due to the planned monitoring systems, engineering controls, and the fact that the evaporation pond is a tertiary (last-resort) option, to be used only if other alternatives are not feasible. To mitigate risks, the wastewater treatment plant will be properly maintained and equipped with automated dosing and alarms, water quality will be monitored prior to discharge, and any exceedances will trigger system checks and corrective actions. If the evaporation pond option is selected, it will include HDPE lining, leak detection, flood protection, and perimeter security, with contingency and emergency response plans in place to manage unexpected events.

In the absence of mitigation, the impact can be generally classed as minor adverse. With the application of mitigation measures specified in following table, the impact will be reduced to a negative negligible significance.

Table 6-47 Operation Phase – Soil and Groundwater Impacts Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Pollution from Accidental Leaks or Spillage	Minor Adverse	Soil and groundwater quality	Low	**Minor**	• O&M Company shall develop and implement an Emergency Response Plan (ERP) to include or link to a Spill Response and Contingency Plan. • Appropriate training of staff in regard to the handling and response to spill/leak events. • Define a designated area of storage of hazardous materials (including fuel) and ensure secondary containment (110% capacity bunding) to contain any spills and adequate security. • Fuel tanks monitoring system shall be operational at all times and any leak detected shall be immediately stopped with applicable correction measures implemented. • Storage of all hazardous materials such as fuels and chemicals on an impermeable base with liners and/or secondary containment bund with enough capacity to hold 110% of the bulk storage container and 25% of the total volume of the multiple containers. • All spills and leaks will be reported promptly and investigated to confirm the cause and put in place appropriate corrective/preventative actions. The spill or leaks incidents will be documented with evidence of investigation and close out. • Restrict access to hazardous materials. • Availability of complete spill kits in all hazardous material storage areas. • Availability of MSDS on-site for any chemicals in use (to be made available at the chemical storage area). • Availability of a chemical register for all the hazardous chemicals on site. • The chemical storage area will have proper ventilation and cover from the elements (i.e., rain, sun) and different storage areas to allow for segregation of incompatible chemicals. • O&M Company shall obtain relevant permits to transport and dispose any hazardous waste from operational processes. • Undertake training for emergency scenarios with the relevant authorities. • Evaporation pond and associated pipes will be inspected for any leaks or overflow. • Ensure a borehole that was created for the geotechnical surveys, closest to the evaporation pond, is maintained and accessible in the event of water quality monitoring. the water quality can then be compared to the baseline to determine whether the impact was existing or caused by potential leaves from the pond. • Maintain a certain level of water within the pond and empty it when required to ensure it doesn't overflow. • Implement a monitoring program to regularly inspect the condition of the evaporation pond liner, geomembrane, and other components. This may include visual inspections during cleaning. • Consider incorporating leak detection systems, such as sensors and monitoring wells, to promptly identify and address any potential leaks. • If used in landscaped areas, the application of fertilisers and pesticides must be limited and monitored. Use of any toxic/non-biodegradable pesticides will be prohibited in accordance with the Stockholm Convention on banned chemicals. Only organic, chloride free and environmentally friendly fertilizers will be applied.	**Negligible**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
					• The implementation of the OESMP and associated Waste Management Plan and Procedures to ensure that solid and liquid waste are stored properly to prevent spills and leaks. • The implementation of good housekeeping practices during maintenance including procedures and requirements for proper handling, storage, and transport of hazardous materials and waste.	

6.2.8 Solid Waste and Wastewater

6.2.8.1 Construction Phase Impacts and Mitigation

The construction phase can often be the most environmentally damaging phase of a project, particularly in regard to the volumes of waste that are generated, if not properly managed. Construction activities such as site preparation, civil works, electrical and mechanical works, materials delivery, operation of labour camps will generate construction, domestic and hazardous waste streams in both solid and liquid form.

The Project will require excavation activities in order to establish a base at suitable level and design elevation for construction which will result in some rubble, rock or soil. Topsoil and excavated material will be stored for cut and fill re-use where suitable. Where it is deemed unsuitable, excavated material will be removed from site to a licensed disposal facility or a designated fill site.

Building works will necessitate concrete use, bricks, cement, some wood, metals and glass. Conceivably there may be some waste materials from such activities, such as offcuts and any damaged items. The civils works (relating to internal roads, stormwater and sewage systems etc.) may also generate some concrete, asphalt and masonry wastes.

Packaging wastes (such as cardboard, paper and plastic) can be easily windblown around sites and may be dispersed to areas off-site or interact with both terrestrial fauna, causing ecological impacts.

Wastewater generated from construction activities at the project site will include the following:

- Sanitary and domestic wastewater generation;
- Wastewater from any vehicles or equipment washing/cleaning;
- Concrete washout water generated during washing the concrete trucks.
- Liquid hazardous waste such as lubricants, solvents, waste oil, hydraulic fluid, waste solvents etc.; and
- Commissioning wastewater.

The construction site will be equipped with on-site temporary sanitation facilities to cater to the needs of construction workers. These facilities are expected to include toilets, basins, and ablution facilities. These facilities will require regular maintenance, including emptying and removal of wastewater from the Project site. This should be carried out by licensed contractors who will ensure the proper transport and disposal of the wastewater at a wastewater treatment plant.

The table below provides a framework[16] for classifying construction waste on the basis of their source and level of potential hazard to human and ecological receptors.

Table 6-48 Classification of Construction Waste Streams

[16] This framework has been developed with reference to the IFC, US Environmental Protection Agency (EPA) and Federal Motor Carrier Safety Administration (FMCSA).

Category	Origin	Description
Non-hazardous construction waste	This waste stream typically originates from site preparation, excavation, civil works, and mechanical and electrical installations.	This waste category generally poses minor risks to the environment and human health, as it is not characterized by the distinct properties of hazardous waste (presented below). It can thus be disposed of at regular municipal facilities after waste minimisation options are exhausted and before obtaining approval. Solid non-hazardous construction waste will include: • Discarded aggregates (concrete, asphalt, excavation spoils etc.); • Scrap metals; • Glass, plastic, rubber, cardboard and wooden refuse from construction materials and packaging; • Organic waste from vegetation clearance.
Non-hazardous domestic waste	On construction projects, general domestic waste is generated by the operation of labour camps, offices and welfare facilities.	This waste category poses negligible to minor risks to the environment and a biohazard to human receptors, mostly comprising of spent/ processed domestic materials. Solid non-hazardous domestic waste will include: • Discarded foodstuffs; • Discarded clothing articles; • Discarded sanitary materials and household items; • Wastepaper from deskwork and packaging; • Sludge from any domestic wastewater. Liquid non-hazardous domestic waste will include grey-water and black-water.
Hazardous waste	On construction projects, such waste typically derives from spills and leaks of hazardous chemicals or concentrated chemical mixtures, damage or wear of equipment components containing hazardous materials, and clean-up of equipment or materials contaminated by hazardous materials.	This waste category poses risks which can be detrimental to human health or the environment and/or may cause an increase in acute, chronic and/or irreversible impacts on health and/ or contribute to an increase in mortality. Waste can be classed as hazardous provided it contains toxic, explosive, flammable, combustible, oxidizing, corrosive, radioactive or infectious materials. Solid hazardous construction and domestic waste will include: • Used batteries; • Discarded chemical containers; • Used oil filters; • Contaminated clean-up materials; • Soil contaminated with spilled chemicals; • Spent machinery/ equipment components containing or contaminated by hazardous materials; and • Medical waste. Liquid hazardous construction and domestic waste will include: • Used oils including lubricants and hydraulic fluids; • Concrete wash-out water; • Wastewater from vehicle wash bays; • Contaminated storm-water and/or floodwater.

The surge in waste due to construction Projects can strain existing waste management facilities and systems due to increased load or limited capacity. The EPC Contractor will make arrangements for the establishment of waste management facilities for the Project's construction phase.

In the absence of mitigation, this impact is assessed as negative, direct and of moderate magnitude. With the application of mitigation measures specified in following table, the impact will be reduced to a minor significance.

Table 6-49 Construction Phase – Solid Waste and Wastewater Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Strain on existing waste and wastewater management facilities	Moderate Adverse	Waste management facilities	Medium	**Moderate**	• The EPC contractor will identify waste and wastewater management companies including recycling companies in Ash Sharqiyah or nearest towns in order to promote the recycling of waste especially packaging materials, wood, metal waste & hazardous materials. • The EPC Contractor will coordinate with the local government authorities (e.g., municipalities) with regards to licensed and appropriate waste management facilities fit to accommodate project waste types and quantities. • A construction stage Waste Management Plan will be prepared and implemented following GIIP measures. • The EPC Contractor will ensure that only licensed waste transporters and waste management facilities (hazardous waste, non-hazardous waste, sludge etc.) will be engaged. **Non-hazardous waste** • Domestic solid wastes to be segregated and identified from the other waste streams into separate waste containers/skips clearly to facilitate recycling and reuse. • Waste containers/skips should be clearly labeled and placed in designated waste storage locations. Labels will be waterproof, securely attached, and written in English and other languages as required for the workforce. • For litter (food waste, domestic waste), an adequate number of covered bins should be strategically placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area. • Food waste must be stored within a sealed metal or plastic skip or bin, in order to prevent pests gaining access. • On-going housekeeping training should be provided to all staff on the importance of the need to avoid littering. • Heavy waste may be contained within an open skip, provided that segregation occurs effectively enough to remove all lightweight material that could be blown away. • Waste generated during construction will be recycled and reused until reduced to as low as practicable prior to collection for disposal by an appropriately licensed waste contractor. • The EPC contractor will develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused and consignments. • Completed waste manifests are required to show the chain of custody of the waste generated on site, its transportation and treatment/disposal. All records will be maintained on site. • Specifically recycling of packaging waste will be promoted, which will require site-based segregation of cardboard, wood/pallets, metals and plastics. **Hazardous waste** • Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, segregated, reused and consignments.	**Minor**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
					• Segregate and identify hazardous waste from the other waste streams into separate waste containers/skips clearly signed and labeled. • Store hazardous waste in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage system, good ventilation and equipped with spill kits & spill response procedures. This area must be placed away from any sources of ignition. • Hazardous waste storage area should be constructed away from drainage system and a rain shelter to avoid any potential instance of runoff, or leakage of runoff. • Waste containers should be clearly marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in English and other languages as required for the workforce. Wherever possible, chemicals will be kept in their original container. • Hazardous waste storage areas will be located away from any ignition sources or fire hazards. **Wastewater** • Develop and maintain a wastewater inventory to document and track sanitary waste generated and disposed. • Sanitary wastewater tanks should be placed in allocated impervious hard standing areas with bonding capacity to hold 110% volume of the maximum volume stored. • Sanitary wastewater tanks to be properly maintained and inspected to ensure tanks do not overflow. • Sanitary wastewater tanks to be equipped with a gauge to monitor wastewater levels and to ensure tanks do not leak or overflow. • Washing of equipment, machinery and vehicles will only be permitted in designated areas, with impermeable surfaces and dedicated drainage systems that lead to separate sumps or, treatment facilities and/or lined evaporation pond. • Concrete washout areas will be located away from storm drainage and will be designed with adequate holding capacity. The wastewater will be contained within the designated impervious bund. • Site inspections will be carried out regularly by the EPC contractor to ensure that all wastewater generated is properly managed, and no leakages or spill occur. In the event of a spill or overflow, immediate action will be taken in accordance with spill containment procedures and clean up procedures. • Engage a licensed waste contractor for the periodic removal of septic tanks. • Commissioning wastewater to be treated onsite or collected and transferred offsite by a licensed contractor to an authorized wastewater treatment plant. • In line with the IFC EHS Guidelines, effort will be made in training construction personnel to minimise water consumption for ablutions and to ensure an understanding of water resource and wastewater issues.	

6.2.8.2 Operation Phase Impacts and Mitigation

The operation of the Project will generate small amounts of non-hazardous and hazadous domestic waste from the administration facilities and from activities of the employees. This waste can be both recyclable and non-recyclable. Recyclable waste includes paper, tin cans, plastics, cartons, rubber, and glass, while non-recyclables will consist mainly of food residues and other organic wastes. The quantity of domestic waste will be small given that only a few personnel are required to operate the Plant. Other solid non-hazardous waste generated during operation will be landscaping waste and uncontaminated replacement parts and packaging.

The operation of the project may also result in the generation of small quantities of the following hazardous waste streams. A dedicated wastewater system is intended to collect all wastewater streams produced within the plant. Wastewater can be classified into storm water, oily wastewater, chemical wastewater and sanitary wastewater.

It is anticipated that the project will result in the generation of different kinds of wastewater. These will be managed as follows:

- Rainwater will pass through a treatment system and diverted to the raw water tank for subsequent use as process water.
- Chemical and de-oiled wastewater will be treated through a dedicated wastewater treatment plant and discharged to the sea with brine and cooling tower blowdown, only after meeting water quality standards. In extreme cases, such as plant malfunction, two alternatives are planned:
    i. Store the wastewater in an interim tank for offsite treatment or return it to the treatment plant once it resumes operation.
    ii. Divert the wastewater to a lined evaporation pond for safe containment.
- Sanitary wastewater: will be treated in a sewage treatment plant; treated effluent will be reused for irrigation within the site while the sludge will be collected by authorised waste management for disposal offsite.

Impacts of wastewater on soil and water have been assessed in section 6.2.7.2 and impacts on the marine water quality have been assessed in section 6.2.6.2.

Table 6-50 Operation Phase – Solid Waste and Wastewater Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Strain on existing waste management facilities	Minor Adverse	Waste management facilities	Medium	**Minor**	• The O&M Company will identify waste and wastewater management companies including recycling companies in Ash Sharqiyah or nearest towns in order to promote the recycling of waste especially packaging materials, wood, metal waste & hazardous materials. • The O&M Company will coordinate with the local government authorities (e.g., municipalities) with regards to licensed and appropriate waste management facilities fit to accommodate project waste types and quantities. • An operation stage Waste Management Plan will be prepared and implemented following GIIP measures. • The O&M Company will ensure that only licensed waste transporters and waste management facilities will be engaged. **Non-hazardous waste** • Domestic solid wastes to be segregated and identified from the other waste streams into separate waste containers/skips clearly to facilitate recycling. • Waste containers/skips should be clearly labeled and placed in designated waste storage locations. Labels will be waterproof, securely attached, and written in English and other languages as required for the workforce. • For litter (food waste, domestic waste), an adequate number of covered bins should be strategically placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area. • Food waste must be stored within a sealed metal or plastic skip or bin, in order to prevent pests gaining access. • Heavy waste may be contained within an open skip, provided that segregation occurs effectively enough to remove all lightweight material that could be blown away. • Paper cardboard, metal cans, plastic, glass to be collected for recycling by a licensed waste contractor. • The O&M Company will maintain copies of the waste management licenses on site (of licensed transporters and disposal/treatment facilities). • Develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused and consignments. • Completed waste manifests are required to show the chain of custody of the waste generated on site, its transportation and treatment/disposal. All records will be maintained on site. **Hazardous waste** • Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, segregated, reused and consignments. • Segregate and identify hazardous waste from the other waste streams into separate waste containers/skips clearly signed and labelled. • Store hazardous waste in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage	**Negligible**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
					system, good ventilation and equipped with spill kits & spill response procedures. This area must be placed away from any sources of ignition. • Waste containers should be clearly marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in English and other languages as required by the workforce. Wherever possible, chemicals will be kept in their original container. **Wastewater** • The Project Company will ensure due diligence in the operation and maintenance of the sanitary wastewater treatment plant, the wastewater treatment plant (chemical and oily wastewater) as well as any potential evaporation pond. • Regular maintenance will be carried out to ensure these facilities are managed according to manufacturers' instructions. • Quality of treated effluent (of sanitary WWTP and process wastewater treatment) will comply with permit requirements by the authorities and the project environmental standards. The following parameters should be tested as a minimum: – Treated sanitary wastewater to be tested for parameters including BOD, turbidity, total suspended solids and ammonia. – Treated process wastewater (chemical and de-oiled wastewater) to be tested for pH, conductivity, temperature, TOC, turbidity, ORP (redox), oil & grease, and hydrocarbons. • Solid wastes from the wastewater treatment plant will be managed as per the waste management plan. • Sludge from these facilities will be emptied and managed as per the waste management plan and requirements of national regulations and laws. • Evaporation pond will be properly lined and associated pipes will be inspected for any leaks or overflow. • Implement a monitoring program to regularly inspect the condition of the evaporation pond liner, geomembrane, and other components. This may include visual inspections during cleaning. • Consider incorporating leak detection systems, such as sensors or monitoring wells, to promptly identify and address any potential leaks. • The evaporation pond will be emptied, if required, to prevent overflow. Wastewater will be collected by a licensed contractor for treatment offsite.	

6.2.9 Landscape and Visual Amenity

6.2.9.1 Construction Phase Impacts and Mitigation

CHANGE IN LANDSCAPE CHARACTER

The construction of a new development, particularly those on a large scale have the potential to result in further changes to the landscape character of the locality through land use and topographical changes.

One of the first stages of construction activities will result in the levelling, grading and preparation of the site prior to the commencement of construction. The proliferation of other activities such as the subsequent construction of the buildings and stacks which will take place steadily over the construction period will eventually further transform the landscape. Magnitude of potential impacts due to changes in its landscape character is assessed to be minor and adverse, however considerring the nature of the site which is predominantly undeveloped industrial landscape composed of barren gravel plains with limited vegetation, it is considerred of **low sensitivity**.

VISUAL NUISANCE

Project construction activities will introduce additional impacts in the form of visual nuisance to surrounding receptors as a result of the movement of heavy construction vehicles and equipment to and from the project site. Earthworks and construction activities can potentially result in dust generation and a resulting temporary haze causing disturbance to the current visual envelope of receptors, by affecting their visual amenity and/or blocking their views.

Impacts to the visual envelope of surrounding receptors will also occur at night where the addition of lighting during construction will illuminate the project area. The use of lighting across the site will result in a night time light haze likely to be visible for several kilometres from the project area. However, it is considered that visual impacts due to lighting on site is of low sensitivity as the project is located within an industrial complex with existing and operational facilities in close proximity. It is anticipated that the development of the proposed Hajr Two IPP CCGT plant will contribute to the cumulative visual impacts in the area, however, this impact is of low sensitivity.

The main receptors in the project vicinity include the workers of nearby industrial facilities and project workers. The landscape in the area had already been impacted by the existing industrial plants and facilities located within the Qurrayah industrial area. Other receptors include the road users of the neaerby Qurrayah road who may potentially be impacted as the road directly connects to the secondary access road proposed for the development of this project. Additionally, the proposed secondary site access road is located approximately 6km from the Khobar – Salwa Coastal Road, a highway within the project development area. The road is within the project's visual zone of influence and it is anticipated that it will form construction part of the logistics network of the project. The visual impacts during construction and the presence of vehicles and equipment, even though largely unavoidable are only temporary, and are not expected to result in significant impacts to the receptors or motorist on the road. Therefore, the magnitude of potential impacts is considered **minor**.

Table 6-51 Construction Phase – Landscape and Visual Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Changes in landscape character	Minor	Landscape Character	Low	**Minor**	• Land clearance will be limited to the area within the Project boundary of the Projects site. • Where appropriate, construction work areas will be screened with stockpiles to reduce the visual intrusion to the off-site receptors. • Cluster temporary facilities and storage areas together to minimise spread of influence in landscape. • All temporary construction facilities will be removed once this phase is complete unless there is an agreement between the Project Company for use during the operation phase. • The laydown areas will be restored to or close to their original condition after the completion of the construction phase. • Incorporate native planting where landscaping is planned to help reinstate the natural landscape.	**Negligible**
Visual nuisance	Minor	Nearby facilities workers Qurrayah IPP workers Project workers	Medium	**Minor**	• Construction laydowns and working areas of the site will be screened to reduce the visual intrusion to existing off site receptors. • Any temporary structures constructed along the access road into the site will be removed immediately after use. • Mitigation and management measures relating to the generation of dust (as detailed in the Section 6.3.2) shall be implemented to minimise visual impacts during construction activities on site and along the access road. • Minimise construction works at night-time to only those strictly required and approved by the relevant authorities through issuance of night permits. • Avoid excessive or unnecessary lighting. • Lights should be installed at low height and ideally should face towards the work area and not outwards from the Project site. • Light fittings shall be directional as deemed appropriate for their use and intended areas of illumination. • Lighting column and lighting head design will be chosen to limit back spill and any unwanted light spill to other site areas or, those areas off the site. If possible, the EPC contractor will plant decorative trees along the boundary of the Project site and access road.	**Negligible**

6.2.9.2 Operation Phase Impacts and Mitigation

Receptors affected by the visual impacts during the project operation will be those that have direct (and partial) views across the existing site. It is inevitable that the plant, once completed will contribute to the existing landscape and visual setting which is mostly an industrial landscape. The proposed Hajr Two IPP CCGT plant is located within the Qurrayah industrial area which comprises of existing and operational plants, it is thus deduced that the development of the proposed Hajr Two IPP will result in minor and insignificant impacts to the visual landscape of the AoI and development region.

Lighting will be required for security around the site perimeter, lighting within the plant itself and that site entrances or along access roads. Impacts due to lighting may result in considerable changes to the night-time views of the site. This will be minimised through implementing the applicable measures to avoid unnecessary sky glow glare or light spill into dark areas.

Considering the existing landscape value of the project area, the impacts are likely to have nagligible magnitude and significance on the surrounding receptors.

Table 6-52 Operation Phase – Landscape and Visual Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residual Significance
Landscape and visual amenity	Negligible	Nearby facilities workers	Medium	**Negligible**	• Efforts will be made to soften the landscape character impacts by planting native trees and vegetation in appropriate areas such as the Project boundary and alongside the access road. • Utilise efficient low energy systems where appropriate in order to preserve intrinsically dark areas and the night sky. • Lighting during operations must be kept to a minimum required for security, health and safety • Light fittings will be directional as deemed appropriate for their use and intended areas of illumination. • Lighting column and lighting head design will be chosen to limit back spill and any unwanted light spill to areas outside of the Plant premises.	**Negligible**

6.2.10 Traffic and Transportation

6.2.10.1 Construction Impacts and Mitigation

Construction will result in additional vehicles on main highways and roads and temporary construction roads on-site. The number of vehicles will vary due to the phasing of works and the timing of vehicular movements. Construction vehicles will include a variety of vehicle classifications, e.g., HGV's, LDV's, trucks, pick-up trucks, excavators and other heavy/light equipment. The works will also require numerous vehicles to be mobilised to transport workers, components and equipment.

Heavy construction vehicles can cause accelerated wear and tear on road infrastructure, leading to potholes, cracks, and road degradation. This can result in nuisance to road users and the local communities, increase accidents risk and require more frequent maintenance. In addition, increase in the number of vehicles along the access road as a result of the project's development has the potential to result in road traffic accidents affecting humans.

The local road users and community may be used to increased traffic including HGVs along the local roads traditionally as the development area is a heavy industrial land. Therefore, the magnitude of potential impacts to road infrastructure is considered minor and the magnitude of road safety incidents is assessed to be moderate.

Table 6-53 Construction Phase – Traffic and Transportation Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residuals Significance
Increased vehicular flow impact to road infrastructure	Minor Adverse	Road infrastructure	Low	**Minor**	• Prepare a Traffic and Transportation Management Plan outlining control measures to reduce impacts of vehicles movement. • The local police and other relevant authorities will be consulted during the development of the Traffic Management Plan. • Construction access roads to be clearly marked, with routes, parking, directions, speed limits, unloading area (amongst others). • Minimise the number of construction road movements as much as practicable, i.e., maximize the capacity of vehicles - Buses should be used and carpooling should be encouraged. • Stagger deliveries to the site will ensure that congestion on local and site roads is minimised, whilst reducing waiting times for drivers and over demand on receiving staff at the site. • Drivers to be fully competent and authorised to drive heavy loads vehicles and to receive specific training. • All site vehicles shall have audible and visual warnings when reversing. • Off-road driving outside of dedicated roads and active work sites shall be prohibited. • Vehicle speeds on all non-public site access and internal site roads will be restricted to 30km/h. • Driving awareness to be provided to workforce. • Ensure escorts, flag persons and other safety measures are employed where necessary (e.g., entering and exiting the site) • The EPC Contractor will notify the local communities on delivery of wide/heavy loads and how it could potentially impact their road use. • All traffic incidents and near misses will be recorded and investigated with any necessary corrective actions taken including reporting to local police. • Prompt repair and maintenance works will be ensured to rectify any damages caused by construction traffic, in coordination with the relevant local authorities. • Compensation of any livestock injured by Project vehicles will be conducted in coordination with local officials. • A grievance mechanism will be established to allow local communities to make complaints relating to Project traffic nuisance or drivers.	**Negligible**
Road Safety Incidents	Moderate Adverse	Local road users and local communities	Medium	**Moderate**		**Negligible**

6.2.10.2 Operation Impacts and Mitigation

Transportation impacts during operations are not expected to be significant, as the operation of the project will not require continuous delivery of materials, or other equipment to operate. There will be operational staff daily commute and occasional deliveries and waste removals from the site, which will not result in a significant amount of traffic on the main roads in the area. Therefore, the traffic and transportation impact assessment during operation has been scoped out and is not discussed any further in the report.

6.2.11 Terrestrial Ecology

6.2.11.1 Construction Phase Impacts and Mitigation

The presence of construction equipment, workers, temporary facilities and environmental externalities resulting from construction processes (i.e., noise, vibration, waste and wastewater) have the potential to impact upon terrestrial ecology during the construction phase. Such impacts may include the partial or direct loss of habitat and flora species as well as disturbance to fauna.

HABITAT LOSS

Site preparation works will include levelling and clearance resulting in the removal of the limited vegetation within the project site and related working areas, including the Temporary Installation Area. This will result in the loss of existing habitats. Based on surveys and baseline information collected till date, there are no “Critical Habitats” within the project area. The site is mostly considered “Disturbed Habitat” with sparse vegetation and low biodiversity with limited areas of anthropogenic influences with several vehicle tracks, construction waste, old tyres and piles of broken tarmac.

Even though the site is located within a proposed protected area (Khalij Salwa), the site visit was undertaken in November 2024 and observations indicated the Project site is a typical desert habitat with sparse natural and native vegetation, primarily small shrubs as well as large ornamental and landscape trees. No fauna species were identified during the site visit.

All flora species observed during the site visit were recorded and identified. All species recorded are common for the region, and none are listed on the KSA high priority list. Four specie are Least Concern on the IUCN list while the remaining species are not evaluated.

Given that the majority of the site has sparse, limited vegetation and given the absence of flora of conservation value suggests that the site does not host rare or endangered species or contribute significantly to biodiversity. Therefore, the development of the project is unlikely to have significant impacts due to habitat loss. Although the site is of a disturbed habitat due to industrialisation, mitigation management will be required and implemented to reduce further or prolonged impacts to the development area.

DIRECT IMPACT TO FAUNA

No fauna or avifauna species were observed on site during the site visit. Furthermore, no burrows, tracks, scat, etc were observed on the development footprint, this subsequently indicates that the project area is of low faunal diversity. However, ground dwelling fauna and smaller invertebrates may be directly impacted by earthworks during construction and may be impacted by the removal of flora habitat for refuge. This is provided these species are present at the development site. However, based on site visit analysis, it is unlikely that ground dwelling species are present on site.

INDIRECT IMPACTS TO FAUNA AND AVIFAUNA

Fauna and avifauna species present within the local areas may be disturbed due to the loss of the habitat, increased human presence, and temporary effects of dust, noise, waste as well as lighting during construction. This may result in a flight response from the project area and such fauna species will be required to migrate away from the work area to find suitable alternative habitat in the surrounding area. However, given the availability of other similar habitat off-site the impact is not expected to be significant.

Table 6-54 Construction Phase – Terrestrial Ecology Impacts and Mitigation

<table>
<tr><th>Impact</th><th>Impact Magnitude</th><th>Receptor</th><th>Sensitivity</th><th>Significance before Mitigation</th><th>Mitigation</th><th>Residuals Significance</th></tr>
<tr><td>Direct loss of habitats and flora</td><td>Minor</td><td>Terrestrial ecology - common species and habitats</td><td>Low</td><td>Minor</td><td>• The Temporary Installation Area should be limited to the required space and areas within the boundary that will not be of use will be delineated and demarcated to prevent access to it and retain its natural characteristics.
• Where possible, optimize the construction areas to avoid areas of vegetation and demarcate these areas.
• Select fencing that allows the free movement of small fauna onto and across the site (through a gap of circa 20 cm under the fence) to support habitat (and soil) restoration goals and limit biodiversity impacts.
• Clearly demarcate all work areas and site access routes to limit risk of clearance of non-designated areas.
• Land clearance (or grading) is to be limited within the boundaries of the Project area.
• As part of the Project design and layout, establish habitat corridors that connect fragmented areas around the Project.
• No unauthorised off-road driving outside of approved haul roads and active work sites.
• There will be no encroachment to land outside of the Project footprint, or defined laydown areas, site access roads, or designated construction access routes.
• To aid re-vegetation, topsoil from the vegetated sand sheets (containing the most nutrient rich soils) should be stripped/removed and stored safely to be reinstalled and spread over any Project disturbed areas including temporary installation areas once construction has been completed.
• For any landscaping activities, the planting pallets to be native species.
• Prevent introduction of any alien or invasive flora species.
• Any required soil imports will be taken from approved local quarry or borrow pit as close to the site as reasonably practical to avoid risk of foreign seeds and invasive species.
• Plant and machinery will require a certificate of inspection before coming onto site and this will include necessary cleaning to reduce risks of importing invasive species.</td><td>Negligible</td></tr>
<tr><td>Direct Impact and loss of Mammals, Reptiles and Invertebrates</td><td>Moderate</td><td>Common fauna species</td><td>Low</td><td>Minor</td><td rowspan="2">• Any sightings of fauna and avifauna species on-site (including nesting) during construction activities must be reported to the Environmental Manager.
• A 30km/h speed limit will be imposed across the construction site in order to minimise risk of direct mortality of fauna.
• Lighting to be minimised at all work areas and all lighting shall be switched off when not in active use.
• Lights should be shielded to prevent spill and glare beyond site boundary.
• Nests of breeding birds, or similar and dens of animals shall not be disturbed.
• Implement the mitigation measures to reduce dust emissions, noise, manage waste etc. included in the applicable chapters of this ESIA.</td><td>Negligible</td></tr>
<tr><td>Indirect Impact to Fauna and Avifauna</td><td>Minor</td><td>Common fauna and avifauna species</td><td>Low</td><td>Minor</td><td>Negligible</td></tr>
</table>

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residuals Significance
					• Avoid creating conditions that will attract birds, animals, pests within the construction areas and immediate surroundings (e.g. artificial water bodies, accumulation of waste etc.). • Implement strict controls forbidding the gathering, poaching or otherwise disturbance of any flora or fauna on site. • Contractor's staff, sub-contractors and visitors shall be provided with environmental awareness training which includes procedures in dealing with sightings of animals. Site inductions to cover the importance of minimising disturbance to habitat and wildlife, the importance of environmental protection and outline the locations where access is permitted.	

6.2.11.2 Operation Phase Impacts and Mitigation

Due to the likely paving and hard standing surface over the majority of the Project site, it is anticipated that impacts during operational phase to any terrestrial ecology will be minimal. As such, the only activities that could negatively impact the terrestrial ecology of the site would be through indirect measures, relating to lighting, poor management practices of any designated landscaped areas; or to the fauna species inhabiting/using these areas. These impacts have been addressed in the applicable chapters of this report and have therefore not been assessed any further.

6.2.12 Archaeology & Cultural Heritage

6.2.12.1 Construction Phase Impacts and Mitigation

Based on the desk review, there are no international or national sites of cultural heritage significance listed in connection with the Project site. The historic port of Al Uqair, situated approximately 22 km south of the project site, is the only noted historical site in the area. The project site itself is located within an industrial area between two existing power plants, with no known archaeologically sensitive sites closer than Al Uqair. Therefore, potential impacts on this heritage site are unlikely.

There is no evidence to suggest that the project site contains significant archaeological or cultural features, and observations from the site visit revealed no findings of concern. The site has also been modified, excavated and compacted, having previously served as temporary construction facility during the construction of the adjacent power plants. As such, impacts on any buried artifacts are considered unlikely. Therefore, archaeology and cultural heritage has been scoped out and is not discussed further in this report.

Nonetheless, an archaeological 'Chance Find Procedure' will be developed prior to the start of site earthworks. This will include protocols and procedures to stop work and methods to preserve potential finds, as well as reporting requirements and coordination with the Authorities.

Table 6-55 Construction Phase – Archaeology and Cultural Heritage Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residuals Significance
Damage to unknown buried artefacts	Minor	Buried artefacts	Low	**Negligible**	• An archaeological 'Chance Find Procedure' will be developed by the EPC Contractor prior to construction and the start of site earthworks, alongside the CESMP. This will include protocols and procedures to stop work and methods to preserve potential finds, as well as reporting requirements and coordination with the Ministry of Culture – Saudi Heritage Commission. • In the event of a discovery of any potential heritage items, all works shall stop in the immediate vicinity. • Removal of any archaeological artefacts from the site is strictly prohibited. • The finding shall be reported to the site supervisor, the Project management team and SEC. • All direction concerning the management of potential archaeological finds must only be taken from the regulator. • Contractor's staff (particularly machinery operators) shall be trained on the Chance Find Procedure and informed of their responsibility and key processes to follow and report any suspected archaeological finds to avoid disturbance. • Where artefacts or archaeological remains are encountered, the site will be clearly signed/delineated with high visibility flagging to impede access and prevent any damage or loss of the artefacts which have just been found.	**Negligible**

6.2.12.2 Operational Impacts and Mitigation

The operational phase of the Project will not result in impacts to archaeology, as the site will be static and further excavations will not be required. Therefore, the operation impacts to archaeology and cultural heritage have been scoped out and are not discussed further in the report.

6.2.13 Socio-Economic

6.2.13.1 Construction Phase Impacts and Mitigation

Employment and Economics

The primary economic impact during construction is likely to result from employment creation during this phase which will have a positive effect. This will include the direct monetary benefit to the families of those employed. Money paid to workers will also stimulate the local economy via the multiplier effect, whereby money earned on the project expended locally will re-circulate within the local economy.

Notwithstanding the above, experience of similar projects within KSA suggests that a lack of available construction workforce among the immediate local population makes it probable that a significant proportion of work on the site will be undertaken by expatriate workers. This could result in the repatriation of wages and a reduction in the benefit to the local economy of wage expenditure.

In addition to the direct monetary impact of employment created during construction, there is the potential for the Project to promote the dissemination of construction and construction support skills from expatriate workers to the local labour force.

Boost to Local / Regional Economy

A secondary impact, also beneficial, is likely to arise from spending on local and foreign goods and services during the construction process. The nature of the development, and specialised nature of required materials, suggests that these will be sourced internationally, with a expectation for construction materials locally (e.g., concrete, masonry, cabling, piping).

Increased Cost of Living

The influx of workers due to construction activities can lead to an increase in demand for basic commodities within the local area. This increased demand, if not managed effectively, can potentially result in inflation or higher prices for essential goods and services. Some of the impacts of may include:

- The increased demand for basic commodities, such as food, housing, and transportation, can drive up prices due to limited local supply, and lead to price inflation. Nonetheless, labour accommodation and workers transportation will be provided which would help manage and control this impact.
- The surge in demand may strain local supply chains, causing shortages or limited availability of basic commodities. This can further exacerbate price inflation and create challenges for the local population to access necessary goods.
- Higher prices for basic commodities can disproportionately affect vulnerable populations with limited financial resources, leading to social and economic inequalities within the community.

Table 6-56 Construction Phase – Socioeconomic Impacts and Mitigation

<table>
<tr><th>Impact</th><th>Impact Magnitude</th><th>Receptor</th><th>Sensitivity</th><th>Significance before Mitigation</th><th>Mitigation</th><th>Residuals Significance</th></tr>
<tr><td rowspan="2">Provision of temporary jobs during construction</td><td>Negligible Beneficial</td><td>Local communities</td><td>High</td><td>Minor Beneficial</td><td rowspan="2">• The Project Company will employ qualified Saudi Arabia citizens to the maximum extent possible and in accordance with the law.
• EPC Contractor will seek to employ local workers where possible, while ensuring equal employment opportunities.
• Engaging with local labor offices, job centers, and community meeting location to primate job opening and facilitate recruitment.
• Establish a fair and transparent recruitment process to ensure equal access to employment opportunities, while implementing procedures that prevent discrimination and promote diversity and inclusion in the workforce.
• Establish a grievance mechanism to address concerns related to employment opportunities, such as unfair treatment, discrimination, or non-compliance with labor regulations, and ensure workers have a channel to voice their concerns and provide feedback.
• The Project Company will develop an HR Policy that outlines key employment processes for the Project. This should include the prioritization of hiring local workers where possible and where skills are available locally.
• The EPC and sub-contractor HR Procedures will be prepared to ensure alignment with the Project Company policy and consistent with local labour laws and international ILO and UN conventions.
• The EPC Contractor is to ensure that this is applied as an overarching policy for all subcontractor company HR policy as part of their contractual arrangements.</td><td>Minor Beneficial</td></tr>
<tr><td>Minor Beneficial</td><td>Employment market (local and regional)</td><td>Medium</td><td>Minor Beneficial</td><td>Minor Beneficial</td></tr>
<tr><td>Increase in skills sets of population</td><td>Minor Beneficial</td><td>Construction workers</td><td>Medium</td><td>Minor Beneficial</td><td>• All project workers will receive induction training at the project as well as vocational specific training for on-site construction works.
• All workers will receive training in regard to health and safety as well as environmental awareness. Providing training programs and skill development opportunities to enhance the employability of local workers.
• Toolbox Talks will be conducted before work each day to ensure workers are reminded of key topics.
• Cultural awareness training for all foreign workers. Implement social integration programs for expatriates to support the smooth transition of workers into the local community.</td><td>Minor Beneficial</td></tr>
<tr><td>Positive indirect benefits and uplift to local economy from increased local spending</td><td>Minor Beneficial</td><td>Local/ Regional Economy</td><td>Medium</td><td>Minor Beneficial</td><td>• Contractors and suppliers to prioritize local procurement, sourcing materials, goods, and services from local businesses whenever feasible</td><td>Minor Beneficial</td></tr>
</table>

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residuals Significance
Increased cost of living for local communities	Minor Adverse	Local Economy	High	**Minor**	• To meet the local content requirements, the Project must procure all goods included in the mandatory list of machinery, equipment and electrical devices from local sources within KSA. • Implement policies that prioritize local employment and procurement, ensuring that a significant portion of the project's workforce and supply chain is sourced from the local community. This can help distribute the economic benefits of the project more evenly and reduce the impact of increased living costs on local populations. • Prioritize the procurement of goods and services from local suppliers and businesses, which can boost the local economy and create job opportunities, thereby offsetting the increased cost of living.	**Negligible**

6.2.13.2 Operational Phase Impacts and Mitigation

The Project will help address the escalating demand for electricity in the Project area. As population growth and economic activities surge, ensuring a stable and reliable power supply in KSA is paramount. At a strategic level the development of the Project not only mitigates the risk of energy deficits but also aligns with the KSA Vision 2030.

As with the construction phase, an economic impact during operation will result from any local employment created by the Project. Whilst the size of the required workforce is significantly small, the type of work and the increased timescales involved offer an opportunity for greater dissemination of skills. This will result in a small amount of job creation and monetary uplift. Although beneficial, this is not expected to be of particular significance.

Table 6-57 Operation Phase – Socioeconomic Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residuals Significance
Provision of employment opportunities	Negligible Beneficial	Employment market (local and regional)	Medium	**Minor Beneficial**	• O&M Company will seek to employ local workers where possible. • The projects recruitment policy will ensure a preference for employing workers from the local population where appropriately skilled workers are available locally (or if unskilled positions are available). • Establish a fair and transparent recruitment process to ensure equal access to employment opportunities, while implementing procedures that prevent discrimination and promote diversity and inclusion in the workforce. • Establish a grievance mechanism to address concerns related to employment opportunities, such as unfair treatment, discrimination, or non-compliance with labor regulations, and ensure workers have a channel to voice their concerns and provide feedback. • The Project Company will need to develop an HR Policy that outlines key employment processes for the Project. This should include the prioritization of hiring local workers where possible and where skills are available locally. • The HR Policy will ensure compliance with local labour laws and international ILO and UN conventions. • The HR Procedures will be prepared to ensure alignment with the Project Company policy and consistent with local labour laws and international ILO and UN conventions. • The O&M Company is to ensure that this is applied as an overarching policy.	**Minor Beneficial**
Increase in skills sets of population	Minor Beneficial	Operation workers	Medium	**Minor Beneficial**	• Workers will be encouraged to develop their careers and may be provided with opportunities to attend training courses and other career development processes. • Training plans to be developed and implemented to facilitate career development and advancement within the local workforce.	**Minor Beneficial**

6.2.14 Community Health, Safety & Security

6.2.14.1 Construction Impacts and Mitigation

Worker Influx

During the construction phase of the project, a dedicated labour force will be required, including site-based security personnel and staff for administration and accommodation areas. This will result in an increase in the local population size within the project area. To accommodate this workforce, suitable accommodation facilities will be needed.

Even though employment priority will be given to the local community, it is anticipated that the workers will also come from outside the project area and will most likely include expatriates. Therefore, the workforce will include workers from various regions of Saudi Arabia, as well as the Middle East and international workforce and experts.

As a result, there is a possibility that workers accommodated in the the project accommodation may interact with residents of towns and villages within the area.

The influx of workers from diverse backgrounds and cultures could potentially lead to cultural conflicts with existing local communities. These conflicts may arise due to differences in ideals, behaviour, and cultural practices, and may lead to potential crime or security risks in extreme situations.

Throughout the construction phase of the project, the arrival of a larger workforce can exert added stress on the local public infrastructure. This strain manifests in various areas including transportation systems, utilities, healthcare facilities, and other public services. The commute to and from the construction site may cause traffic congestion and longer travel durations, thereby impacting the overall efficiency of transportation networks. Moreover, local utilities such as water supply may face difficulties accommodating the heightened population, potentially resulting in service interruptions. Electricity is expected to be provided by onsite generators and therefore is not expected to increase the pressure to energy infrastructure. Healthcare facilities and emergency services might encounter challenges in meeting the increased demand for their services.

Public/Community Safety

Considering the relatively low population in the surrounding area of the Project, the typical construction risks to external parties, such as the movement of high-powered equipment and vehicles, excavations, and the risks associated with fire and pollution releases, are not expected to impact the public/community. However, the site is fenced and secure, therefore there is negligible potential that the Project could be accessed by the public in the vicinity of the Project area.

Such instances would only be expected in the event of public access to the site, which could have the potential to result in isolated incidents if the site is not properly managed to prevent unauthorised access by adults or children to areas of excavation, equipment and machinery.

While the use of hazardous materials or chemical and fuel storage on-site is limited, isolated incidents related to oil spills, dust dispersion, or other similar events may still occur in the Project area. These incidents, although not widespread, should be addressed through appropriate measures to prevent and mitigate their potential impact on the environment and external parties.

The introduction of workers in the vicinity of local communities has the possibility of increasing Gender Based violence (GBV) between workers and community members. However, this is considered to be unlikely due to the distance from the Project to the nearest communities.

SECURITY

The site is expected to be fenced and site-based security personnel are expected to be stationed at the project offices, laydown areas, and patrol the project area to prevent the public from trespassing onto the construction sites. Their presence will help maintain a secure environment and minimize the risk of construction site incidents.

It is understood that by law in KSA all security personnel have to be Saudi locals and are not allowed to be armed; in most cases of security issues, the security is required to directly inform and report to the police. This raises the risk that the security personnel who are mandated with providing protection to the workers can abuse their position of power and status and become perpetrators of the human rights of the members of the workforce or the community in case of conflict.

DISEASE AND ILLNESS

The nature of construction projects, involving workers from various regions and parts of the world, presents a potential risk for the transfer of communicable diseases and illnesses. The close interaction and mixing of workers on construction sites and in labour accommodations can facilitate the spread of such diseases, which may also impact the surrounding communities.

Furthermore, construction activities, including the presence of temporary facilities, can create environments conducive to the growth and spread of bacteria and parasites. Sanitation facilities, in particular, may serve as breeding grounds for these microorganisms, posing a potential indirect risk to local communities. Any potential contamination from the site such as spillage of raw sewage or hazardous materials could potentially result into water related and water borne diseases through contamination of surface and groundwater.

Table 6-58 Construction Phase – Community Health, Safety & Security Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residuals Significance
Community disgruntlement with external staff (potentially including expatriate workers)	Minor Adverse	Local communities	High	**Minor**	• Develop and implement robust stakeholder engagement plan to foster open communication, transparency, and dialogue between the project team and the local community. • Prioritize local employment opportunities by actively recruiting and hiring from the local community. This demonstrates a commitment to supporting the local economy and provides a sense of ownership and involvement in the project. • Provide cultural sensitivity training to all external staff, including expatriate workers, to promote understanding and respect for local customs, traditions, and social norms. This helps to prevent cultural misunderstandings and promotes harmonious interactions with the community. • Develop community integration programs to facilitate positive interactions and relationships between external staff and the local community. • Establish a grievance mechanism that allows community members to voice their concerns, provide feedback, and seek resolution to any issues arising from the presence of external staff. This mechanism should be easily accessible, transparent, and responsive to community needs. • EPC Contractor will appoint a representative who will maintain communication with the local facilities.	**Negligible**
Community health risks	Minor Adverse	Local communities	High	**Minor**	• The Health and Safety teams on site will provide advice during training/inductions on exposure to disease including preventative measures. • During construction, staff will have access to medical professionals and suitable medical facilities, which will aim to prevent the spread of diseases internally and externally. Site personnel will only be cleared for work after with a medical fitness certificate from an authorized medical center. • Any reportable disease will be diagnosed by the authorized occupation health center doctor. Diagnosis includes identifying any new symptoms, or any significant worsening of existing symptoms. • Any external and internal spreading diseases will be diagnosed and taken the precautions as per the instructions from the national/ local medical authority. • The potential for exposure to water-borne, water-based, vector-borne diseases and communicable diseases as a result from project activities will be avoided or minimized. • Additional management and mitigation measures will be in accordance with the World Bank guidance note on Managing the Risks of Adverse Impacts on Communities from Temporary Project Induced Labour Influx (2016).	**Negligible**
Increased pressure on public infrastructure	Minor Adverse	Local communities	High	**Minor**	• Conduct an assessment of the existing public infrastructure to identify potential areas of strain. • Assess the capacity of existing utilities and services, such as water supply, electricity, and waste management, and plan for necessary expansions or upgrades to meet the increased demand. Coordinate with local utility providers to ensure timely provision of additional services and prevent service disruptions.	**Negligible**

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residuals Significance
					• Consider the construction of temporary infrastructure, such as temporary roads or utilities, to alleviate pressure on existing infrastructure during the construction phase. This can help to distribute the increased demand and prevent overburdening of the existing systems. • Implement effective traffic management measures to mitigate congestion and minimize disruptions to the local transportation system. This can include implementing alternative traffic routes, coordinating construction schedules to minimize peak traffic hours, and providing clear signage and communication to redirect traffic.	
Exposure of community to construction hazards	Minor Adverse	Local communities	High	**Minor**	• The employees during the construction phase shall undergo a Code of Conduct training to ensure smooth coordination with the neighbouring community. • Risks to public safety will be appropriately addressed and prepared for in the construction phase 'Emergency Preparedness and Response Plan' and training. • The plan will include the appropriate procedure to respond to any such incidents, as well as site specific contact details and details of external agencies who may be required. • All high-risk areas including fuel storage areas will be secured with internal fencing and will be patrolled by security throughout the day. • Appropriate mechanisms for emergency control (e.g. firefighting equipment) will be placed at suitable positions around the site.	**Negligible**
Security risks to the Project and the community (including use of excessive force)	Minor Adverse	Local communities	High	**Minor**	• The project will employ its own security staff who will provide 24/7 security control across the Project site and dedicated security staff at gatehouses. • The EPC will prepare a Security Plan consistent with its Security Risk Assessment. • The project will be fenced during enabling works stage. • All vehicles entering the site will require pre-approved clearance and will need to be registered. Project security will record all instances of incoming vehicles. • CCTV will be installed at key locations around the site and at gatehouses. • Appropriate lighting will be provided at gatehouses for security personnel to prevent unauthorized access. • Project personnel will only be provided access to the construction site with valid ID cards and permits to work in line with HSE requirements. • The security arrangements will require to be guided by UN Code of Conduct for law enforcement officials, the IFC's Good Practice Handbook on the Use of Security Forces: Assessing and Managing Risks and Impacts IFC's and the Voluntary Principles on Security and Human Rights. • Security personnel will receive internal training in regard to receiving grievances, reporting such grievances and code of conduct for dialogue with any members of the local community and the workers.	**Negligible**

6.2.14.2 Operational Phase Impacts and Mitigation

PUBLIC/COMMUNITY SAFETY AND EMERGENCY SITUATIONS

The operation of the Plant is associated with various risks that could potentially result in impacts to public safety in the absence of required control measures. Depending on its nature and severity, such impacts could be transferred or received outside of the Project site. Such impacts will arise from hazards associated with the unloading, storage and handling of hazardous materials potentially leading to unforeseen incidents that may relate to fire, releases of toxic gases, explosions, spills of back up fuels, releases of untreated wastewater.

The extent of such impacts may range outside of the projects boundaries and require the involvement of outside agencies to help manage and abate such impacts (e.g. police, fire department etc).

Public risks during operation as a result of incidents could have a significant impact upon neighbouring communities and populations. However, the Plant will be equipped with advanced leak detection systems and alarms with remote operated emergency isolation valves and continuous emissions monitoring systems to detect fugitive emissions of gases which will avoid such risks. Storage of hazardous liquids such as fuel will be within secure areas and tanks with adequate secondary containment bunds and double walls as necessary. The firefighting system at the Plant will be routinely checked and maintained as required to ensure its efficiency for use in case of fire incidents. Storage volume of hazardous materials at the Plant will reduced to the minimum required.

Risks to public safety will be appropriately addressed and prepared for in the operational phase ‘Emergency Preparedness and Response Plan’ and via appropriate training of staff.

SECURITY STAFF AND CLASHES

The development of the Project will also include security at the Project main entrance and on patrol around the site during operations. Although unlikely, this raises the risk that the security personnel who are mandated with providing protection to the Project can abuse their position of power and status and become perpetrators of the human rights of the members of the workforce or the community in case of conflict.

Table 6-59 Operation Phase – Community Health, Safety & Security Impacts and Mitigation

Impact	Impact Magnitude	Receptor	Sensitivity	Significance before Mitigation	Mitigation	Residuals Significance
Public/ community safety and emergency situations	Moderate Adverse	Local communities	High	**Moderate**	• Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan (EPRP)' and training. • The EPRP will be developed, also based on consultations with local authorities. • A Community Health and Safety Plan will be prepared for implementation which will also be based on consultation with local communities. • The EPRP will include the appropriate procedure to respond to any such incidents, as well as site specific contact details and details of external agencies who may be required. • The employees during the operational phase shall undergo a Code of Conduct training to ensure smooth coordination with the neighboring community. • Appropriate mechanisms for emergency control (e.g., leak detection and alarm systems, firefighting equipment) will be placed at suitable positions around the site. • The project will implement an appropriate system to allow external parties to raise grievances in regard to the Project. • The Grievance Mechanism will be clearly defined, transparent and accessible to identified stakeholders. • EPC Contractor will appoint a representative who will maintain communication with the local facilities.	**Negligible**
Security staff and clashes	Negligible Adverse	Local communities	High	**Minor**	• The project will employ its own security staff who will provide 24/7 security control across the Project site and dedicated security staff at gatehouses. • All vehicles entering the site will require pre-approved clearance and will need to be registered. Project security will record all instances of incoming vehicles. • CCTV will be installed at key locations around the site and at gatehouses. • Appropriate lighting will be provided at gatehouses for security personnel to prevent unauthorised access. • Project personnel will only be provided access to the construction site with valid ID cards and permits to work in line with HSE requirements. • The security arrangements will require to be guided by UN Code of Conduct for law enforcement officials, the IFC's Good Practice Handbook on the Use of Security Forces: Assessing and Managing Risks and Impacts IFC's and the Voluntary Principles on Security and Human Rights. • Security personnel will receive internal training in regard to receiving grievances, reporting such grievances and code of conduct for dialogue with any members of the local community and the workers.	**Negligible**

6.2.15 Labour & Working Conditions

6.2.15.1 Construction Impacts

CONTRACTUAL AGREEMENTS

KSA labour law includes clear guidelines for timely payment of salaries, working hours, breaks, rest days, paid leave, sick leave and end of service benefits. Salaries are protected by the Wage Protection System (WPS) in KSA, and all workers shall receive their salaries in local currency and bank accounts as per the Law. In addition, the IFC PS2 and ILO conventions provide clear requirements related to the working conditions.

However, contractors may violate the laws and regulations and workers potentially accept the unjust conditions they experience as they are not aware of their legal rights or afraid of the adverse outcomes expressing their concern may result in.

Local and migrant workers can be the most vulnerable to risks related to working conditions. However, such risks could affect all construction workers. Some possible risks for this project include no provision of a work contract or other relevant documentation, lack of payment or insufficient payment of overtime hours, or unsuitable accommodation, among others. In addition, workers that are new to construction work may be unaware of their rights in the workplace.

LABOUR RIGHTS, FORCED LABOUR AND CHILD LABOUR

Several parties will be involved in the construction process and there will likely be various internal processes and protocols related to worker management for each party. Certain parties will also engage contract staff (e.g. from agencies), where additional manpower is required. There will also be suppliers/service providers (e.g. for deliveries, waste management) who will have access to the site and will be exposed to certain risks of exploitation.

Discrimination based on gender, nationality, religion or as a result of different social status or work position is widespread within construction industries. Labour exploitation on construction sites, unfortunately, has become a reality in some parts of the world with history of contractors and recruitment agency exploitation of workers despite existing Labour Law articles that forbid such practices. Inequality in income, education and opportunities has led to opportunistic practices with labourers and site staff suffering as a consequence. All workers have a right to make a living through work they have chosen and accepted freely without coercion or intimidation. This also includes access to suitable work in safe working conditions.

Workers are also at risk (especially migrant workers) as they face the risk of debt bondage through unscrupulous recruitment agencies in their home countries. Even though the EPC Contractors will be responsible for covering the required expenses as per the Labour Law, there still remains a risk of engaging uncertified recruitment agencies who have human rights violations.

Child Labour is forbidden by law and compliance is regulated by KSA work permitting processes for foreigners and residents through the Ministry of Human Resources and Social Development (MHRSD). Illegal recruitment of minors may be observed in the absence of regular monitoring of the contractors' human rights practices and auditing the sites and the management systems in place. However, the recruitment process in the KSA such as obtaining a work permit from the relevant government departments ensures that children are not exploited.

Occupational Health and Safety

Common activities undertaken during construction such as the movement of heavy machinery, excavation, handling of chemicals, etc. can all introduce significant risk to the health and safety for the associated work force. In particular, risks are more likely to be apparent for those who are not familiar with the type of works undertaken and/or the associated hazards.

There is also a likelihood of injury when different work processes are being undertaken. The type of hazards attributable to a construction site will vary significantly dependent on the construction methods employed and the degree of control implemented by the EPC and affiliated sub-contractor.

The close interaction and mixing of workers on construction sites and in labour accommodations can facilitate the spread of such diseases, which may also impact the surrounding communities.

In addition, climate related risks can impact worker welfare (e.g., dust storms, excessive temperature, high intensity rainfall etc.).

These impacts are expected to increase in the absence of awareness, proper management, and access to suitable medical care and health insurance provisions.

Gender Based Violence and Harassment

During the construction phase, workers will be vulnerable to various forms of harassment, exploitation and abuse, aggravated by traditionally male working environment. Gender based violence and harassment (GBVH) may be committed by co-workers or construction supervisors and can be attributed to gender stereotypes.

The construction workers are likely to be predominantly young male coming from outside of KSA. As such, these workers will be away from their families and removed from their normal social spheres. This could potentially result into peer pressure and involvement in unlawful behaviour such as harassment of local community members or co-workers. Such behaviour can lead to increase in unwanted aggressive advances and harassment.

Some of the male workers who will be transporting Project machinery and equipment and goods will also be involved in long distance travel which in some cases may be between different countries. There is a risk that they can also be involved in GBVH on the routes they use and at track stops associated with the Project even if it is outside the Project boundary.

Labour Accommodation

The workers' rights to adequate living conditions may be potentially impacted during the project implementation especially for those living in shared worker accommodation camps. This can include a lack of welfare provisions on-site such as clean drinking water, hygienic and ample toilet and shower facilities, hand basins (with soaps/hand wash), temperate rest areas, food and other amenities necessary to the workers.

Part VIII of the KSA Labour Law requires employers to provide proper accommodation or pay of accommodation allowance in cash or as part of the wages. However, there is still a risk that companies providing accommodation can significantly impact the lives of Project workers, not only in the choice of accommodation but the number of workers per room, facilities and amenities available to workers, maintenance accommodation areas and provisions of associated services (e.g., catering, waste management etc.).

To ensure the wellbeing of the staff associated with the project, the EPC Contractor and associated subcontractors will need to plan for necessary provisions relative to the requirement of the required workforce. This includes appropriate labour accommodation plans and mechanism for inspections and corrective actions.

Due to the remote location of the Project and the use of a largely migrant workforce, it will be necessary for the EPC Contractor to provide suitable accommodation to their workers. The Client will develop and operate a dedicated temporary construction accommodation facility meeting the regulatory requirements in KSA and those of IFC & EBRD Workers Accommodation: Processes and Standards, 2009. Personnel during the construction phase of the project will have access to this facility.

SUPPLY CHAIN

The engagement of suppliers will present potential risks relating to labour and working conditions such as:

- Child labour, forced labour, gender- based violence and sexual abuse, exploitation and harassment;
- Lack of written contracts for workers;
- Labour rights violations including poor working conditions and poor terms of agreement for female employees, overtime work without pay etc;
- Health & safety issues for workers and local communities;
- Risks associated with the use of migrant labour and ethnic minorities;
- Risks to freedom of movement e.g., not being able to leave worker accommodation; and
- Impact on the environment relating to pollution of water supplies, soil, air etc..

In addition, risks arise from the involvement of suppliers in situations of armed conflict if they are located in areas or countries that are in conflict situations.

The Project Company is committed to upholding human rights in all aspects of the Project, including material sourcing and worker recruitment. Throughout the Project, the Project Company will implement strict policies and procedures that emphasize the importance of engaging with suppliers and subcontractors who adhere to ethical labour practices and prioritise human rights. It is noted that the EPC Contractor will be contractually obligated to follow ACWA Power’s Chartered Institute of Procurement & Supply (CIPS) procurement system which requires that all contractors and suppliers engaged by the EPC are vetted and meet ACWA Power’s procurement policies as well as national and lenders requirements. The EPC Contractor will be responsible for undertaking due diligence to ensure that its contractors and suppliers are in compliance with the applicable national and lenders requirements.

Table 6-60 Construction Phase – Labour and Working Conditions Impacts and Mitigation

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
Risk of poorly formed contracts and their implementation	Moderate Adverse	Workers	Medium	**Moderate**	• The wages to all the workers including unskilled workers will be enough to constitute for a living wage. • Wages, benefits and conditions of work offered should, overall, be comparable to those offered by equivalent employers in the relevant region of that country/region and sector concerned. • The Project Company, EPC Contractor and sub-contractors shall provide their workers with accommodation, transportation and food services or compensate with what will be enough taking into consideration the Project location and proximity to services. • The Project Company, EPC Contractor and sub-contractors shall comply with the KSA labour law requirements for timely payment of salaries, working hours, breaks, rest days, paid leave, sick leave and end of service benefits etc. • The Project Company, EPC Contractor and sub-contractors will document and communicate to all workers their working conditions and terms of employment including their entitlement to wages, hours of work, overtime arrangements and overtime compensation, and any benefits (such as leave for illness, maternity/paternity, or holiday). • The work schedule will follow the KSA labour law requirements with respect to maximum working hours, summer out of sun periods, Ramadan hours and overtime. • EPC and subcontractors to commit to having written work contracts available for all the Project employees that would clearly specify their terms of employment, consistent with the local labour law and the IFC PS2. • In the event that workers are required to work overtime, on weekends, holidays or planned leave days, the Contractor will ensure the workers are compensated in compliance with the KSA labour law. • Project Company, EPC Contractor and sub-contractors will only engage certified and registered recruitment agencies who are committed to human rights and have a good track record i.e., have no court cases. • Project Company, EPC Contractor and sub-contractors shall ensure workers are not liable for any expenses related to their recruitment process. They will ensure that recruitment agencies have not received payments from the workers and any recruitment expenses paid by the workers for getting employed by the Project will be reimbursed; these may be identified through consultations with workers during the early stages of recruitment. • To ensure the workers have a clear understanding of the content of the agreements and contracts (that they will receive in English and Arabic), it is recommended that the contracts' clauses are translated to the workers' native language or explained to them in their native language during the recruitment process by a staff member to ensure they are aware. • Monitor through performance reports and audits the WPS or bank statements of contractors and subcontractors to ensure workers are receiving their salaries on time as in line with the amounts agreed on in the contracts. • A robust grievance mechanism will be provided to remedy for any victims without any retributions to workers who voice their concerns.	**Negligible**

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
					• The workers will be informed of their legal rights and provided with the contact details of the internal grievance and the MHRSD local offices. • The right to work will be guaranteed by ensuring workers are not unfairly dismissed from their duties. Even where such dismissals may be legally permissible under local law, the Project will be expected to uphold higher international standards and good practice. • If the EPC contractor anticipates collective dismissals associated with the proposed project, the EPC contractor will develop a plan to mitigate the adverse impacts of retrenchment, in line with national law and good industry practice and based on the principles of non-discrimination and consultation. Without prejudice to more stringent provisions in national law, such consultation will involve reasonable notice of employment changes to the workers' representatives and, where appropriate, relevant public authorities so that the retrenchment plan may be examined jointly in order to mitigate adverse effects of job losses on the workers concerned. The outcome of the consultations will be reflected in the final retrenchment plan.	
Risks of violating labour rights and risks of forced and child labour	Moderate Adverse	Workers	Medium	**Moderate**	• EPC Contractor to hire a site HR Manager and HSE Officer (for site and accommodation). • The EPC contractor will provide a Labour and Working Conditions Management Plan detailing how working conditions and terms of employment are compliant with national labour, social security and occupational health and safety laws. • All EPC Contractor staff to be trained (as part of the induction) on labour terms and conditions (aligned with IFC PS2) • EPC to prepare a Local Hiring and Gender Management Plan to encourage employment of workers from local communities and women. • Special measures of protection or assistance to promote local employment opportunities or selection for a particular job based on the inherent requirements of the job which are in accordance with national law, will not be deemed discrimination. • The EPC contractor will not employ forced labour, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements. • HR policies and procedures will be adapted appropriately to the size of the workforce required for the Project. Policies and procedures must be prepared to demonstrate consistency with the requirements of national legislation and IFC PS 2. • The EPC contractor will comply with all relevant national laws' provisions related to the employment of minors. • In any event, the client will not employ children in a manner that is economically exploitative or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. • Young people below the age of 18 years will not be employed in hazardous work and all work of persons under the age of 18 will be subject to an appropriate risk assessment. • Employees will be free to terminate their employment in accordance with the reforms to KSA Labour Law. It is recommended that SEC and the Contactors give the workers the freedom to transfer to another employer and not prevent them from leaving the country shall they have a valid reason for their request.	**Negligible**

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
					• The workers will be informed of their legal rights and provided with the contact details of the internal grievance and the MHRSD local offices.	
Major Injury or fatality where key risks are not suitably managed	High Adverse	Workers	Medium	**Major**	• Ensure all workers receive worker induction and regular ongoing training (e.g., toolbox talks, setting to work briefings) on environment, H&S, labour and working conditions, worker code of conduct, GBVH, and other requirements. • EPC Contractor and subcontractors to hire HSE Managers and Officers (1:40 for construction workforce) • Subcontractors with more than 20 workers shall deploy a dedicated HSE Officer and an additional HSE Officer for each additional 50 workers deployed onsite. • Workers will be provided with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project construction activities as well as climate change risks including heat stress, dust storms, intense rainfall etc. • Chemicals and Hazardous materials should only be handled by trained personnel and personal protection equipment (gloves, face mask, nose mask, etc.) will be provided. • Workers to receive correct PPE, free of charge and to be replaced when needed. • Workers will be informed of the chemicals that are hazardous to health or flammable and must be trained on handling such chemicals. • The EPC Contractor will implement and maintain an OHS management system taking into account specific risks associated with the project, legal requirements and duty of care. • The EPC Contractor will be responsible for ensuring that all affiliated sub-contractors comply with the OHS management system. The OHS management system will be in-line with recognised international best practice and as a minimum, this plan will include: - Means of identifying and minimising, so far as reasonably practicable, the causes of potential H&S hazards to workers. - Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. - Provision of appropriate equipment to minimise risks and requiring and enforcing its use. - Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment. - Documentation and reporting of occupational accidents, diseases and incidents. - Emergency prevention, preparedness and response arrangements. • The Project Company will ensure that regular labour audits are undertaken on the contractors and sub-contractors including suppliers. • All workers will be entitled to health insurance and sick leaves in accordance with KSA Labour Law. • Hospital & Medical bills will be covered under the Medical Insurance Scheme, and additional items will be reimbursed. • The availability of medical facilities and camp nurses as well as transport for medical emergencies shall be provided in the labour accommodation. First aid will be always available on every project site. • Identify shelter locations for workers in the event of a dust storm. • Prohibit work in wind conditions more than 15 km/hr.	**Minor**
Occupational health and safety including minor injury to workers	Moderate Adverse	Workers	Medium	**Moderate**		**Minor**

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
					• Ensure sufficient shelter/shade during summer months and erect temporary shade at all work fronts for all workers. • Where possible, ensure workers have access to cooled resting areas for lunch breaks. • Ensure sufficient supply of potable water at the work fronts (>3.5 L per worker per day). • Provide extra rest periods for workers when temperatures exceed 35 $^{\circ}$C (as applicable by law or periods between 12:00pm and 3:00 pm as minimum). • Change the shift hours in line with the cooler hours. • Ensure workers are not penalised for taking extra rest breaks during periods of extreme heat. • Monitor weather forecast and halt work in any expected events of extreme weather conditions (i.e., dust storms, intensive rain, extreme heat waves etc.)	
Gender based violence & harassment and discrimination	Moderate Adverse	Workers	Medium	**Moderate**	• Employment relationship will be on the principle of equal opportunity and fair treatment and will not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. • The EPC contractor will not make employment decisions on the basis of personal characteristics, such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation, unrelated to inherent job requirements. • Promote transparency in pay structures by disclosing salary ranges for different positions within the organization. This helps identify any existing pay gaps and encourages equal pay for equal work. • Implement and enforce clear policies that emphasize pay equity and prohibit wage discrimination based on gender. • The workers will be provided with information regarding worker code of conduct in local languages as part of their employment contract which will include provisions for reporting, investigations, termination and disciplinary action against those who perpetrate gender violence and harassment. • The EPC Contractor shall conduct mandatory regular training and awareness raising for the workforce about gender-based violence and harassment towards local community members and their colleagues especially women and the availability of a grievance mechanism to report any GBVH cases. • The workers shall be made aware of the laws and regulations that make sexual harassment and gender-based violence a punishable offence which is prosecuted. • As applicable, ensure inclusion of a balanced representation of women on the HSE team who will be easily relatable and approachable to female workers (if any). • Project personnel in charge of receiving GBVH grievances will be provided with appropriate training on how to handle such complaints. It is recommended that the personnel are trained in coordination with any GBVH organisations working in the Project area where available. • As applicable, female workers will be included in the grievance redress committee to help female workers and host community members raise their grievances. • The grievance mechanism will be confidential and provide referral and support system for any workers reporting cases of GBVH.	**Negligible**

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
					• The EPC shall provide safe, secure and separate living spaces and sanitary facilities for the male and female workers (lockable sanitary facilities will be mandatory for women). • The EPC Contractor will work to identify a suitable labour pool locally in order to minimise the need for bringing large number of workers from other regions or countries. This could also help the EPC Contractor in cutting cost associated with provision of accommodation facilities if the majority of the workers are sourced locally. • Provision of opportunities for the workers to regularly return to their families who may be located far from the Project site. • The EPC Contractor will provide opportunities for workers to have access to entertainment opportunities away from the host communities. • EPC Contractor will allow submission and investigation of anonymous harassment complaints by workers and host community members and protect the confidentiality of the complainants. • The EPC Contractor will work in close coordination with the local authorities in investigating any complaints relating to gender violence and harassment in the host communities where it relates to Project workers. • The EPC Contractor will provide targeted training (including in life skills such as leadership and decision-making) and awareness raising to vulnerable workers such as women.	
Poor quality housing and lack of welfare facilities and working amenities	Moderate Adverse	Workers	Medium	**Moderate**	• Employees should be provided with suitable accommodation and worker accommodation areas will be managed in accordance with the EBRD and IFC Workers' Accommodation: Processes and Standards. • Establish clear and enforceable housing standards for labor accommodations during the construction phase. These standards should include requirements for living space, ventilation, lighting, cleanliness, sanitation facilities, and basic amenities. • Ensure that laborers have access to safe and decent accommodation. Provide weather-resistant and structurally sound shelters with proper insulation and ventilation to protect them from harsh environmental conditions. • Ensure that labor accommodations have adequate sanitation facilities, including clean toilets, washrooms, and bathing facilities. Regular maintenance and cleanliness should be ensured to promote hygienic living conditions. • Provide access to clean and potable drinking water within the labor accommodations. Install water filtration systems or ensure a regular supply of safe drinking water. • Provide proper ventilation systems to maintain good air quality and reduce heat stress. Additionally, in areas with high temperatures, consider installing cooling systems or providing fans to mitigate extreme heat conditions. • Ensure that labor accommodations provide sufficient living space to accommodate the number of residents comfortably. Overcrowding should be avoided as it can lead to health and safety hazards. • Conduct regular inspections of labor accommodations to ensure compliance with housing standards and identify any issues or deficiencies. Address identified concerns promptly and take necessary corrective actions.	**Minor**

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
					• Implement measures to ensure the safety and security of labor accommodations. This includes having secure entry and exit points, adequate lighting in common areas, and measures to prevent theft or unauthorized access. • Ensure the availability of a robust grievance mechanism to record concerns related to accommodation and address the grievances and close them out in a timely manner. • Project Company shall carry out regular inspections and audits (directly and through independent third-party auditors) of the accommodation facilities, identify nonconformance, and ensure the contractors close-out these non-conformances especially those that have an impact on the H&S of the workers.	
Violations to workers' rights in the supply chain	Moderate Adverse	Workers	Medium	**Moderate**	• The Project company will carry out a screening of its suppliers and contractors to ensure the selected companies do not record of human rights violations. • The EPC Contractor will devise a supply management plan to ensure the measures above are implemented by any sub-contractors. • The EPC Contractor will mandate its suppliers and sub-contractor to provide GBVH training to their workers in accordance with the code of conduct.	**Negligible**

6.2.15.2 Operational Impacts and Mitigation

CONTRACTUAL AGREEMENTS

Similar to the construction phase, local and migrant workers can be the most vulnerable to risks related to unjust working conditions. Some possible risks for this project include no provision of a work contract or other relevant documentation, lack of payments or insufficient payment of overtime hours, unsuitable accommodation, among others.

In addition, any violations of the laws and regulations and if workers accept the unjust conditions they experience if they are not aware of their legal rights or afraid of the consequences of expressing their concern may result in adverse impacts.

OCCUPATIONAL HEALTH AND SAFETY

Workers may be exposed to chemicals utilized in maintenance activities, encompassing the handling and management of fuels, lubricants, and cleaning agents. Certain areas of the plant will generate elevated noise levels, potentially jeopardizing workers' hearing and well-being in the absence of proper PPE. The gas turbine operation involves high temperatures, posing the risk of burns or heat-related illnesses for workers engaged in maintenance or repair tasks. In addition, dealing with electrical systems and equipment, entry into confined spaces, and working at heights, exposes workers to the hazards of electrical shocks or burns, inadequate ventilation or physical constraints and risk of falls.

In addition, emergency situations such as fires, electrical issues, or fuel/gas leaks that may occur due to equipment, fuel supply or other system components malfunctions pose a significant risk to the Project and the operational employees.

These impacts are expected to increase in the absence of awareness, proper management, emergency plans and procedures and access to suitable medical care and health insurance provisions. In the absence of mitigation, this impact can be classed as negative, direct and major. With the application of mitigation measures specified in following table, the impact will be reduced to a negative minor significance.

WORKERS LIVING CONDITIONS

Long-term accommodation requirements are not being established specifically for the Project. The operational staff will potentially be housed in existing housing areas in Qurrayah and provided with transportation to the site. However, this is yet to be confirmed by the Project Company.

As with construction, operational activities will need to plan for and enforce just and fair treatment of operation and maintenance staff (including any engaged sub-contractors) in accordance with lender requirements and relevant national requirements. The O&M workers accommodation or housing will require compliance with KSA requirements and the IFC & EBRD Workers Accommodation: Processes and Guidelines (2009). Allowance will also need to be made for site staff welfare facilities including sanitation, rest, recreational and medical facilities.

Table 6-61 provides a summary of the impact assessment and applicable mitigation.

Table 6-61 Operation Phase – Labour and Working Conditions Impacts and Mitigation

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
Risk of poorly formed contracts and their implementation	Moderate Adverse	Workers	Medium	**Moderate**	• The wages to all the workers including to any unskilled workers will be enough to constitute for a living wage. • Wages, benefits and conditions of work offered should, overall, be comparable to those offered by equivalent employers in the relevant region of that country/region and sector concerned. • The Project Company, O&M Company and sub-contractors shall provide their staff with accommodation, transportation and food services or compensate with what will be enough taking into consideration the Project location and proximity to services. • The Project Company, O&M Company and sub-contractors shall comply with the KSA labour law requirements for timely payment of salaries, working hours, breaks, rest days, paid leave, sick leave and end of service benefits etc. • The Project Company, O&M Company and sub-contractors will document and communicate to all workers their working conditions and terms of employment including their entitlement to wages, hours of work, overtime arrangements and overtime compensation, and any benefits (such as leave for illness, maternity/paternity, or holiday). • In the event that workers are required to work overtime, on weekends, holidays or planned leave days, the O&M Company will ensure the workers are compensated in compliance with the KSA labour law. • Project Company, O&M Company and sub-contractors will only engage certified and registered recruitment agencies who are committed to human rights and have a good track record i.e., have no court cases. • Project Company, O&M Company and sub-contractors shall ensure workers are not liable for any expenses related to their recruitment process. They will ensure that recruitment agencies have not received payments from the workers and any recruitment expenses paid by the workers for getting employed by the Project will be reimbursed; these may be identified through consultations with workers during the early stages of recruitment. • To ensure the workers have a clear understanding of the content of the agreements and contracts (that they will receive in English and Arabic), it is recommended that the contracts' clauses are translated to the workers' native language or explained to them in their native language during the recruitment process by a staff member to ensure they are aware. • Monitor through performance reports and audits the WPS or bank statements of contractors and subcontractors to ensure workers are receiving their salaries on time as in line with the amounts agreed on in the contracts. • A robust grievance mechanism will be provided to remedy for any victims without any retributions to workers who voice their concerns. • The workers will be informed of their legal rights and provided with the contact details of the internal grievance and the MHRSD local offices. • The right to work will be guaranteed by ensuring workers are not unfairly dismissed from their duties. Even where such dismissals may be legally permissible under local law, the Project will be expected to uphold higher international standards and good practice.	**Negligible**

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
					• Employment relationship will be on the principle of equal opportunity and fair treatment and will not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. • The O&M Company will not make employment decisions on the basis of personal characteristics, such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation, unrelated to inherent job requirements. • Promote transparency in pay structures by disclosing salary ranges for different positions within the organization. This helps identify any existing pay gaps and encourages equal pay for equal work. • Implement and enforce clear policies that emphasize pay equity and prohibit wage discrimination based on gender. • If the O&M Company anticipates collective dismissals associated with the proposed project, the O&M Company will develop a plan to mitigate the adverse impacts of retrenchment, in line with national law and good industry practice and based on the principles of non-discrimination and consultation. Without prejudice to more stringent provisions in national law, such consultation will involve reasonable notice of employment changes to the workers' representatives and, where appropriate, relevant public authorities so that the retrenchment plan may be examined jointly in order to mitigate adverse effects of job losses on the workers concerned. The outcome of the consultations will be reflected in the final retrenchment plan.	
Major Injury or fatality where key risks are not suitably managed	High Adverse	Workers	Medium	**Major**	• Ensure all workers receive worker induction and regular ongoing training (e.g., toolbox talks, setting to work briefings) on environment, H&S. labour and working conditions, worker code of conduct, GBVH, and other requirements. • Workers will be provided with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the Project operation activities as well as climate change risks including heat stress, dust storms, intense rainfall etc. • Chemicals and Hazardous materials should only be handled by trained personnel and personal protection equipment (gloves, face mask, nose mask, etc.) will be provided. • Workers will be informed of the chemicals that are hazardous to health or flammable and must be trained on handling such chemicals. • The O&M Company will implement and maintain an OHS management system taking into account specific risks associated with the project, legal requirements and duty of care. • The O&M Company will be responsible for ensuring that all affiliated sub-contractors comply with the OHS management system. The OHS management system will be in-line with recognised international best practice and as a minimum, this plan will include: - Means of identifying and minimising, so far as reasonably practicable, the causes of potential H&S hazards to workers. - Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. - Provision of appropriate equipment to minimise risks and requiring and enforcing its use.	**Minor**
Occupational health and safety including minor injury to workers	Moderate Adverse	Workers	Medium	**Moderate**		**Minor**

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
					- Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment. - Documentation and reporting of occupational accidents, diseases and incidents. - Emergency prevention, preparedness and response arrangements. • All workers will be entitled to health insurance and sick leaves in accordance with KSA Labour Law. • Hospital & Medical bills will be covered under the Medical Insurance Scheme, and additional items will be reimbursed. • Ensure the availability of medical facilities and nurses as well as first aid and transport for medical emergencies. • Prohibit outdoor work or maintenance activities in wind conditions more than 15 km/hr. • Ensure sufficient shelter/shade during summer months and erect temporary shade at all work fronts for maintenance workers. • Ensure sufficient supply of potable water (>3.5 L per worker per day). • Provide extra rest periods for outdoor maintenance workers when temperatures exceed 35 ºC (as applicable by law). • Monitor weather forecast and halt outdoor maintenance work in any expected events of extreme weather conditions (i.e., dust storms, intensive rain, extreme heat waves etc.).	
Gender based violence & harassment and discrimination	Moderate Adverse	Workers	Medium	**Moderate**	• Employees should be provided with suitable accommodation and worker accommodation areas will be managed in accordance with the EBRD and IFC Workers' Accommodation: Processes and Standards. • Ensure that laborers have access to safe and decent accommodation. Provide weather-resistant and structurally sound shelters with proper insulation and ventilation to protect them from harsh environmental conditions. • Ensure that labor accommodations have adequate sanitation facilities, including clean toilets, washrooms, and bathing facilities. Regular maintenance and cleanliness should be ensured to promote hygienic living conditions. • Provide access to clean and potable drinking water within the labor accommodations and work areas and offices. • Provide proper ventilation and cooling systems is working and living areas to maintain good air quality and reduce heat stress. • Ensure that labor accommodations provide sufficient living space to accommodate the number of workers comfortably. Overcrowding should be avoided as it can lead to health and safety hazards. • Conduct regular inspections of labor accommodations to ensure compliance with housing standards and identify any issues or deficiencies. Address identified concerns promptly and take necessary corrective actions. • Ensure the availability of a robust grievance mechanism to record concerns related to accommodation and address the grievances and close them out in a timely manner. • Project Company shall carry out regular inspections and audits (directly and through independent third-party auditors) of the accommodation facilities of its direct workers and sub-contractors where possible, identify nonconformance, and ensure the contractors close-out these non-conformances especially those that have an impact on the H&S of the workers.	**Negligible**

Impact	Magnitude	Receptor	Sensitivity	Significance Before Mitigation	Mitigation	Residual Significance
Poor quality housing and lack of welfare facilities and working amenities	Moderate Adverse	Workers	Medium	**Moderate**	• Employees should be provided with suitable accommodation and worker accommodation areas will be managed in accordance with the EBRD and IFC Workers' Accommodation: Processes and Standards. • Ensure that laborers have access to safe and decent accommodation. Provide weather-resistant and structurally sound shelters with proper insulation and ventilation to protect them from harsh environmental conditions. • Ensure that labor accommodations have adequate sanitation facilities, including clean toilets, washrooms, and bathing facilities. Regular maintenance and cleanliness should be ensured to promote hygienic living conditions. • Provide access to clean and potable drinking water within the labor accommodations and work areas and offices. • Provide proper ventilation and cooling systems is working and living areas to maintain good air quality and reduce heat stress. • Ensure that labor accommodations provide sufficient living space to accommodate the number of workers comfortably. Overcrowding should be avoided as it can lead to health and safety hazards. • Conduct regular inspections of labor accommodations to ensure compliance with housing standards and identify any issues or deficiencies. Address identified concerns promptly and take necessary corrective actions. • Ensure the availability of a robust grievance mechanism to record concerns related to accommodation and address the grievances and close them out in a timely manner. • Project Company shall carry out regular inspections and audits (directly and through independent third-party auditors) of the accommodation facilities of its direct workers and sub-contractors where possible, identify nonconformance, and ensure the contractors close-out these non-conformances especially those that have an impact on the H&S of the workers.	**Minor**

6.3 Summary of Impacts Prior to Mitigation

Table 6-62 Summary of Project Construction and Operation Impacts by Before Mitigation

Topic	Beneficial	No change	Negligible	Minor	Moderate	Major	Total
Construction Phase							
Air Quality				6			**6**
Climate Change				2			**2**
Noise			1	6	2		**9**
Soil and Groundwater				3			**3**
Hydrology, Surface Water Drainage and Flood Risk				2			**2**
Marine Ecology			2	8			**10**
Marine Water Quality				4			**4**
Solid Waste and Wastewater					1		**1**
Landscape and Visual Amenity				2			**2**
Traffic and Transportation				1	1		**2**
Terrestrial Ecology				3			**3**
Archaeology and Cultural Heritage			1				**1**
Socio-economic	4			1			**5**
Community Health, Safety & Security				5			**5**
Labour & Working Conditions					6	1	**7**
Total	**4**	**0**	**4**	**37**	**10**	**1**	**56**
Operation Phase							
Air Quality				3			**3**
Climate Change			1	1	1		**3**
Noise			2	1	1		**4**
Marine Ecology			1	2	1		**4**
Marine Water Quality				3			**3**

Topic	Beneficial	No change	Negligible	Minor	Moderate	Major	Total
Soil and Groundwater				1			**1**
Solid Waste and Wastewater				1			**1**
Landscape and Visual Amenity			1				**1**
Socio-economic	2						**2**
Community Health, Safety & Security				1	1		**2**
Labour & Working Conditions					4	1	**5**
Total	**2**	**0**	**5**	**13**	**8**	**1**	**29**

6.4 Cumulative Impacts

6.4.1 Introduction

An assessment of potential cumulative impacts of the Project together with other projects that will also have impacts within the Project's area of influence was conducted to align with the requirements of IFC PS1. According to the IFC's Good Practice Handbook (2013), a cumulative impact is defined as, '….*those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones'*.

Cumulative Impacts Assessment (CIA) is therefore the process of:

- Analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and environmental and social external drivers on the chosen Valued Environmental and Social Components (VECs) over time; and
- Proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk.

The purpose of a CIA is to determine how the potential impacts of a proposed development might combine cumulatively, with the potential impacts of other projects or human activities. The objectives and expected outcomes of a CIA process are as follows:

- Identification of VECs such as air, water, soil etc. that may be affected by the Project and the selected VECs the assessment will focus on;
- Identification of existing and reasonably anticipated and/or planned developments, as well as natural environmental and external social drivers, that could affect the selected VECs;
- Assessment and/or estimation of the future condition of selected VECs, as the result of the cumulative impacts that the development is expected to have, when combined with those of other reasonably predictable developments;
- Evaluation of the future condition of the VECs relative to established or estimated thresholds of VEC condition or to comparable benchmarks;
- Avoidance and minimisation of cumulative impacts of the Project on the VECs and
- Monitoring and management measures to ensure the VEC viability over the life span of the development or its impacts.

6.4.2 Identification of Other Activities and Environmental Drivers

For the purpose of this ESIA and in light of the Projects that will be developed for the expansion of an exisiting project, the cumulative impacts assessment will be undertaken to establish whether there are barriers to both ongoing and future development within the Projects AoI, such as:

- Is there sufficient environmental carrying capacity available for future development?
- Are there any factors that may restrict ongoing or future development?
- Are there any key factors of concern that may relate to the development/operation of other projects in tandem with the Project?

The ongoing and planned developments included in the cumulative impacts assessment consist of the Hajr Two IPP and the SEC CCGT Project, which will be developed simultaneously adjacent to our project. Additionally, existing and operational plants considered in the assessment include the following:

- Qurrayah Power Plant 2
- Qurrayah IPP
- Qurrayah Power Station
- Qurrayah Sea Water Plant

6.5 Identification of Valued Environmental and Social Components (VECs)

This ESIA has assessed cumulative impacts of several environmental and social parameters in the main sections of this ESIA. For instance, construction air quality (particulates), construction noise impacts, etc. have considered the measured baseline conditions in combination with the predicted process contributions. As a result, this has provided an assessment of cumulative impacts, as a result of the Project itself and any cumulative impacts from existing neighbouring projects or emission sources.

The cumulative impact assessment for the Hajr Two IPP and SEC CCGT projects considers both construction and operational impacts, as they will be developed in parallel. In contrast, the cumulative assessment with the existing facilities focuses solely on the operational phase, given that these plants are already in operation. The cumulative assessment considers most of the operational environmental and social components assessed in this ESIA.

6.6 Assessment of Cumulative Impacts on VECs Due to Development of Project Area

A qualitative assessment of the potential and relevant operational cumulative impacts have been undertaken considering the project information available and assuming the future SEC CCGT and the nearby existing facilities have very similar activities to the Project. Quantitative assessments were carried out for operational noise and air emmissions by conducting modelling studies.

Table 6-1 Summary of Cumulative Impacts and General Management Requirements

Environmental & Social Aspects	Construction	Operation
Air Emissions & Ambient Air		
Hajr Two IPP	During construction, local ambient air quality may potentially be affected by increased dust and exhaust fumes from construction vehicles, equipment and temporary power generators including emission of VOCs from fuels, paints and other volatile substances Residual impact assessed as **Negligible** or **Minor** with the implementation of mitigation and management measures.	Nitrogen Dioxide (NO_2): The maximum predicted annual mean concentrations, comply with KSA air quality standards and the WHO interim targets. Emissions contribute to less than 25% of these standards, indicating no significant impact. The predicted 24-hour mean concentrations align with WHO guidelines and remain below 25% of the applicable standards, confirming no significant air quality impacts. The highest predicted 1-hour mean concentrations comply with national and WHO guidelines and contribute less than 25% of the respective standards, making the impacts insignificant. Carbon Monoxide (CO): The 99th percentile of 24-hour mean, 8-hour mean, 1-hour mean, and 15-minute mean CO concentrations remain within compliance at all receptor locations under all operational scenarios, with contributions below 25% of the relevant standards, resulting in an insignificant impact. Ammonia (NH_3): Since there are no national or WHO guidelines, UK Environmental Assessment Levels were used for comparison. The predicted ammonia concentrations comply with these standards, with process contributions below 1%, making the impact insignificant. Sulfur Dioxide (SO_2): Under scenarios 3 & 4, the process contributions to the 24-hour mean are compliant with the standards but exceed 25% of national standards and WHO Interim Target 1 at some receptors. However, since backup fuel use is limited to a maximum of 30 days per year, and actual sulfur content may be lower than assumed, the overall impact remains minimal. For hourly mean, no exceedances of national standards were predicted, but contributions exceeded IFC's 25% threshold at some receptors. Given the limited operation of the plant on back-up fuel, the impact is considered insignificant. Particulate Matter (PM10 & PM2.5): Predicted 24-hour mean concentrations comply with both national standards and WHO guidelines at all sensitive receptors under all scenarios, with process contributions remaining below 25% of the applicable standards. No significant impacts are expected.
SEC CCGT	Increases in dust and gaseous emissions due to construction plant, equipment and vehicles. Residual impacts likely to be Negligible or Minor following the implementation of the mitigation and management measures.	Considering the SEC CCGT is adjacent to the Hajr Two CCGT and assuming it has similar design specifications, impacts to the surrounding receptors are not considered to be significant.

Environmental & Social Aspects	Construction	Operation
Impacts from Existing Projects	The existing plants are currently operational, meaning that emissions result from its ongoing activities. Baseline monitoring has shown that air quality in the project area is not degraded, suggesting that emissions from the existing facilities are within regulatory standards.	As the air quality survey results did not show any exceedances of national standards, the impact of the existing facilities' operations on the ambient air quality is considered insignificant.
Cumulative Impacts	The construction of the Project will run parallel with the construction of the newly planned SEC CCGT. Therefore, cumulative impact on air quality with respect to dust generation and gaseous emissions from construction activities is anticipated to be **minor**. Impacts significance will be reduced by the implementation of the mitigation measures outlined and the implementation of a robust grievance mechanism. **The residual significance of cumulative impacts is Negligible or Minor.**	To determine the Predicted Environmental Concentration (PEC), the baseline concentrations, which reflect air emissions from existing plants, were combined with the process contribution (PC) from the Hajr Two CCGT. The air emissions specifications for nearby future SEC CCGT were also included in the model to account for its future impact of operating all plants together. The modeling report is provided in **Appendix H.** Nitrogen Dioxide (NO_2): The maximum predicted annual mean concentrations, comply with KSA air quality standards and WHO interim targets. Emissions contribute to less than 25% of the standards, indicating no significant impact. The predicted 24-hour mean concentrations align with WHO guidelines and remain below 25% of the WHO Target 1, confirming no significant air quality impacts. The highest predicted 1-hour mean concentrations comply with national and WHO guidelines and contribute less than 25% of the respective standards, making the impacts insignificant. Carbon Monoxide (CO): The 99th percentile of 24-hour mean, 8-hour mean, 1-hour mean, and 15-minute mean CO concentrations remain within compliance at all receptor locations under all operational scenarios, with contributions below 25% of the relevant standards, resulting in an insignificant impact. Ammonia (NH_3): Since there are no national or WHO guidelines, UK Environmental Assessment Levels were used for comparison. The predicted ammonia concentrations comply with these standards, with PEC below 10%, making the impact insignificant. Sulfur Dioxide (SO_2): Under scenarios 3 & 4, the predicted 24-hour mean cumulative PEC contribution are compliant with the national standards but exceed the WHO Interim Target 1 at some receptors. For hourly mean, exceedances of national standards may occur at one receptor (R7). However, the plant will operate primarily on natural gas, the backup fuel will only be used in the event of an interruption to the supply of natural gas. It is estimated that the plant will only operate for 30 days per year on the back up fuel. The concentrations presented in the table above represent the worst-case concentration over a five-year period i.e. under the worst-case meteorological conditions experienced in the five years considered. The plant is only likely to operate for a maximum of 30 days per year with the backup fuel, the operation of the plant on back up fuel is therefore an infrequent event, and it is unlikely that this would coincide with the worst-case meteorological conditions. It should also be noted that at the time of the assessment, the actual sulphur content of the backup fuel was not known. The emissions of SO2 were therefore calculated from

Environmental & Social Aspects	Construction	Operation
		the limit value (0.015% by volume at 15%O2, dry), which is likely to be higher than the actual sulphur content. The actual concentrations experienced during a period of use of the backup fuel are therefore likely to be significantly lower than the values presented. Particulate Matter (PM10): Predicted 24-hour mean concentrations comply with the national standards but exceedances of the WHO Interim Target 1 are predicted at two receptors (R7 and R8) under scenarios 3 and 4. It should be noted that a worst-case assumption has been made the purposes of modelling particulates within this assessment. The emission limit used for particulates is provided as total particulates, for the purposes of assessing PM10 concentrations it has been assumed that all particulates emitted from the stacks are PM10. The concentrations presented above are therefore likely to be over estimations. Particulate Matter (PM2.5): Predicted 24-hour mean concentrations comply with the national standards and WHO guidelines at all sensitive receptors under scenarios 3 and 4. Cumulative impact is assessed as Minor. Impacts significance will be reduced by the implementation of the mitigation measures outlined in section 6.3.2.2 and the implementation of a robust grievance mechanism. The residual significance of cumulative impacts is Negligible.
Climate Change		
Hajr Two IPP	The construction phase of the Project will necessitate the use of generators and an amount of mobile equipment/plant and vehicles to facilitate works. This will result in GHGs emissions and therefore contributing to climate change. Residual impact assessed as Negligible with the implementation of mitigation and management measures.	The annual emissions of ±6.6MtCO2e/year significantly exceed the IFC threshold for GHG quantification (25,000tCO2/year), for emissions that are within direct control of the facility within the study period. Residual impact assessed as Moderate with the implementation of mitigation and management measures.
SEC CCGT impacts	Construction activities of will result in increase in GHG emissions due to operation of construction plant, equipment and vehicles. Residual impact assessed as Negligible with the implementation of mitigation and management measures.	Considering the SEC CCGT Project is of similar specifications, it will likely generate similar GHG emissions. Residual impact assessed as Moderate with the implementation of mitigation and management measures.
Impacts from Existing Projects	The existing plants are currently operational, meaning that emissions result from its ongoing activities. GHG emissions are expected from the existing plants.	The power projects in the vicinity likely generate similar or more GHG emissions.
Cumulative Impacts	The development of Hajr Two IPP and the SEC CCGT will run parallel. Therefore, cumulative impacts of GHG emissions from construction activities are anticipated to be minor.	The operation of Hajr Two IPP and SEC CCGT will run parallel together with the operation of nearby existing facilities. Therefore, cumulative impact of GHG emissions from is anticipated to be Moderate.

Environmental & Social Aspects	Construction	Operation
	With the adoption of good management practises (mitigation measures) outlined in section 6.2.2.1, the cumulative impacts significance will be reduced. The residual significance of cumulative impacts is Minor.	The Hajr Two IPP Project is required to be designed with a Carbon Capture system to reduce the GHG emissions. With the implementation and proper operation of this system, the cumulative impacts significance will be reduced **to** minor when operated.
Noise		
Hajr Two IPP	Construction activities will result in temporary and short duration increases in the noise levels emanating from the project sites, access road and the laydown area. Residual impact assessed as Negligible with the implementation of mitigation and management measures.	Noise modelling was conducted as part of the operational noise impacts assessment to predict the potential noise egress from the proposed Hajr Two IPP Project and the potential effect on the receptors. The results indicate that all the receptors comply with the IFC/KSA day and night-time limits except for the Qurrayah IPP which slightly exceeds the national standards at night. As the Qurrayah IPP is operational at night and generate noise levels that are most likely above 65 dBA within the plant and is affected by other nearby industrial sites, noise levels from the Hajr 2 IPP site are unlikely to be perceptible for the site workers at the Qurrayah IPP industrial site during night-time operations and therefore the impact is considered to be minor.
SEC CCGT impacts	Increases in noise due to construction plant, equipment and vehicles. Residual impacts likely to be Negligible following the implementation of the mitigation and management measures.	Noise modelling was conducted as part of the operational noise impacts assessment to predict the potential noise egress from the proposed Hajr Two IPP Project and the potential effect on the receptors. The results indicate that all the receptors comply with the IFC/KSA day and night-time limits except for the Qurrayah Power Plant 2 which slightly exceeds the national standards at night. As the Qurrayah Power Plant 2 is operational at night and generate noise levels that are most likely above 65 dBA within the plant and is affected by other nearby industrial sites, noise levels from the SEC CCGT site are unlikely to be perceptible for the site workers at the Qurrayah Power Plant 2 industrial site during night-time operations and therefore the impact is considered to be minor.
Impacts from Existing Projects	The existing plants are currently operational, meaning that noise result from its ongoing activities. However, noise baseline monitoring at the site indicated the background levels are compliant with the national standards for industrial areas.	The existing plants are currently operational, meaning that noise result from its ongoing activities. However, noise baseline monitoring at the site indicated the background levels are compliant with the national standards for industrial areas.
Cumulative Impacts	The construction of the Project will coincide with the operation of the planned SEC CCGT. Therefore, cumulative impact on noise from construction activities is anticipated to be Moderate. Impacts significance will be reduced by the implementation of the mitigation measures outlined in section 6.2.3.1 and the implementation of a robust grievance mechanism. The residual significance of cumulative impacts is Minor.	Noise modelling was conducted as part of the operational noise impacts assessment to predict the potential noise egress from the Hajr Two CCGT, the proposed SEC CCGT Project and the potential effect on the receptors. The results indicate that all the receptors comply with the IFC/KSA day and night-time limits except for the Qurrayah IPP and Qurrayah Power Plant 2 which slightly exceed the national standards at night. As the Qurrayah IPP and Qurrayah Power Plant 2 are operational at night and generate noise levels that are most likely above 65 dBA within the plant and are affected by other nearby industrial sites, noise levels from the Hajr 2 IPP and the SEC CCGT sites are unlikely to be perceptible for the site workers

Environmental & Social Aspects	Construction	Operation
		at the Qurrayah IPP and Qurrayah Power Plant 2 industrial sites during night-time operations. Therefore, the cumulative impact is considered to be minor.
Hydrology and Flood Risk		
Hajr Two IPP impacts	The construction of the Project is not anticipated to increase the flood risk of the area. However, the presence of fuels and chemical storage areas could introduce the risk of pollution to the runoff/downstream areas in the event of a significant rain events, where a pathway for runoff is directed to these areas and a pathway for drainage. In addition, water resource may result in pressure to existing services and infrastructure. Residual impact assessed as Negligible or Minor with the implementation of mitigation and management measures.	Cumulative impacts to hydrology and flood risk are not anticipated during operation.
SEC CCGT impacts	The impacts are similar to those of the Hajr Two Project. Residual impact assessed as Negligible or Minor with the implementation of mitigation and management measures.	
Impacts from Existing Projects	Not applicable	
Cumulative Impacts	Considering the proximity of both Projects, the potential exists for cumulative impacts to develop due to increased risk of contamination of downstream areas due to runoff as well as impacts to water resources and services due to water consumption for construction activities and workers accommodation. Therefore, cumulative impact on hydrology and water resources from construction activities is anticipated to be Minor. However, the impact will be reduced with the adoption of mitigation measures. The residual significance of cumulative impacts is Negligible.	
Marine Ecology and Water Quality		
Hajr Two IPP	Pipeline trenching may cause minor habitat loss, particularly for sparse seagrass, but overall ecological impact is low. Dredging activities could temporarily increase suspended sediments, affecting water clarity, though impacts will be localized and managed. Vessel anchoring may disturb seagrass, but micro siting will help minimize damage, and vessel strikes on marine fauna are not a concern. Underwater noise from construction may temporarily displace marine species, but significant effects are unlikely. Diesel spills pose a potential risk, though mitigation measures will be in place to prevent and manage incidents. The introduction of invasive	Brine and heated water discharge can alter salinity and temperature, potentially disrupting marine ecosystems by affecting biodiversity, reproduction, and nutrient distribution. To mitigate these impacts, the intake and outfall design was optimized to ensure compliance with national standards, limiting excess salinity to 3% and temperature increase to +5°C within the mixing zone. Maintenance of intake pipelines may result in localized organic material discharge due to the removal of fouling organisms, though impacts are expected to be minimal.

Environmental & Social Aspects	Construction	Operation
	species through ballast water will be controlled through adherence to international regulations.	Additionally, the intake system poses a risk of impingement and entrainment of small marine organisms, but adherence to IFC and US EPA intake velocity guidelines (0.15 m/s) and the inclusion of bar and mesh screens mitigate these risks.
SEC CCGT impacts	Similar impacts to the Hajr Two CCGT are anticipated	Similar impacts to the Hajr Two CCGT are anticipated
Impacts from Existing Projects	No Applicable	The thermal and brine discharges from existing power plants may be impacting the marine ecology in the area. Entrainment is also a potential impact at the intakes of these facilities. These activities potentially contribute to stress on the marine environment. Significant ecological impacts are not anticipated.
Cumulative Impacts	The construction of the intakes and outfalls of the Hajr Two and The SEC CCGT Projects will result in adverse cumulative impacts on the Project area. However, considering the nature of the area and the absence of sensitive habitats apart from certain locations of seagrass, cumulative impact from construction activities is anticipated to be Minor. These may be mitigated as per section 6.2.5.1 to reduce residual significance of cumulative impacts to Negligible.	The design and route for the intakes and outfalls of both the Hajr Two CCGT and the SEC CCGT Plant have been optimised to ensure discharge from the proposed outfall complies with national standards of excess salinity (ΔS) below 3% of background salinity and excess temperature (ΔT) within +5°C at the edge of the defined mixing zone. Therefore, significant impacts are not anticipated. Cumulative impacts from entrainment and non-routine discharges may also adversely impact the marine ecology if not mitigated. The implementation of the mitigation measures listed in 6.2.6.2 will reduce the residual significance of most cumulative impacts to Negligible.
Solid Waste & Wastewater		
Hajr Two IPP impacts	The construction phase can often be the most environmentally damaging phase of a project, particularly in regard to the volumes of waste that are generated, if not properly managed. During construction, waste will be generated during the earthworks and construction activities. Residual impact assessed as Minor with the implementation of mitigation and management measures.	The Project's operational domestic waste and wastewater generation is expected to be minimal. Domestic wastewater will be treated in a sewage treatment facility and reused for irrigation onsite while process wastewater will be treated in a dedicate effluent treatment facility before being discharged to outfall with brine after meeting quality standards; However, screening waste and sludge are expected to be generated regularly which can increase pressure on existing waste infrastructure, particularly in regard to the volumes, if not properly managed.
SEC CCGT impacts	The impacts are similar to those of the Hajr Two IPP Project.	The impacts are similar to those of the Hajr Two IPP Project.
Impacts from Existing Projects	Not applicable.	The impacts from waste and wastewater are subject to the waste management practices applied by the nearby facilities. It is expected that similar type of waste is generated and that these facilities have contracted licensed contractors to manage waste.

Environmental & Social Aspects	Construction	Operation
Cumulative Impacts	Sufficient waste management infrastructure is lacking in the Region. The construction of multiple developments and projects will result in a strain on existing waste management facilities in the area due to volumes of waste. The cumulative impacts are expected to be moderate. The Projects' EPC contractors will identify waste and wastewater management companies including recycling companies in Ash Sharqiyah or nearest towns in order to promote the recycling of waste especially packaging materials, wood, metal waste & hazardous materials. Coordination will also be required with the local government authorities (e.g., municipalities) with regards to licensed and appropriate waste management facilities fit to accommodate project waste types and quantities. The impact significance will be reduced with the adoption of mitigation measures presented in section 6.2.8.1 The residual significance of cumulative impacts is Minor	Sufficient waste management infrastructure is lacking in the Region. The construction of multiple developments and projects will result in a strain on existing waste management facilities in the area due to volumes of waste. Considering the volumes of solid waste other than sludge are not expected to be significant and the cumulative impacts are expected to be Minor. The Projects' O&M Companies will identify waste and wastewater management companies including recycling companies the nearest towns in order to promote the recycling of waste and management of sludge. Coordination will also be required with the local government authorities (e.g., municipalities) with regards to licensed and appropriate waste management facilities fit to accommodate project waste types and quantities. The impact significance will be reduced with the adoption of mitigation measures presented. The residual significance of cumulative impacts is Negligible.
Traffic and Transportation		
Hajr Two IPP impacts	Construction will result in additional vehicles on the main roads leading to the site, resulting in increased traffic and accident risks to the communities along these roads. In addition, heavy construction vehicles can cause accelerated wear and tear on road infrastructure, leading to potholes, cracks, and road degradation.	Significant traffic and transportation impacts are not expected during normal operation of the Project; as such, cumulative impacts are not anticipated.
SEC CCGT impacts	The impacts are similar to those of the Hajr Two Project.	
Impacts from Existing Projects	Existing facility within the development AoI are not anticipated to result in significant impacts as it is likely that transport and logistics are minimal as the facilities are operational.	
Cumulative Impacts	Both Projects are expected to utilize the same roads to reach the Project area. considering construction activities will run parallel, the increase in traffic is expected to result in cumulative impacts of moderate significance. The implementation of traffic management plans and mitigation actions will reduce the impact significance. The residual significance of cumulative impacts is Minor.	
Landscape & Visual Amenity		

Environmental & Social Aspects	Construction	Operation
Hajr Two IPP impacts	Construction stage will result to levelling, grading etc. and gradual construction of buildings and stacks which will eventually transform the landscape and result in land use change. Movement of machinery, vehicles will potentially lead to disturbance to the visual envelope of receptors.	Permanent visual impacts from the development of the Hajr Two CCGT Project with the addition of new structures, power generating equipment and stack structures which will be visible to receptors looking into the Project site. Additional security and lighting at the entrances and along the perimeter may also result in change in night-time views.
SEC CCGT impacts	The impacts are similar to those of the Hajr Two Project.	Impacts are expected to be similar to the impacts identified for the Project.
Impacts from Existing Projects	Impacts from existing facilities is not anticipated.	
Cumulative Impacts	As the construction periods of both the projects are likely to coincide, there will be cumulative impacts due to gradual change in landscape character. The residual significance of cumulative impacts is Negligible.	The development of the Hajr Two CCGT Project within the heavy industrial area of Qurrayah will contribute to the permanently alteration of the landscape character of the Project area which is predominantly already consists of industrial plants in the area. The residual significance of cumulative impacts is Negligible.
Terrestrial Ecology		
Hajr Two IPP impacts	A site visit was undertaken in November 2024 and observations indicated the Project site is a typical desert habitat with sparse natural and native vegetation, primarily small shrubs as well as large ornamental and landscape trees. No fauna species were identified during the site visit. All flora species observed during the site visit were recorded and identified. All species recorded are common for the region, and none are listed on the KSA high priority list. Four specie are Least Concern on the IUCN list while the remaining species are not evaluated. Given that the majority of the site has sparse, limited vegetation and given the absence of flora of conservation value suggests that the site does not host rare or endangered species or contribute significantly to biodiversity. Therefore, the development of the project is unlikely to have significant impacts due to habitat loss. Although the site is of a disturbed habitat due to industrialisation, mitigation management will be required and implemented to reduce further or prolonged impacts to the development area.	Significant impacts to terrestrial ecology are not expected during normal operation of the Project; as such, cumulative impacts are not anticipated.
SEC CCGT impacts	The impacts are similar to those of the Hajr Two Project.	

Environmental & Social Aspects	Construction	Operation
Impacts from Existing Projects	Impacts from existing facilities is not anticipated.	
Cumulative Impacts	Given that the project construction will coincide with the construction of SEC CCGT cumulative impacts to terrestrial ecology are anticipated to be Minor. However, the impact will be reduced with the adoption of mitigation measures presented in section 6.2.10.1. The residual significance of cumulative impacts is Negligible.	
Archaeology & Cultural Heritage		
Hajr Two IPP impacts	Project related impacts in relation to archaeology and cultural heritage would mainly be those related to the excavation, earthworks and clearance of the Project asset site and the potential for encountering unknown buried archaeological, however, this is unexpected. A Chance Find Procedure will ensure that any unexpected finds are not damaged and reported to the authorities.	The operational phase of the Project will not result in impacts to archaeology, as the site will be static and further excavations will not be required. Therefore, cumulative impacts are not anticipated.
SEC CCGT impacts	The impacts are similar to those of the Hajr Two Project.	
Impacts from Existing Projects	Impacts from existing facilities is not anticipated.	
Cumulative Impacts	The risk is considered **low** and unlikely as it is limited to the Project area and therefore it is not envisaged that cumulative impacts to archaeology and cultural heritage will take place.	
Socioeconomic		
Hajr Two IPP impacts	Project impacts would be mainly those related to creation of employment and dissemination of skills during construction (beneficial impact). On the other hand, the influx of workers due to construction activities can lead to an increase in demand for basic commodities within the local area.	Positive cumulative impacts are expected during operation, as the project will contribute to regional service provision, help alleviate power shortages, and support meeting energy demand.
SEC CCGT impacts	Impacts are similar to those of the Project.	
Impacts from Existing Projects	Impacts from existing facilities is not anticipated.	

Environmental & Social Aspects	Construction	Operation
Cumulative Impacts	Positive impacts in terms of cumulative increase in local employment and dissemination of skills. This can be enhanced further by prioritising local recruitment where possible. A grievance mechanism shall be developed and implemented to manage the impacts of worker influx in the development region and impacts to community and nearby facilities safety. The residual significance of cumulative impacts is Negligible.	
Community Health, Safety & Security		
Hajr Two IPP impacts	Project related impacts would mainly be those associated with construction: influx of workers, public trespassing, security concerns, strain to public social services as well as incidents (accidents) from the presence of vehicles, heavy plant and machinery. The Project is located within the Qurrayah Complex which is a gated area that requires a special site access pass to allow visitors in. therefore, trespassing or direct interactions with the communities are not anticipated.	Impacts related to operations will be mainly due to emergency situations (unplanned events) such as fire, explosion and release toxic materials as well as incidents (accidents) from equipment operation and the Project vehicles and public trespassing. The Project is expected to be fenced and with security guards to ensure that there is no unauthorised access into the site nor the Qurrayah Complex. Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan' and via appropriate training of staff.
SEC CCGT impacts	Impacts are similar to those of the Project.	
Impacts from Existing Projects	Impacts from existing facilities is not anticipated.	
Cumulative Impacts	Given that the project construction will coincide, the influx of workers during the construction phase could lead to outbreak of diseases and illnesses, strain the public social services and result in security risks etc. Construction works could also increase the risk relating to public safety. The cumulative impacts are considered to be moderate and can be reduced by the implementation of the relevant mitigation provided. The residual significance of cumulative impacts is Minor.	
Labour and Working Conditions		
Hajr Two IPP impacts	Project impacts would mainly be those associated with poor working conditions, gender-based violence and harassment, health and safety hazards etc. which will need to be safeguarded through implementation of dedicated management systems and policies. Significance of residual impacts are assessed to be minor or negligible depending on the impact.	Impacts during operations are Project-specific and therefore cumulative impacts are not expected.
SEC CCGT impacts	The construction activities are expected to result in similar impacts identified for the Project.	

Environmental & Social Aspects	Construction	Operation
Impacts from Existing Projects	Impacts from existing facilities is not anticipated.	
Cumulative Impacts	Impacts associated with poor working conditions, gender-based violence and harassment, health and safety hazards etc. are Project-specific and therefore cumulative impacts are not expected. Cumulative impacts may occur if the workers for Hajr Two and SEC CCGT are accommodated in the same facilities; however, this is not confirmed. The cumulative impacts can be managed by ensuring the labour camp is in compliance with the IFC/EBRD Worker Accommodation Guidelines. The residual significance of cumulative impacts is Minor	

7 Environmental and Social Mitigation and Management

7.1 Environmental and Social Mitigation and Management Plan

Detailed project-specific mitigation is presented in Section 6.2 of this ESIA report. These mitigation measures will be outlined in the Project specific CESMP and OESMP.

7.2 Proposed Environmental Monitoring Plan

The following Table 7-1 outlines the monitoring requirements related to the construction and operation of the Project for the topics assessed in the Chapter 6. Considering impacts during the operation phase are limited, the majority of the monitoring required will be for the occasional maintenance activities. These should be validated and updated as required by the O&M Company based on the risk assessments when maintenance is required.

The EPC Contractor and the O&M Company will be responsible for undertaking and reporting on the required monitoring during construction and operation respectively. An Environmental Monitoring Plan for construction and operation of the Project will be developed by the EPC Contractor and O&M Company respectively, which will detail the monitoring methodologies and specific detail on location, frequencies, duration, monitoring parameters etc.

Table 7-1 Construction Monitoring Requirements

Topic	Impact	Parameter	Description	Frequency	Monitoring Location
Air Quality	Dust Generation	Dust	Visual observation for dust emissions	Daily	Access Roads to all construction sites. Construction sites and temporary facilities areas.
			Visual observations of any off-road driving	Daily	Throughout Project area.
			Quantitative dust monitoring	If dust generation is considered to be excessive or complaints are received	At source of excessive dust emissions (if any).
	Emissions from engines	Vehicle Emissions	Authorisation checks on vehicle conditions, including associated emissions	Before granting site access and following maintenance of vehicles	All construction vehicles and engines.
			Visual check for black smoke being emitted from equipment	Daily	Access Roads to all construction sites. Construction sites and temporary facilities areas.
			Quantitative air emissions monitoring	If complaints are received	Plant or stationary equipment used on site.
	Hazardous Material storage areas	VOCs	Olfactory observations – as part of inspection checks (for hygiene, safety and appropriate storage/containment).	Daily	All hazardous material, chemical and fuel storage areas.
	Sanitary Facilities	Odour	Olfactory observations – as part of inspection checks (for hygiene, safety and appropriate storage/containment).	Daily	All sanitary facilities available within the laydown areas, labour camps and work areas.
Noise	Construction Noise	Leq(A)	Quantitative noise monitoring	Monthly for 1-hour periods; daytime and night-time if construction is carried out	At Project boundary and nearby facilities
Soil Quality	Pollution from Accidental Leaks or Spillage	Soil quality	Visual inspection of work areas (including dewatering) to record any visible spills & leaks	Daily	Throughout construction areas.
			Visual inspection of storage areas to record any visible spills & leaks	Daily	Hazardous material, chemical and fuel storage areas. Waste and sanitary wastewater storage areas.
			Review records of spill response drills and training provided to workers handling hazardous material, waste, and wastewater.	Monthly	Records and documentation
Hydrology	Risk of pollution to the runoff/downstream areas in the event of a significant rain events	Wadi and run-off areas	Visual inspection of storage areas to ensure they are outside wadi areas	At beginning of construction and continuously after it	Natural drainage areas
			Inspection of temporary stormwater infrastructure	Weekly and following a rain event	Stormwater infrastructure areas
Marine Ecology	Presence of marine megafauna	Marina megafauna	Continuous visual monitoring for marine megafauna (e.g. dolphins, dugongs and turtles and other sensitive species)	Where marine construction works are taking place	In the vicinity of marine construction activities by MMO onboard construction vessel. Should any observations be made

Topic	Impact	Parameter	Description	Frequency	Monitoring Location
					within 300 m of dredging and installation activities, activities will be temporarily halted until the animal has either left the area or has not been sighted for 15 minutes. All activities to re-start under soft-start conditions and ramped up over 30-45 minutes to allow any present fauna time to leave the area.
Marine Water Quality	Release of turbidity during dredging and backfilling	TSS, Temperature, Turbidity, and Salinity	Required to monitor water quality during dredging and backfilling operations	Continuous real-time, in-situ monitoring through marine construction works.	Nearfield (immediately outside dredging area or silt curtain if installed) and far-field (up to 250 m from silt curtain, in two directions (north and south) relative to both intake and outfall. The monitoring buoys will be programmed with automatic alerts to notify the Environment Manager, vessel crews and of high turbidity levels when levels are within 50% (yellow alert) and 75% (red alert) of national standards for industrial coastal waters of the Red Sea. Activities will be reduced by 50% following a yellow alert until levels return to below 50%. All works will cease following a red alert. Both yellow and red alert will require a full inspection of the silt curtain, if installed.
	Integrity of silt curtain	Turbidity	Visual inspection of the silt curtains	Continuously through marine construction works.	Continuous visual observations of the silt curtains to monitor for damage and dispersion of the sediment plume in the receiving environment. If damage is observed, construction works will be put on hold until the damage is repaired, or new silt curtains have been installed. Aerial surveys during marine construction works will also be undertaken using a drone to monitor turbidity and any resultant sediment plumes and the effectiveness of the silt curtain.
	Dewatered effluent	pH, conductivity, turbidity, and dissolved oxygen (DO).	Monitor dewatered effluent quality before discharge into the marine environment, throughout the dewatering phase.	Twice before discharge into the marine environment	Water quality monitoring will be performed using handheld meters to ensure compliance with NCEC marine discharge standards prior to discharge into the marine environment. Monitoring will be conducted at the outlet of the sedimentation tank or pond, before the discharge point.

Topic	Impact	Parameter	Description	Frequency	Monitoring Location
Solid Waste and Wastewater	Inappropriate/ uncontrolled handling, storage, transport and/or disposal of non-hazardous, hazardous or sanitary wastewater	Solid waste and wastewater	Visual inspection of segregation, handling, storing, and collection of waste materials	Daily	Wastewater and waste segregation, handling, storage and collection areas
		Waste contractors	Ensuring engaged contractors, their vehicles and waste management facilities have applicable registrations/ licenses at time of procurement	At beginning of construction and continuously after it	Records and documentation
		Waste transfer records	Records of waste to be monitored; waste manifests are required to show the chain of custody of the waste generated on site, its transportation and treatment/disposal	On-going as and when there is waste collection from site	Records and documentation
		Waste reduction	Monitor waste records to identify targets to reduce waste generation	Monthly	Records and documentation
Landscape and Visual	Light spill	Visual Amenity	Visual inspection of suitability of lighting and limitation of light spill outside of working areas	Anytime night-time construction is carried out	Where lighting is installed
Traffic and Transportation	Increased vehicular flow and traffic on local roads	Speed limit	Records of traffic related issues, incidents, and near misses	On-going (as encountered)	Records of traffic incidents and near misses (on highways, main roads and access routes)
Archaeology and Cultural Heritage	Damage to unknown buried artefacts	Unknown buried artefacts	Records of any archaeological chance finds	Continuously during intrusive ground works	Records and documentation
Terrestrial Ecology	Impacts to flora and fauna	Training on terrestrial ecology	Inspection of training records to ensure environmental issues are incorporated into site induction.	At beginning of construction and when induction material is updated	Induction materials
	Impacts to fauna	Fauna	Records of fauna encounters, injuries or mortality of fauna and avifauna	On-going (as encountered)	Records and documentation
	Impact to habitats	Habitats	Visual checks of events of off-roading or activities utilising areas outside those clearly demarked	On-going (as encountered)	Project active area and surroundings
Socio-economic	Provision of temporary jobs during construction	Local employment	Number of persons employed from the local population	At recruitment	Human Resources (HR) department
	Loss of livelihood due to restrictions on herding	Third party grievances	Grievances received from herder	On-going (as encountered)	Grievance Management System
Community, Health, Safety and Security	All community, health, safety and security risks	Conflicts, incidents, grievances etc.	Record of any conflict between the workers and community members including any cases relating to harassment.	On-going (as encountered)	Security department/ HSE department
			Record of human rights violation/complaints from the local communities	On-going (as encountered)	Record keeping system/HSE department
			Record of any communicable diseases on site that could pose a risk to the local communities	On-going (as encountered)	Project site clinic or HSE department

Topic	Impact	Parameter	Description	Frequency	Monitoring Location
			Records of any health and safety accidents of near misses with the community	On-going (as encountered)	Project site clinic or HSE department
			Records of any security incidents	On-going (as encountered)	Security department/local police
			Number of grievances closed out	Monthly	Grievance Management System
			Average time for grievance processing and close out and trends	Monthly	Grievance Management System
			Number of grievances still open, method to submit the grievance and trends	Monthly	Grievance Management System
			Topics raised in grievances and trends	Monthly	Grievance Management System
Labour and Working Conditions	Risk of poorly formed contracts and their implementation	Worker contracts	Records of contracts, payments, receipt of benefits, leave entitlements, retrenchment etc.	On-going (as encountered)	Human Resources (HR) department
	Risks of violating labour rights and risks of forced and child labour	workers grievances	Human rights complaints/violations as reported by Project workers including workers hired through third-parties or in the supply chain	On-going (as encountered)	Grievance Management System Supply Chain Management Process
	Major Injury or fatality	Health of the workers	OH&S emergency situations and incidents	On-going (as encountered)	Project site clinic or HSE department
	Occupational health issues, and minor injury to workers	Health of the workers	Near misses, injuries or illnesses the workers are suffering from and an analysis of top diseases.	On-going (as encountered)	Project site clinic or first aid facility
	Poor quality of accommodation	Health of the workers	The workers accommodation camp compliance with KSA requirements and the IFC & EBRD Workers Accommodation: Processes and Guidelines (2009).	Once before operating the accommodation and monthly after that	All accommodation facilities provided to direct and sub-contracted labour.

Table 7-2 Operation Monitoring Requirements

Topic	Impact	Parameter	Description	Frequency	Monitoring Location
Air Quality	Emissions from natural gas combustion	Gas emissions	Combustion emissions (NO_x, NO_2, CO)	Continuous Emissions Monitoring System (CEMS). Manual testing if the CEMS is not calibrated at the start of commissioning stage.	CCGT main stacks and bypass stacks.
			Combustion emissions (NO_x and CO)	Annual manual stack emissions monitoring	CCGT main stacks and bypass stacks.
			Combustion emissions (NO_x and CO)	Continuous air quality monitoring every quarter for a period of 2 weeks	In proximity to the nearest sensitive receptor
	Emissions from engines	Vehicle Emissions	Authorisation checks on engines conditions, including associated emissions	Before purchase and following maintenance	All road and non-road vehicles, plant and equipment.
			Visual check for black smoke being emitted from equipment	During operation of these equipment	All road and non-road vehicles, plant and equipment.
	Odour emissions from wastewater treatment and evaporation pond	Odour	Olfactory observations – as part of inspection checks (for hygiene, safety and appropriate storage/containment).	Daily	Wastewater treatment and evaporation pond
Noise	Operation Noise	Leq(A)	Quantitative noise monitoring	Quarterly and in case of complaints or change in operation for 15-minute periods; daytime and night-time	At Project boundary and nearby receptors
Soil Quality	Pollution from Accidental Leaks or Spillage	Soil quality	Visible spills & leaks of hydrocarbons and other potentially hazardous or chemicals	Daily during operations	The entire project area
			Visual inspection of storage areas and evaporation pond to record any visible spills, leaks or overflows	Daily	Hazardous material, chemical and fuel storage areas. Waste and evaporation pond areas
			Review records of spill response drills and training provided to workers handling hazardous material, waste, and wastewater.	Monthly	Records and documentation
Hydrology	Risk of pollution to the runoff/ downstream areas in the event of a significant rain events	Wadi and run-off areas	Inspection of stormwater infrastructure	Weekly and following a rain event	Stormwater infrastructure areas
Marine Ecology	Entrained flora and fauna	Marine Flora and Fauna	Daily observations on screens Monthly at intake head		

Topic	Impact	Parameter	Description	Frequency	Monitoring Location
	Impact on marine ecology	Phytoplankton Zooplankton Benthic Infauna	Sampling and analysis	Once every 6 months	At the edge of the mixing zone and at 2 km from the shoreline
Marine Water Quality	Commissioning discharge	Biochemical Oxygen Demand Chemical Oxygen Demand Chlorides Cyanide Detergents Dissolved Oxygen Fluorides Ammoniacal Nitrogen Nitrate Organic Nitrogen Total Nitrogen Emulsified Oil & Grease Free Oil pH Non-chlorinated Pesticides Petroleum Hydrocarbons Phenols Phosphate-Phosphorous Total Sulfates Sulfides as S Surfactants TSS TDS Temperature Turbidity Antiscalant Sodium Bisulfate	Monitoring of the RO effluent after commissioning for process chemicals used in the plant and at the edge of the mixing zone	At inception and until a representative profile of the discharge is established. Every 6 months thereafter	At the outfall location and the edge of the mixing zone.
	Brine and thermal discharge	Temperature, Salinity, flow rate	Monitoring of the RO effluent during normal operations	Continuous monitoring	At the boundary of the mixing zone for the outfall and at one (1) control location.
	Residual chlorine in discharge	Residual chlorine	Monitoring of the RO effluent during normal operations	Continuous monitoring	Prior to discharge into the outfall
	Treated chemical and de-oiled wastewater	pH, conductivity, temperature, TOC, turbidity, ORP	Monitoring of process treated wastewater effluent	Continuous monitoring	Before the point of discharge

Topic	Impact	Parameter	Description	Frequency	Monitoring Location
	discharged through the outfall into the marine environment	(redox), oil & grease, and hydrocarbons.			
Solid Waste and Wastewater	Treated Sewage reuse in irrigation	BOD, turbidity, total suspended solids and ammonia.	Monitoring of treated sewage effluent	Daily	Before use in irrigation
	Strain on resident waste public management facilities during operations	Solid waste and wastewater	Number of grievances from waste management service providers and/ or affected communities and commercial/ industrial establishments with regards to disruption of waste management services	Monthly	Records and communication with waste management facilities
	Risk of contracting unlicensed third-party waste contractors and disposal facilities	Waste contractors	Ensuring engaged contractors, their vehicles and waste management facilities have applicable registrations/ licenses	At the time of procurement and upon their license or Project contract renewal	Records and documentation
	Improper waste management and disposal	Waste transfer records	Records of waste to be monitored; waste manifests are required to show the chain of custody of the waste generated on site, its transportation and treatment/disposal.	On-going	Records and documentation
	Waste quantities	Waste reduction	Monitor waste records to identify targets to reduce waste generation	Monthly	Records and documentation
	Non-compliant treated wastewater effluent (as applicable)	Quantities discharged into the evaporation pond	Ensure non-compliant treated wastewater effluent is recorded to keep track of the efficiency of the treatment process and the maintenance required	On-going, if non-compliant treated wastewater effluent occurs	Records and documentation
Landscape and Visual	Light spills	Visual Amenity	Visual inspection of suitability of lighting	On-going	Where lighting is installed
Traffic and Transportation	Increased vehicular flow and traffic on local roads	Speed limit	Records of traffic related issues, incidents, and near misses	on-going (as encountered)	Records of traffic incidents and near misses (on highways, main roads and access routes)
Terrestrial Ecology	Impacts to flora and fauna	Training on terrestrial ecology	Inspection of training records to ensure environmental issues are incorporated into site induction.	At beginning of operation and when induction material is updated	Induction materials
	Impacts to fauna	Fauna	Daily visual observations for sightings of fauna within the Project site.	Daily	Project site
Socio-economic	Provision of jobs during	Local employment	Number of persons employed from the local population	At recruitment	Human Resources (HR) department
	Issues concerning socio-economic factors	Third party grievances	Grievances received from local community	On-going (as encountered)	Grievance Management System

Topic	Impact	Parameter	Description	Frequency	Monitoring Location
Community, Health, Safety and Security	All community, health, safety and security risks	Conflicts, incidents, grievances etc.	Record of any conflict between the workers and community members including any cases relating to harassment.	On-going (as encountered)	Security department/ HSE department
			Record of human rights violation/complaints from the local communities	Continuously	Record keeping system/HSE department
			Record of any communicable diseases on site that could pose a risk to the local communities	Continuously	Project site clinic or HSE department
			Records of any health and safety accidents of near misses with the community	Continuously	Project site clinic or HSE department
			Records of any security incidents	Continuously	Security department/local police
			Number of grievances closed out	Monthly	Grievance Management System
			Average time for grievance processing and close out and trends	Monthly	Grievance Management System
			Number of grievances still open, method to submit the grievance and trends	Monthly	Grievance Management System
			Topics raised in grievances and trends	Monthly	Grievance Management System
Labour and Working Conditions	Risk of poorly formed contracts and their implementation	Worker contracts	Records of contracts, payments, receipt of benefits, leave entitlements, retrenchment etc.	Continuously	Human Resources (HR) department
	Risks of violating labour rights and risks of forced and child labour	workers grievances	Human rights complaints/violations as reported by Project workers including workers hired through third-parties or in the supply chain	Continuously	Grievance Management System Supply Chain Management Process
	Major Injury or fatality	Health of the workers	OH&S emergency situations and incidents	Continuously	HSE department Medical records
	Occupational health issues, and minor injury to workers	Health of the workers	Near misses, injuries or illnesses the workers are suffering from and an analysis of top diseases.	Continuously	HSE department Medical records
	Poor quality of accommodation	Health of the workers	The O&M workers accommodation camp compliance with KSA requirements and the IFC & EBRD Workers Accommodation: Processes and Guidelines (2009).	Once before operating the accommodation and monthly after that	All accommodation facilities provided to direct and sub-contracted labour.

7.3 Summary of Residual Impacts

The significance of the residual impacts are shown in Table 7-3.

Table 7-3 Summary of Project Construction and Operation Residual Impacts

Topic	Beneficial	No change	Negligible	Minor	Moderate	Major	Total
Construction Phase							
Air Quality			5	1			6
Climate Change			2				2
Noise			7	2			9
Soil and Groundwater			3				3
Hydrology, Surface Water Drainage and Flood Risk			1	1			2
Solid Waste and Wastewater				1			1
Marine Ecology			9	1			10
Marine Water Quality			4				4
Landscape and Visual Amenity			2				2
Traffic and Transportation			2				2
Terrestrial Ecology			3				3
Archaeology and Cultural Heritage			1				1
Socio-economic	4		1				5
Community Health, Safety & Security			5				5
Labour & Working Conditions			4	3			7
Total	**4**	**0**	**44**	**8**	**0**	**0**	**56**
Operation Phase							
Air Quality			3				3
Climate Change			2		1		3
Noise			2	2			4
Soil and Groundwater			1				1
Marine Ecology			3	1			4

Topic	Beneficial	No change	Negligible	Minor	Moderate	Major	Total
Marine Water Quality			3				3
Solid Waste and Wastewater			1				1
Landscape and Visual Amenity			1				1
Socio-economic	2						2
Community Health, Safety & Security			2				2
Labour & Working Conditions			2	3			5
Total	**2**	**0**	**20**	**6**	**1**	**0**	**29**

7.4 Emergency Preparedness and Response Plan

The likelihood of an incident can be minimised by effective preparedness and planning of reasonably foreseeable emergency situations. Given the nature of the project, construction risk assessments and Method Statements will include consideration of the potential for environmental incidents.

The Executive Regulations for Preparedness and Response to Emergencies and Environmental Disasters specify the controls for preparing and implementing these plans. The project must commit to preparing and updating its own plan for preparedness and response to potential environmental emergencies and disasters. The NCEC may request that the plan be submitted for review based on the results of the environmental inspection, periodic follow-up, or classification of the activity as a sensitive facility.

The Project will prepare certain complimentary plans/procedures associated with potential emergency situations (such as the material handling and storage plan). Such complimentary plans will be outlined in the Framework Environmental and Social Management Plan (FESMP) that will be prepared as part of the ESIA. The plans will identify procedures for reasonably foreseeable emergency situations considering the following:

- The most appropriate method for responding to an emergency situation.
- Internal and external communication process (with stakeholders and responders).
- Action required to prevent or mitigate health and safety, community and environmental impacts.
- Mitigation and response actions to be taken for different types of emergency situations.
- The need for post-emergency evaluation to determine and implement corrective and preventative actions.
- Periodic testing/drills related to planned emergency response actions.
- Training of emergency response.
- A list of key personnel and aid agencies, including contact details (such as fire department, spillage clean-up services).
- Evacuations routes and assembly points.
- The possibility of the need for mutual assistance from neighbouring organisations/projects.

In addition, when the Project includes the use of chemicals, the following information should be included in the plan:

1. Cases that require the use of chemicals (amount and type of leak that requires its use).
2. Type and components of the required chemicals.
3. Storage sites (locations, nature of the sites, depths, environmentally sensitive areas, environmentally sensitive receptors, etc.).
4. The expected environmental impacts of its use and how to address those impacts.

The project shall implement the plan, controls and requirements set by NCEC, and provide qualified human resources, equipment and necessary devices that ensure readiness to implement the plan. To increase readiness to implement the plan, the Project Company can contract a service provider approved by the NCEC. The plan shall include programs for periodic maintenance of equipment, to respond to environmental emergencies and disasters.

It is also necessary to commit to conducting an internal audit to assess the project preparedness - at least once a year - provided that the relevant reports are submitted to the NCEC within a period not exceeding 30 days from the completion of the audit.

The NCEC determines the reporting mechanisms. In the event of an environmental incident, regardless of its size or type, the EPC Contractor through the Project Company must inform the NCEC and relevant authorities.

7.5 Environmental Rehabilitation and Remediation Plan

The baseline information and assessments outlined in Chapter 5 and Chapter 6 of this Report have not identified any specific instances of existing contamination or potential for degradation from the Project that would necessitate the requirement for a rehabilitation or remediation plan.

In the instance that the rehabilitation and remediation of the Project sites including all temporary laydown areas and yards are required, the related plan will be produced by the Project Company and issued to NCEC for approval. Those responsible for the production of the plan will assume responsibility for its implementation to ensure its objective are met.

A Decommissioning Plan will be prepared at least 12 months prior to planned decommissioning and submitted to the Regulator (currently NCEC) for review and approval. No decommissining works can be commenced without a permit from the Regulator. The Plan will detail the site and surrounding environment and receptors and may require new baseline studies to assess the condition of the site, adajcent areas and the overall area of influnce including designated sites. Based on the details outlined in this Report, the measures will likely relate to the following:

- Removal of all Project related components and wastes and appropriate disposal method that adopts the waste hierarchy and maximises re-use and recycling of materials;
- Restoration of the terrestrial ecology habitats within the Project footprint including access roads e.g. re-seeding and re-vegetation using local indigenous species; and
- Remediation and/or sclarifiction of any compacted soils.

7.6 Framework Environmental and Social Management Plan

The Framework Environmental and Social Management Plan (ESMP) provides a framework for the effective implementation of the mitigation and monitoring measures outlined in Chapters 6.2 and 7.2 of this Report. This framework ensures alignment with applicable elements of the established ACWA Power corporate level E&S Policy and ESMS Implementation Manual.

The framework ESMP will provide a framework for the development of both CESMP and OESMP by the EPC Contractor and O&M Company respectively. The intention is that the Framework ESMP will be used by both the EPC Contractor and O&M Company for the development of specific environmental and social management plans, based on the specific findings and recommendations of the ESIA. The following sections outline the Framework ESMP as required by NCEC for the environmental permitting of the Project.

7.6.1 Objectives and Scope

The production and implementation of a Framework ESMP provides the mechanism by which to implement the findings of the ESIA. This Framework ESMP sets out specific objectives and targets defining a ‘framework’ for the way in which the ESIA and its recommended mitigation and monitoring measures should be addressed in the next stages of the Project development.

This Framework ESMP is intended to be adopted by the EPC Contractor who will develop and author their own detailed CESMP with supporting activity and topic specific management plans and method statements to cover the construction of the Project. A future OESMP will be developed by the O&M Company which will closely align with the FESMP in terms of structure but will provide operations specific detail.

This Framework ESMP will also contribute to the development and implementation of the ESMS. The Project ESMS will align with applicable elements of the established ACWA Power corporate level E&S Policy and ESMS Implementation Manual.

7.6.2 Intended Users

This Framework ESMP aims to clearly communicate to the Project Company, their EPC Contractor, O&M Company and all sub-contractors the Project's environmental and social commitments. The Project Company holds primary responsibility for the production and implementation of the CESMP by their EPC Contractor and all sub-contractors and the OESMP by the O&M Company and all sub-contractors.

7.6.3 Legislative Requirements

Chapter 2 and **Appendix C** of this ESIA outlines the national, regional, and lenders commitments that are applicable to the Project. Other applicable requirements are included to each section in Chapter 6.

7.6.4 Organisational Structure

An overview of the organisational structure of all parties involved in the implementation of the ESMP is outlined below:

- **NCEC:** As the Competent Authority in KSA, NCEC is responsible for issuing the required Environmental Permit and ensuring all construction and operational conditions related to the Environmental Permit are met. Other general responsibilities include:
  - Enforcement of KSA laws and regulations;
  - Provision of guidelines on compliance with environmental requirements;
  - Strategic overview of environmental issues;
  - Review and approval of the ESIA Report;
  - Issue of the Environmental Permit and any associated conditions; and
  - Undertake inspections, audits etc. to ensure compliance with the Environmental Permit.
- **Project Company:** The Project Company is responsible for the financing and development of the Project and will assume all responsibility for ensuring all environmental and social commitments of the Project are met. The Project Company will adopt a Project E&S Policy and work under a construction ESMS and operational ESMS.
- **EPC Contractor**: The EPC Contractor is responsible to the Project Company for ensuring all environmental and social commitments of the Project construction phase are met. The EPC Contractor will produce and implement the detailed CESMP.
- **O&M Company**: The O&M Company is responsible to the Project Company for ensuring all environmental and social commitments of the Project operation phase are met. The O&M Company will produce and implement the detailed OESMP.

* **Sub-Contractors:** All sub-contractors undertaking works on behalf of the EPC Contractor/O&M Company will be responsible for undertaking works in line with the CESMP/OESMP and all approve method statements and management plans.

7.6.5 Key Roles and Responsibilities

The key roles and responsibilities related to the implementation of the CESMP or OESMP (when applicable) are outlined in the following table. Further details will be provided in the Project CESMP and OESMP.

Table 7-4 CESMP/OESMP Roles and Responsibilities

ROLE	KEY RESPONSIBILITIES
Project Company – Project Manager	• Review and approve environmental and social management budgets, resourcing and staffing. • Attend and actively input to environmental and social management review meetings. • Formal sign off and approval of all ESMS documentation produced by the EPC Contractor/O&M Company, including the CESMP/OESMP. • Ensure the project adheres to all applicable environmental laws, regulations, and standards. This includes obtaining necessary permits, licenses, and approvals. • Continuously seek opportunities to improve the project's environmental performance through exploring alternative technologies, materials, and practices that are more environmentally friendly, as well as evaluating the effectiveness of implemented mitigation measures. • Promote environmental awareness among project team members and stakeholders. • Manage applicable stakeholder engagement with local communities, regulators, and SPPC, to address their concerns, gather input, and ensure transparency in environmental decision-making processes.
Project Company – HSE Manager	• Follow up, review and internal approval off ESMS documentation produced by the EPC Contractor/ O&M Company, including the CESMP/OESMP. • Inspect and audit EPC Contractor/O&M Company. • Liaise with the Project manager, the regulators and/or other authorities on environmental and social matters. • Be responsible for communications regarding environmental and social reporting and third-party audits. • Implementing a system for monitoring and tracking the project's environmental performance.
EPC Contractor/O&M Company Project Director	• Review and approve environmental and social management budgets, resourcing and staffing.
EPC Contractor/O&M Company HSE Manager	• Review and approve EPC Contractor/O&M Company environmental and social management budgets, resourcing and staffing. • Ensure sufficient resources for the management of environmental and social matters. • Undertake regular site inspections. • Monitor and report on environmental management and performance, including compliance with the CESMP/OESMP. • Undertaken regular inspections and audits to assess compliance and manage implementation of corrective and preventative actions. • Stop operations that may adversely impact the environment. • Attend and actively input to environmental and social management review meetings. • Set and review environmental objectives and targets for the Project. • Promote environmental and social awareness and provide induction, trainings and drills at all levels. • Follow-up and close out any grievances. • Inspect and audit welfare facilities and labour camps of contractors and sub-contractors. • Stop any health and safety risk tasks and ensure corrective action is implemented.
EPC Contractor/O&M Company HSE Engineer / Environmental Engineer	• Monitor and report on environmental management and performance, including compliance with the CESMP/OESMP. • Prepare and monitor site bulletin boards. • Undertake daily site walkovers and inspection of works. • Prepare daily reports on findings including non-conformance and liaise with the responsible parties to rectify and close-out outstanding findings. • Escalate pending non-conformances during management meetings to ensure these are addressed as required.

ROLE	KEY RESPONSIBILITIES
	• Maintain applicable environmental and social records • Act as point of contact for any sub-contractor with regard to environmental issues. • Follow-up and close out any grievances.
Subcontractors	• The subcontractors shall at all times comply with the requirements outlined in the Project ESMS. • Where required, and based on the number of workers, subcontractors will deploy dedicated HSE Officers onsite. • The subcontractors E&S responsibilities are similar to those of the EPC Contractors/O&M Company for the activities under their scope.

7.6.6 Environmental Capacity Building, Training and Awareness

All Project staff must be fully competent to perform their tasks based on appropriate education, training or experience. To minimise potential impacts of the Project on the environment, all Project Company, EPC Contractor/O&M Company and sub-contractor staff will be adequately trained to understand and comply with the environmental requirements and commitments of the Project.

All site-based Project Company, EPC Contractor/O&M Company and sub-contractor staff will be required to undertake a site-specific Environmental Induction prior to commencing any works. The aim of the Environmental Induction is to raise awareness of environmental issues identified in the ESIA and the associated mitigation and management measures detailed within the CESMP/OESMP and to ensure all Project staff are informed of their responsibilities and duties.

Outside of the Environmental Induction, the level of training will vary depending on staff roles and responsibilities. Example training requirements are outlined in the table below. As part of the ESMS, a tailored Training Plan will be developed which include all training requirements. The CESMP/OESMP will provide further detail on the training requirements.

Table 7-5 Example Training Requirements

EXAMPLE TRAINING	PROJECT STAFF	CONTENT	TIMING
Environmental Induction (Site Induction)	All Project Staff and Visitors	• Site layout; • Safety procedures and use of PPE; • Environmental Policy; • Legal commitments and requirements; • Overview of the CESMP/OESMP including environmental aspects and impacts associated with construction activities; • Role and responsibilities of site environmental management; • Communication procedures; • Grievance mechanism; • Emergency Procedures and contacts; and • Incident reporting procedure.	Prior to involvement in any construction activities.
Environmental Induction for Supervisors	Site Supervisors/ HSE Managers/ Environmental Managers	• As per the above, in addition: - Importance of toolbox talks and how to conduct toolbox talks; - Management of training records and grievances.	Prior to involvement in any construction activities.
Spill and Emergency Response Training	All Project Staff	• Detailed training on the response and procedures in the event of a spill of emergency.	Prior involvement in any construction activities.
Toolbox Talks	All Project Staff	• Toolbox Talk environmental training sessions may be focused on the following subjects: - Dust control and dust mitigation;	Weekly – additional bulletins and alerts as required.

EXAMPLE TRAINING	PROJECT STAFF	CONTENT	TIMING
		- Air quality emissions and control measures; - Hazardous materials management, handling and transportation; - Spill prevention and response for personnel involved in the storage of fuel and other hazardous materials. Including use of spill kits and refuelling; - Storage, handling and use of chemicals; - Ecologically significant fauna and mitigation measures; - Noise control and mitigation measures; - Traffic control and mitigation; - Chance Find Procedure; - Waste management; and - Emergency incident response.	

Records of training delivered by internal and external providers shall be maintained by the EPC Contractor/O&M Company. These records should include a training register which details the name and date of the training and list of all attendees.

7.6.7 Internal and External Communications

The CESMP/OESMP will be required to establish, implement, and maintain processes needed for internal and external communications relevant to the environmental and social performance of the Project.

All Project staff, including Project Company, EPC Contractor/O&M Company and sub-contractors will be responsible for the communication of any potential environmental issues to the appropriate person.

The CESMP/OESMP will develop a communication plan which will establish:

- What will be communicated;
- When it will be communicated;
- With whom to communicate; and
- How to communicate.

Formal modes of internal communications relevant to the environmental and social management of the Project may include:

- Management meetings;
- Progress meetings; and
- Monthly reports (e.g. monitoring, inspection, incident reports).

7.6.8 Control and Reporting

The EPC Contractor/O&M Company shall be responsible for ensuring that throughout the construction phase, monitoring reporting requirements provided in this CESMP/OESMP are implemented. Monitoring reporting should be in line with the regulatory requirements (if any). The EPC Contractor/O&M Company is required to report, as a minimum, the following:

- Incident and relevant investigation reports;
- Weekly/Biweekly environmental reports including inspections, incidents, accidents etc.;
- Monthly environmental reports, including monitoring, inspections, incidents, accidents, internal audits highlighting non-conformances, grievances, environmental performance, etc.;

In addition, the CESMP/OESMP is intended to be an evolving 'live' document, which is regularly reviewed, revised and developed, to ensure the depth of environmental management is compliant and complete.

It is recommended that the detailed CESMP/OESMP is reviewed throughout the construction of the Project at regular intervals. Reviews of the detailed CESMP/OESMP should be undertaken in collaboration between the Project Company, EPC Contractor/O&M Company and their Environmental Advisor and should consider the following as a minimum:

- Any additional responses / comments from NCEC;
- Updated construction activity details;
- Outcomes of any environmental monitoring;
- Recorded incidences and non-conformances;
- Recorded enquiries and complaints;
- Changes in organisation structure and responsibilities; and
- Changes in environmental standards and legislation.

7.6.9 Data Management

All environmental & social management documentation including ESMS documents and generated records including meeting minutes, work method statements, toolbox talks/ inductions/training material and evidence records, site inspections, system audits, monitoring records, incident investigations etc. shall be retained on site. These will be managed under the EPC Contractor/O&M Company document management plan and document control system. Such provisions should as a minimum include:

- All documentation will be uniquely identifiable (e.g. by a file name, date, revision number and have page numbers), stored and readily retrievable (either on a local area network or in hardcopy files) for use by personnel.
- The document control procedure shall ensure that applicable documentation has been reviewed and approved before finalisation.
- Documentation and Records arising from the implementation of the ESMS shall be retained for the project lifecycle.

There are certain requirements in Saudi Arabia for environmental documentation to be maintained for five years.

7.6.10 Auditing and Inspection

7.6.10.1 Internal Audits

Internal audits will be undertaken to assess the compliance and conformance of the Project Company and the EPC Contractor/O&M Company with the CESMP/OESMP. Internal audits will involve the observation of construction activities, meetings with key Project staff and a review of records i.e. monitoring reports, management meetings, complaints etc.

Should any non-compliances or opportunities for improvement be identified during the internal audit, corrective action requests will be issued to the responsible party. These requests will take the form of a short document / form setting out the following information, as a minimum:

- The nature of the non-compliance (date, location, description);
- The nature of the recommended / investigative / remedial / corrective action;
- The individual responsible for the action;
- The timeframe for undertaking and completing the action; and
- A record and sign-off of the action undertaken.

The CESMP/OESMP will detail the frequency, scope and personnel responsible for the internal audits.

7.6.10.2 External Audits

As the Project is seeking finance from lenders who may (or may not) be signatories of the EP or have investment policies that are consistent with the IFC Performance Standards, the Project will be required to comply with lenders requirements.

In accordance with Equator Principle, an Independent Environmental & Social Consultant shall undertake monitoring and reporting activities on behalf of the lenders for the period of the project loan. During construction, quarterly third-party audits will be conducted. In the first year of operation, audits will be performed every six months to ensure the management system is progressing as planned, with annual audits taking place thereafter.

7.6.10.3 Inspections

Daily inspections will be undertaken by the HSE Manager and/or Environmental Manager to monitor and record the general environmental performance of the Project. The daily walkover inspection will include of key areas i.e. construction activity locations, site offices, site compound / laydown/ storage areas and will cover the following as minimum:

- General site housekeeping;
- Dust management and air quality;
- Ecological observations;
- Noise and vibration;
- Runoff and spill management;
- Waste storage and management;
- Chance Find Procedure;
- Lighting management; and
- Traffic management.

All site inspections will be documented via an Environmental Inspection Record which will be submitted to the HSE Manager on a monthly basis.

In addition to the above, a more formal walkover with the HSE Manager and/or Environment Manager and the Construction Manager will be undertaken and documented.

7.6.11 Environmental and Social Plan, Procedures and Monitoring

7.6.11.1 E&S Management Plans (CESMP and OESMP)

The key E&S management plans will be the CESMP and OESMP; respective to construction and operations. The CESMP and OESMP will comprise stand-alone documents structured to detail how environmental and social risks, impacts, opportunities and compliance will be managed and monitored. This shall be the top-level management plan document prepared by the EPC Contractor and O&M Company respectively. Chapter 6 of this Report has delineated the environmental and social mitigation required for the Project and to be incorporated in the CESMP/OESMP.

The typical content of a CESMP/OESMP has been outlined below. This is not mandatory to be structured in this manner, but it is expected that the headings and sub-headings as a minimum are captured within the respective CESMP/OESMPs.

- Introduction
  - Background of Environmental Permitting
  - Objectives of the CESMP/OESMP
  - Scope of the CESMP/OEMSP
  - Limitations
  - Structure of the CESMP/OESMP
- Project Description
  - Project Rationale and Background
  - Project Location
  - Land Use
  - Sensitive Receptors
  - Overview of Project Components
  - Overview of Associated Facilities
  - Overview of Construction/Operational Works and Workforce Requirements
  - Overview of Construction/Operational Facilities
  - Project Schedule (for CESMP)
- Regulatory Framework
  - Overview of Regulatory Framework and Compliance Obligations
    - Regional and International Treaties and Conventions
    - KSA Legislation
    - Lenders Requirements
    - Environmental Standards
- Environmental and Social Management

- Summary of Environmental and Social Management System (ESMS)
- Reference to E&S Policies
    - Applicable Project Company E&S Policy
    - EPC Contractor/O&M Company E&S Policy
- Statement of other supporting/complementary Plans and Procedures
- Organisational Structure
    - NCEC
    - Lenders
    - Project Company
    - EPC Contractor/O&M Company
    - Sub-contractors
- HSE Roles and Responsibilities
- Environmental Awareness and Training
    - Environmental & Social Induction Training
    - Toolbox Talk Environmental & Social Training Sessions
    - CESMP/OESMP Training
- Competency Needs and Records
- Internal and External Communications
    - Internal Communication
    - External Communication
    - Liaison with Regulator
- Inspections and Audits
    - Daily and Weekly Inspections
    - Internal Audits
    - Annual Internal Audits
    - External Audits
- Non-conformity, Corrections and Corrective Action
    - Non-Conformity, Investigation and Response
    - Incident Definition, Reporting, Investigation and Response
    - Corrections and Corrective Actions
- Control of Records

- Mitigation, Management and Monitoring
    - Air Quality
    - Climate Change
    - Noise & Vibration
    - Soil, Geology, Groundwater
    - Hydrology and Flood Risk
    - Terrestrial Ecology
    - Traffic & Transportation
    - Archaeological and Cultural Heritage
    - Landscape and Visual Amenity
    - Socio-Economic
    - Solid Waste & Wastewater Management

- Community Health, Safety & Security
- Labour & Working Conditions

- Monitoring Summary
- Emergency Preparedness and Response Overview
- Appendices.

7.6.11.2 Supporting/Complimentary Plans & Procedures

Complimentary plans and procedures will be required to developed alongside the CESMP/OESMP. Such supporting/complimentary management plans/procedures include those linked to specific activities that carry environment and social risks, for which defined and documented management processes need to be specified. The plans will include SMART (specific, measurable, achievable, relevant and time- based) targets and, where applicable, Key Performance Indicators (KPIs) with distinct milestones. The plans will also specify who is responsible for achieving these targets.

The implementation of each management plan is led by one designated party (Company or EPC Contractor/O&M Contractor), as specified in Table 7-6 below. The Project Company ESMS (construction and operation) and the EPC-ESMS (construction) will be designed to implement the requirements of these plans. ESMS implementation tools, including forms, templates, checklists, and other documentation, will be used to implement the Project requirements.

Table 7-6 Required Complimentary Plans and Procedures

PLAN / PROCEDURE	Project Phase	PURPOSE AND KEY REQUIREMENTS	LEAD IMPLEMENTATION
Environmental and Social Monitoring Plan	Construction & Operation	Monitoring is required to demonstrate compliance to KSA environmental standards and lender requirements. The monitoring plan is to specify monitoring requirements for all ESIA parameters (as specified in section 7.2 of this ESIA). The plan will therefore need to include: • What parameters need to be monitored and measured and at what locations. • The methods for monitoring measurement, analysis and evaluation to ensure valid results. • The criteria against which compliance and performance will be measured. • When and at what frequency monitoring needs to be performed. • How the results from monitoring and measurement will be analysed and evaluated (independent or internal).	EPC Contractor / O&M Contractor
Hazardous Material Handling and Storage Procedure	Construction & Operation	To identify locations for material storage, storage requirements (specifications of bunds and buildings/warehouses to ensure environmental and H&S protection, segregation requirements etc.) and handling procedures to minimise environmental and OH&S risks. The plan will outline record keeping as per chain of custodies, requirements for MSDS and roles & responsibilities. Specific method statements regarding the handling of materials will be detailed, as well as training requirements for staff involved in such activities.	EPC Contractor / O&M Contractor
Traffic Management Plan	Construction	The plan will identify specific requirements for heavy, or oversize loads, including timings of deliveries, specific routes (to minimise disruption), engagement mechanisms with external transport authorities (as per the SEP, e.g. local government and stakeholders). To include measures to minimise congestion, fuel use and risks to the public and site staff.	EPC Contractor
Water Management Plan	Construction	The Water Management Plan identifies sources of water supply for the Project, estimation of required quantities, and procedures for the sustainable use and management of water resources used throughout the construction phase of the Project. This includes management of any impacts on community water availability.	EPC Contractor
Waste Management Plan	Construction & Operation	To identify site specific requirements for waste & wastewater management, containment of wastes (segregation, storage area specifications and locations), collection methodologies & transport (identification of licensed contractors including recycling and hazardous waste facilities, their capacity to handle waste and the process to engage), treatment/disposal (identification of licensed treatment and disposal sites), record keeping and reporting requirements related to waste.	EPC Contractor / O&M Contractor
Marine Traffic Management Plan	Construction	The plan will align with the site mobilisation plan and include all aspects of marine traffic management including, but not limited to i) certification and inspections, ii) speed limits and standard operating procedures for vessels while on site (e.g. mooring, discharges to the marine environment, re-fueling, waste management, etc.), iii) transit to the site, journeys during construction and transit back to home base. iv) environmental risks (to align with the biosecurity plan), and v) emergency response (to address issues relating to accidents at sea, inclement weather, spills and other environmental incidents etc.	EPC Contractor
Marine Wildlife Management Plan	Construction & Operation	Risks and impacts relating to the project's potential interactions with marine wildlife will be set out and procedures developed to manage these risks. The scope of the plan will include: i) ship strikes and interactions during dredging, and transits, ii) entrainment of marine wildlife into the seawater intake system, iii) emergency response in case of standing of live or dead animals, oil spill etc. The plan will include definitions of incidents and near misses, and will set out monitoring and reporting requirements.	EPC Contractor / O&M Contractor
Biosecurity Management Plan	Construction & Operation	The plan will address biosecurity risks associated with fouling from vessels during the construction phase, operational (maintenance) phase, and in due course the decommissioning phase. They main risk requiring active management is that from hull fouling of vessels that enter KSA Sea from other seas. Safeguards are required to minimise the risk of introducing an alien invasive species from fouling on hulls, or in ballast water (if applicable).	EPC Contractor / O&M Contractor
HAB, Jellyfish Bloom and oil spill response Plan	Operation	Responses of the plant's operation to marine environmental risks need to be developed and included in the emergency response plan.	EPC Contractor / O&M Contractor

PLAN / PROCEDURE	Project Phase	PURPOSE AND KEY REQUIREMENTS	LEAD IMPLEMENTATION
Dewatering Management Plan	Construction	The Plan will include a detailed, step-by-step method statement to describe the dewatering procedures, including dewatering methods, dewatering effluent collection and disposal method and treatment, discharge locations and monitoring plans. Monitoring plan will include detail on the parameters to be monitored, the location of monitoring and the frequency of monitoring.	EPC Contractor
Chance Finds Procedure	Construction	An archaeological 'Chance Find Procedure' will be developed prior to construction and the start of site earthworks, alongside the CESMP. This will include protocols and procedures to stop work and methods to preserve potential finds, as well as reporting requirements and co-ordination with SPPC and the regulator.	EPC Contractor
Emergency Preparedness and Response Plan	Construction & Operation	To identify the contingencies put in place for a variety of potential emergency situations relevant to the commissioning or operational phases. The plan will outline the response mechanisms, roles and responsibilities, training requirements, internal communication, equipment and relevant engagement with external stakeholders. Requirements for on-site equipment shall be established based upon the potential emergency risks, including training provisions for site personnel regarding such equipment. The plan will identify site specific requirements for response to pollution incidents. To include the identification of high-risk areas on a plan and the location of spill kits (and contents of spill kits).	EPC Contractor / O&M Contractor
E&S Training Plan	Construction & Operation	To identify specific staff members for training and the type (i.e. classroom, practical, toolbox talks) how/when this is to be delivered, the frequency of training and whether follow up training provisions are required. The training will be linked to the specific content of the listed plans and procedures, or key risk activities that may be identified from on-site method statements.	EPC Contractor / O&M Contractor
Stakeholder Engagement Plan (SEP)	Construction & Operation	To identify project stakeholders, identify communication protocols for engagement with stakeholders. To identify frequency or event-based communication with stakeholders (i.e. for emergencies and specific grievances). To detail the workers grievance mechanism or provide a reference to a separate grievance mechanism.	Project Company
Grievance Mechanism (stakeholder)	Construction & Operation	To be included within or be linked to the SEP. To develop and identify the process for external parties to raise grievances regarding the project. The mechanism shall be easily accessible (including for any vulnerable groups), non-discriminatory and provide a transparent process to raise concerns or complaints, which may be issued in an anonymous nature. The mechanism shall specify the roles and responsibilities of internal staff about the grievance mechanism and the procedure for responding to received grievances, including the timeline for response, engagement mechanisms and recording of records.	Project Company
Site Inspection and Audit Plan & Procedure	Construction & Operation	To specify the timing and frequency of inspections (e.g. daily, weekly walkovers) and audits (including internal & external independent audits for the lenders as appropriate). To detail the methodology of such inspections and audits to ensure applicable Environmental and Social requirements are included as criteria within the scope of the inspection/audit. For internal audits, the procedure will identify the audit scope (site, laydown areas, accommodation areas, sub-contractor areas etc.), audit criteria (e.g. CESMP, OESMP, ESMS), selection process for audit evidence, reporting format and auditor competence requirements. The Procedure will specify definitions of non-conformance, observations and best practices, as well as detailing the mechanisms for issuance and follow up of Non-Conformance reports, including time periods for action and the implementation of corrective and/or preventative measures.	EPC Contractor / O&M Contractor
Security Management Plan	Construction & Operation	A security plan will be developed based on the outcomes of a security risk assessment. It is noted that security arrangements will be guided by UN Code of conducts for law enforcement. Security personnel will follow a strict code of conduct and will be trained in weapons handling (if applicable), human rights and receipt of grievances.	EPC Contractor / O&M Contractor

PLAN / PROCEDURE	Project Phase	PURPOSE AND KEY REQUIREMENTS	LEAD IMPLEMENTATION
Occupational Health & Safety Plan	Construction & Operation	Identify the required controls for worker health and safety during the commissioning and operational phases. As a minimum, this plan shall include: • Means of identifying and minimising, so far as reasonably practicable, the causes of potential hazards to workers. • Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. • Provision of appropriate equipment to minimise risks and requiring and enforcing its use. • Training of workers, and provision of appropriate incentives for them to use and comply with health and safety procedures and protective equipment. • Documentation and reporting of occupational accidents, diseases and incidents. • Emergency prevention, preparedness and response arrangements.	EPC Contractor / O&M Contractor
Human Resources Policies and Procedures	Construction & Operation	Human resource policies and procedures will be adapted appropriate to the size of the workforce required for the Project. Policies and procedures must be prepared to demonstrate consistency with the requirements of national legislation and IFC Performance Standard 2.	EPC Contractor / O&M Contractor
Recruitment Plan	Construction & Operation	The EPC contractor and O&M Company will provide a plan detailing how working conditions and terms of employment are compliant with KSA labour, social security and occupational health and safety laws. This plan will provide set of actions for the recruitment of the workforce. The plan will detail the procedure for effective recruitment of local staff (where available), the positions that could be filled by unskilled, semi-skilled and skilled local workforce, mechanisms that will be in place to ensure there is non-discrimination of women in assessing recruitment procedures and the training ton be provided for each job role. The plan will also specify how working conditions and terms of employment are compliant with national labour, social security and occupational health and safety laws. The EPC Contractor and O&M Company will ensure that the following documents are prepared prior to the employment of workers. • Employment agreements and recruitment policies; • Equal opportunities and non-discrimination policy (incorporating maternity policies and policies associated with GBVH); and • Child and forced labour policies / procedures (covering recruitment fees and arrangements, as well as document (e.g. passport) retention.	EPC Contractor / O&M Contractor
Local Content Plan	Construction	This plan will clearly identify the Project commitment to purchasing goods and services (where practicable without compromising on the quality and standard requirements for the Project). It will also set expectations with regards to the extent goods and services can be purchased from the local market in order to benefit local businesses without potentially leading to higher prices for local consumers. This plan will be shared with local businesses interested in providing goods and services to the Project.	EPC Contractor
Workers Accommodation Plan	Construction	This plan will outline the process and standards for the accommodation for the Project workforce. It will include accommodation areas directly managed by the Project, or rented/shared to accommodate direct Project employees and/or temporary or other contract staff (dedicated to the project). Accommodation areas in use by sub-contractor companies/staff (where staff are dedicated for the Project) will also be included.	EPC Contractor /
Decommissioning Management and Monitoring Plan	Decommissioning	Decommissioning phase plan (with supporting subplans) for managing E&S risks with supporting procedures, forms and method statements as per the requirements of this ESMP.	Project Company

8 Conclusion

8.1 The Environmentally, Socially and Economically "Preferred" Alternative

The Project will help increase the stability of electricity supply and further ensure the efficient use of scarce natural resources.

Not implementing the Project would be a missed opportunity for a secure and reliable electricity generation and supply system which would have significant social and economic development implications including the realisation of the KSA vision 2030. In addition, the no project alternative would hinder KSA's efforts to transition from liquid-based fossil fuels to natural gas power generation.

The current Project location and technology described in this report were selected based on an assessment of their technical performance and environmental and social considerations. The site is also relatively away from sensitive receptor communities and towns. Locating the Project close to existing CCGT plant facilities and other industrial infrastructure prevents other E&S impacts relating to the development of new associated facilities. In addition, using the selected proposed site also prevents the need to disturb any critical habitats since the Project site was previously utilised for the laydown area and later decommissioned. Furthermore, the site has limited flora and fauna species that are common in KSA.

This approach ensures that the Project will be efficient, sustainable, and able to meet the long-term needs of the communities it serves.

8.2 Summary of the Environmental, Social and Economic Losses and Gains that Justify the Establishment of the Proposed Business Activity

The development of the Hajr Two IPP is in line with the KSA Vision 2030 which aims to diversify the national energy mix used in electricity production, increase the share of natural gas (and renewable energy sources) to approximately 50% while reducing the use of liquid fuel. In addition, the power industry is a strategic industry in the KSA which has ensured its continued economic development and industrial diversification. The Project also aligns with KSA climate change strategy which includes transition from liquid-based fossil fuels to natural gas power generation. The Project will help increase the stability of electricity supply and further ensure the efficient use of scarce natural resources.

The main impact of the Project will be the GHG emissions that significantly exceed the IFC threshold for GHG quantification (25,000tCO_2/year). The Project will be decarbonisation-ready with measures implemented to allow for the addition of carbon capture and sequestration technology at a later date without major modifications to the Plant. If this is implemented and operated, the impact from GHG emissions will be reduced to acceptable levels.

Additionally, the air quality and noise modelling indicated that the Project will not result in significant impacts. The Project will result in other E&S impacts that will require proper mitigation and monitoring. The implementation of the ESIA mitigation measures and a robust ESMS by the EPC Contractor and the O&M Company that aligns with ACWA Power Corporate E&S Policy and ESMS Implementation Manual and the continuous monitoring, reporting and supervision will ensure that adverse impacts of the Project are minimised to acceptable levels.

8.3 Summary of How the Negative Impacts Are Addressed and to What Extent They Will Be Mitigated, Improved or Controlled

The Project design and construction and operation methods detailed in Chapter 3 of this report has been identified as the preferred Project. Chapter 6 of this report has identified the potential environmental and social impacts and the required mitigation measure of the Project based on the detail described in Chapter 3.

As summarised below, the ESIA has identified the following:

- 85 environmental and social impacts associated with the development and operation of the Project. During the construction phase of those assets, 56 impacts have been identified, of which four (4) are positive and 52 are negative. During construction one (1) impact was assessed to be of major significance, ten (10) as moderate significance while the rest are minor or negligible. There are a total of 29 operational phase impacts, of which two (2) are positive and 27 are adverse. During operation, one (1) impact is major significance and eight (8) are of moderate significance impacts while the rest are minor or negligible. The major impacts are related to labour major injury or fatality where key risks are not suitably managed, while this is unlikely to happen, the significance of this occuring would be major.
- Through the application of the appropriate mitigation and management measures, the significant impacts that were identified (i.e. major or moderate) have been reduced/improved to an acceptable level of significance or magnitude. The only remaining moderate impact would be the impact of GHG emissions. These emissions are inevitable and the reduction of the significance of this impact will be through the proper implementation and operation of the decarbonisation system. While the Project will be decarbonisation-ready with measures implemented to allow for the addition of carbon capture and sequestration technology, the operation date of this system has not been confirmed yet and therefore GHG emissios will remain significant until its operation.

8.4 Summary of the Environmental Management Plan

To ensure that mitigation measures and management plans set out in this ESIA are implemented, a Project ESMP will be developed.

A Framework ESMP has been provided in the ESIA to guide the development of the Project Construction ESMS and Operation ESMS by the EPC Contractor and O&M Company respectively. The Project policies and plans will set out the mitigation and monitoring requirements which need to be effectively implemented. These will be developed by the appointed EPC Contractor and O&M Company, based on the ACWA Power Corporate E&S Policy and ESMS Implementation Manual as well as their existing procedures and management systems, method statements and the requirements set out in this ESIA and overseen by the Project Company.

It is assumed that no works will commence until the Environmental Permit is obtained and an ESMP is in place and implemented for each phase.

8.5 Roles of the Various Relevant Authorities

8.5.1 Ministry of Environment, Water and Agriculture

MEWA is a government ministry in KSA responsible for overseeing environmental protection, water resources management, and agricultural development in the country. MEWA is responsible for developing and implementing policies and regulations to protect the environment, conserve biodiversity, and mitigate the impact of human activities on ecosystems. The ministry works towards preventing pollution, managing waste, and promoting sustainable practices in various sectors, including industry, agriculture, and transportation.

8.5.2 National Centre for Environmental Compliance

The NCEC has been the regulator for preventing the deterioration of environmental environments in KSA since 1st January 2021. NCEC is responsible for the issuing and renewal of environmental licenses for Category 1, 2 and 3 projects in accordance with the KSA Environmental Law and applicable MEWA Executive Regulations.

8.5.3 National Centres of Environment

In addition to the NCEC, the following National Centres have also been established and have their own policies and standards each in its field and must be taken into account during the construction, operation and decommissioning of the project.

- **NCM:** monitors weather and climate condition;
- **NCW:** supervises programmes related wildlife and biological diversity and protected areas;
- **NCVC:** regulates habitat loss and vegetation cover, combats desertification, conducts studies and supports research related to vegetation; and
- **MWAN:** organizes the waste management sector and issuing licenses to waste management service providers, including transportation, storage, recycling, treatment and disposal of hazardous and non-hazardous waste.

9 Appendices

Appendix A – References

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Appendix B – Project Team CVs

Appendix C – Environmental Standards

The applicable environmental standards for the Project as per the national regulations and lender guidelines are outlined below. Where there is contradiction in limits between Saudi standards and lender guidelines, the most stringent will apply.

In accordance with lender requirements, where specific national standards do not exist, a best practice standard should be applied.

1. Air Quality

A. National Requirements

Air Emissions

The table below presents the applicable air emissions standards for combustion facilities (constructed on or after 1st September 2005), specific to the Project technology, as per the Executive Regulations for Air Quality of the Environmental Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH.

Table A-0 KSA Air Emissions Standards

#	Source	Pollutant	Emission Standard
13.14	Stationery gas turbines with heat input > 100 MW	NO_x	9 ppmv at 15% O_2 dry basis
13.15		SO_2	0.015% by vol. at 15% O_2 dry basis
13.16		Sulfur contents of turbine fuel	<0.8% Sulphur by weight

Ambient Air Quality Standards

The table below presents the national ambient air quality standards (MEWA, 2020) as per the Executive Regulations for Air Quality of the Environmental Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH.

Table A-1 KSA Ambient Air Quality Standards (µg/m³ unless otherwise specified)

Pollutant	Average Period	Executive Regulations (2020)*	
		Standards	Permitted Allowances
Sulphur Dioxide (SO_2)	1 Hour	441	24 times per annum
	24 Hours	217	3 times per annum
	Annual	65	-
Nitrogen Dioxide (NO_2)	1 Hour	200	24 times per annum
	Annual	100	-
Carbon Monoxide (CO)	1 Hour	40,000	Once per annum
	8 Hours	10,000	Twice per annum
Ozone (O_3)**	8 Hours	157	25 days per annum, average calculated over 3 years
Suspended Particulate Matter (<10µm) PM_{10}	24 Hours	340	12 times per annum ***
	Annual	50	-
	24 Hours	35	12 times per annum ***

Pollutant	Average Period	Executive Regulations (2020)*	
		Standards	Permitted Allowances
Suspended Particulate Matter (<2.5µm) $PM_{2.5}$	Annual	15	-
Lead (in suspended particulate Pb) (in TSP)	3 Months	0.15	Average is over 3 months

Notes:

* The values are at a standard temperature of 25°C and atmosphere pressure of 1atm.

** To calculate the ozone (O_3) value for 8 hours and to allocate it to the appropriate day, the following rule shall be applied: The maximum daily concentration of eight hours must be determined by examining the eight-hour operating averages, and it shall be calculated from the data every hour and updated every hour. Each calculated eight-hour average is assigned to the day it ends with. That is, the initial calculation period for any day will be from 5 pm on the previous day to 1 am of the day; the last calculation period for any day is from 4 pm to 12 am.

*** Exceedances calculation: Contributions from natural sources can be assessed through measurements, modelling and remote sensing, then subtract these contributions from the air quality monitoring results. This is how the exceedances are calculated.

The table below provides the applicable standards for air emissions from 'stationary sources'.

Table A-2 Emission Limit Values for Emissions to Air from Stationary Sources

Source	Pollutant	Maximum Values for Emissions
All emissions sources	PM	Opacity level shall not exceed 20% over the normal levels
Stockpiles	PM	Opacity level shall now exceed 10% over the normal levels

B. RfP Requirements

In addition to compliance with the above Saudi Air Regulation and to meet the ground level concentrations, the Project is required to comply with the maximum permissible emission levels stipulated with the RfP Technical Specifications (v5.0) as set out in the table below.

These maximum permissible emission levels are to be met within the specified temperature range between minimum plant load and maximum continuous rating of each gas turbine in combined cycle mode.

Table A-3 Maximum Permissible Stack Emissions

Emission	Unit	Gas turbine and HRSG	
		Gas	Back-up Fuel
NO_X (as NO_2)	mg/Nm^3 (dry, 3% O_2)	18[3)4)]	18 [1)3)5)]
CO	mg/Nm^3 (dry, 3% O_2)	50	50
SO_2	mg/Nm^3 (dry, 3% O_2)	[2)]	[2)]
Smoke Density	Bacharach	2	2
Reference – O_2	Vol.-%	15	15

Notes:

1) NOx emission for Back-up fuel is based on maximum fuel bound nitrogen content of 0.015% by weight.

2) According to sulphur content in the fuel

3) This value of 18 mg/Nm3 (or 9 ppmv) applies for combined cycle operation

4) In case open cycle is implemented, this value may be exceeded up to a value of maximum 50 mg/Nm3 subject to the approval by the competent authorities.

5) In case open cycle is implemented, this value may be exceeded up to a value of maximum 150 mg/Nm3 subject to the approval by the competent authorities.

C. Lenders Requirements

As per IFC requirements (and as outlined in the OECD Common Approaches) the WBG EHS Guidelines are applicable for the Project and establish emissions limits as detailed below for both air emissions and ambient air quality.

Air Emissions

Table A-4 IFC EHS Guidelines for Thermal Power Plants (Draft for Second Public Consultation - May/June 2017) - Air Emissions (mg/m^3 or as indicated)

Pollutant	Combustion Turbine Natural Gas (Unit ≥ 50MWth)	
	Non-Degraded Airshed	Degraded Airshed
Nitrogen Oxides (NOx)	50 (~25ppm)	30 (~15ppm)
Sulphur Dioxide (SO_2)	n/a	n/a
Particulate Matter (PM)	n/a	n/a

Note: Excess Dry Gas O_2 Content (%) = 15

Ambient Air Quality

The WHO ambient air quality standards are adopted by the WBG General EHS Guidelines and are presented in the table below.

Table A-5 WHO Ambient Air Quality Standards (µg/m3 unless otherwise specified)

Parameter	24 hour	Annual
PM_{10}	150 (Interim target 1)	70 (Interim target 1)
	100 (Interim target 2)	50 (Interim target 2)
	75 (Interim target 3)	30 (Interim target 3)
	50 (Interim target 4)	20 (Interim target 4)
	45 (guideline)	15 (guideline)
$PM_{2.5}$	75 (Interim target 1)	35 (Interim target 1)
	50 (Interim target 2)	25 (Interim target 2)
	37.5 (Interim target 3)	15 (Interim target 3)
	25 (Interim target 4)	10 (Interim target 4)
	15 (guideline)	5 (guideline)
NO_2	120 (Interim target 1) 50 (Interim target 2) 25 (guideline	40 (Interim target 1) 30 (Interim target 2) 20 (Interim target 3) 10 (guideline)
SO_2	125 (Interim target 1)	500 (10-minute guideline)
	50 (Interim target 2)	
	40 (guideline)	
O_3	100 (interim target 1) (8-hour daily maximum)	

Parameter	24 hour	Annual
	70 (interim target 2) (8-hour daily maximum)	
	60 (8 hour daily maximum guideline)	

Source: WHO Global Air Quality Guidelines, 2021

For new power plants, as per the IFC EHS Guidelines for Thermal Power Plants (2008), emissions from a single project should not contribute to more than 25% of the ambient air quality standards.

2. Climate Change Impacts & Adaptation

A. National Requirements

The Paris Agreement came into force on 4th November 2016. The KSA signed and ratified the Agreement on 3rd November 2016 (UNTC, 2020). Following the launch of Vision 2030 in 2016, the Kingdom of Saudi Arabia has taken several steps towards a more sustainable future with establishing a number of initiatives to address climate change issue. In 2021, the government inaugurated the Saudi Green Initiative (SGI) which unites environmental protection, energy transition and sustainability programs with the overarching aims of offsetting and reducing emissions, increasing the Kingdom's use of clean energy and addressing climate change.

To deliver KSA's sustainability goals, SGI strives to implement the following[17]:

SGI is steering the implementation of a sustainable long-term climate action plan with three (3) overarching targets to reduce emissions, achieve afforestation, and protect land and sea protection.

The Kingdom has committed to have 50% of its power generated from renewable sources by 2030. Beyond a domestic energy mix transformation, SGI is steering a range of ambitious initiatives that will reduce emissions including investing in new energy sources, improving energy efficiency, and developing a carbon capture and storage program.

<u>Nationally Determined Contribution</u>

The KSA submitted their Nationally Determined Contributions (NDC) [18] to the United Nations Framework Convention on Climate Change (UNFCCC) outlining the actions that would be undertaken in reducing, avoiding and removing GHG emissions by 278 million tons of CO_2eq annually by 2030.

[17] https://www.greeninitiatives.gov.sa/about-sgi/

[18] https://unfccc.int/sites/default/files/resource/202203111154---KSA%20NDC%202021.pdf

To achieve its sustainable development objectives, the KSA is engaging in actions and plans pursuit of economic diversification with the following co-benefits:

- Greenhouse gas emissions avoidance, reduction and removal;
- Climate adaptation; and
- Managing the impacts of response measures.

B. Lenders Requirements

EPFI's

Equator Principles IV establishes that impacts to climate should be avoided where possible, and in support of the 2016 Paris Agreement recognises that EPFIs have a role to play in improving the availability of climate-related information.

Factors including climate change are required to be incorporated into the Project Review and Categorisation (EP1), while a key element of EP IV (under EP2 for Environmental and Social Assessment) is that an assessment of climate change risks is required in an ESIA.

For projects that have Scope 1 & 2 GHG emissions of over 100,000 tonnes of CO_2 equivalent per annum, there are also other requirements linked to alternative analysis and client annual reporting on GHG emissions.

3. Noise & Vibration

A. National Requirements

The KSA standards in the tables below have been referenced from the Executive Regulation for Noise of the Environment Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH, these standards relate to the following:

- Residential and commercial areas (Ambient Noise Standards);
- Roadsides;
- Industrial areas; and
- Construction sites.

The noise standards applied to residential and commercial areas are according to the following classifications:

- Class A: Low-density residential areas as well as attractions and theme parks, areas around hospitals, schools, nursing homes, nurseries and environmentally sensitive areas.
- Class B: Medium-density residential areas.
- Class C: High-density residential areas and areas that include a mix of residential and commercial activities.
- Class D: Commercial areas, including warehouses and financial centres.

It is prohibited to exceed the noise levels standards for residential and commercial areas shown below, except with a permit from NCEC. It should be noted that these standards are applied at the closest receptor location.

Table A-6 Noise Standards for Residential and Commercial Areas

Class	Daytime LAeq, T (dB)	Night LAeq, T (dB)
A – Low-Density Residential Areas	50	40
B – Medium-Density Residential Areas	55	45
C – High Density Residential Areas	60	50
D - Commercial Area	65	55

The table below presents the noise limits for roadsides.

Table A-7 Noise Standard for Roadside

Daytime LAeq, T (dB)	Night LAeq, T (dB)
70	65

The table below presents the noise limits are industrial areas (at the outer boundaries of activities).

Table A-8 Noise Standards for Industrial Area

Daytime LAeq, T (dB)	Night LAeq, T (dB)
70	65

The noise limits for construction sites are presented in the table below.

According to Article 7 of MEWA Executive Regulation for Noise, the noise limits outlined in the table above can be exceeded while carrying out construction works from 7am to 6pm. The exceedance shall be in accordance with the corrective limits presented in the table below.

Table A-9 Corrective Limits of Permissible Noise Levels at Construction Sites

Duration of Construction Activities	Correction of the Permissible Noise Limits LAeq,T (dB)
Up to 2.5 hours	10
2.5 to 8 hours	5
More than 8 hours	0

B. Lenders Requirements

In addition, the IFC General EHS Guidelines require that noise impacts from a project should not exceed the WHO noise standards which are presented in the table below or result in a maximum increase in background levels of 3dB at the nearest off-site point of reception.

Table A-11 WHO Noise Standards (At off-site receptors)

Receptor	One Hour LAeq (dB(A))	
	Daytime (07:00 – 22:00)	Nighttime (22:00 – 07:00)
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

Furthermore, the following requirements have also been specified in the IFC EHS noise guidelines:

- No employee should be exposed to a noise level greater than 85 dB (A) for duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140dB(C).
- The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85dB (A), the peak sound level reaches 140dB(C), or the average maximum sound level reaches 110dB (A). Hearing protective devices provided should be capable of reducing sound level at the ear to at least 85dB (A).
- For every 3dB (A) increase in sound levels, the allowed exposure period or duration should be reduced by 50%.
- Where feasible, use of acoustic insulating materials isolations of the noise source and other engineering controls should be investigated and implemented prior to the issuance of hearing protection devices as the final control mechanism.
- Medical hearing checks on workers exposed to high noise levels should be performed periodically.

4. Terrestrial Ecology

A. National Requirements

Under the Environmental Law and the creation of the National Centres of Environment, the NCW has been established as the responsible authority for the protection and development of wildlife and biodiversity and the planning and management of protected areas. The NCW supersedes the Saudi Wildlife Authority (SWA) and will work with NCEC to develop and implement the national policy for conservation and protection of species and reserve areas. NCEC and NCW has identified conservation areas that require protection and are working to protect and prevent damage to these areas.

Under the Environmental Law, the following Executive Regulations pertaining to flora and fauna have been released:

- Development of Vegetation Cover and Combating Desertification: sets out KSA's commitment to protecting vegetated areas in the Kingdom and promoting their development through the implementation of a greater level of regulation and sustainable management practices
- Logging: sets out KSA's commitment to the regulation of the import, collection (including felling), transfer, storage and commercial sale of firewood and charcoal.
- Hunting terrestrial wildlife species: sets out KSA's commitment to regulating hunting of wildlife animal species and migratory birds. It prohibits the hunting of:
  - The hunting of endangered wildlife animals such as Arabian Leopard, jackal, lynx, sand cat, honey badger, etc
  - The hunting of ungulates such as Arabian Oryx, Goitered gazelle, Idmi gazelle and Nubian Ibex.
  - The hunting of specific species of endemic birds such as Arabian Partridge, Asir Magpie, Yemen Warbler, Arabian Golden Sparrow, Sooty Gull, White eyed gull, etc.
  - The hunting of gestating wildlife animal species or their offspring or tampering with their nests, eggs or habitats are prohibited.

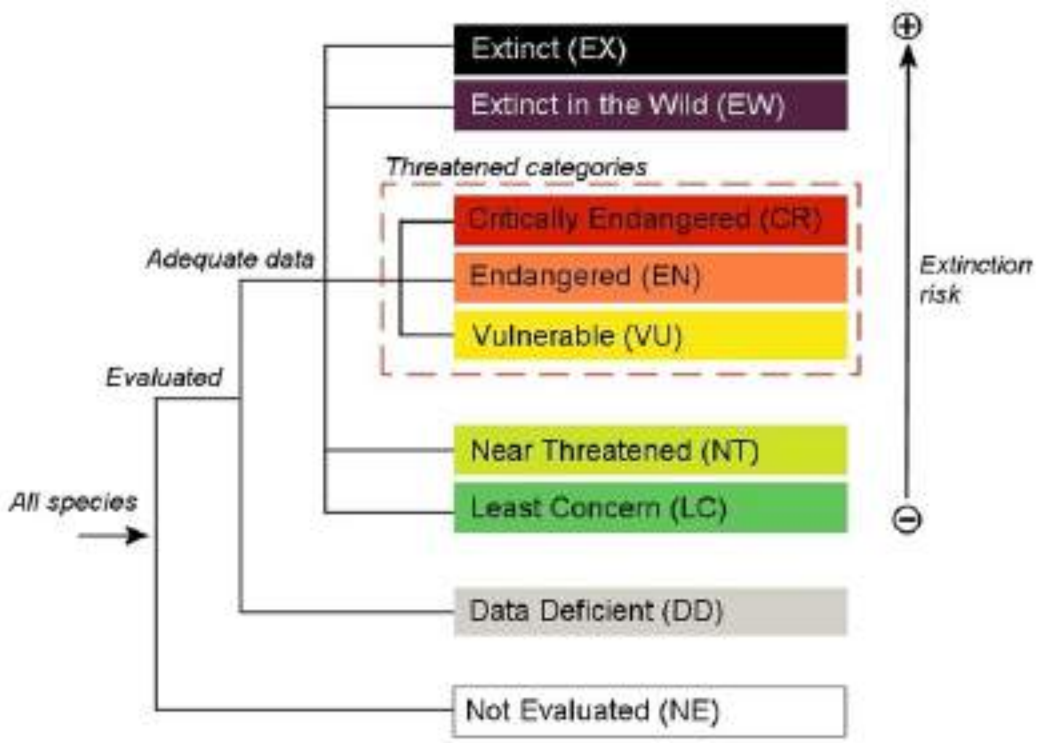
In its commitments to the United Nations Convention of Biological Diversity (UNCBD), KSA has produced a list of species considered to be of High Conservation Priority (HCP), these are commonly used as a de facto protected species list for the purpose of ESIA in KSA.

KSA has two policy documents related to biodiversity: The National Biodiversity Strategy and Action Plan (NBSAP) and the National Protected Area System Plan (NPAS), which together set national targets and a vision for Protected Areas in KSA. The NPAS is the guiding document for KSA to fulfil its obligations regarding in situ conservation under the Convention on Biological Diversity.

In the absence of any national protected species list, two (2) approaches are proposed to classify species of conservation concern for the ESIA; Global Red List published by the International Union for Conservation of Nature (IUCN) and the HCP species.

The IUCN Global Red List which classifies species in accordance with their risk of extinction on a global basis is used. The IUCN Version 3.1 Categories are shown in the figure below.

Figure A-1 IUCN System – Red List Categories



The table below provides further definition of each of the categories listed above

Table A-12 IUCN Extinction Risk Categories

IUCN Extinction Risk	Description
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A

IUCN Extinction Risk	Description
	taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
Not Evaluated (NE)	A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

The HCP species are used in the absence of national legislation covering species protection in KSA, this list was produced in response the requirements of UNCBD and set out in KSA's first letter to the UNCBD. This sets out a number of criterion which relate to both culture and conservation importance of species, as detailed below:

- Criterion 1: Genera, species, or subspecies that are Critically Endangered, Endangered, or Vulnerable (globally, regionally, or nationally); taxa which are locally extinct in the wild may be included, provided that there is an NCWCD policy to reintroduce them;
- Criterion 2 - Genera, species, or subspecies that are endemic to the Arabian Peninsula, the Red Sea, or the Gulf;
- Criterion 3 - Genera, species, or subspecies of which the conservation of populations within Saudi Arabia is essential to the conservation of the taxon (e.g. near-endemics and migrants for which Saudi Arabia represents a critical range);
- Criterion 4 - Relict genera, species, or subspecies that are of global, regional, or national significance;
- Criterion 5 - Genera or species of special ecological importance (i.e. fulfilling a vitally important function in an ecosystem such as providing a key habitat for other species, serving as indicator species, etc.);
- Criterion 6 - Genera of species of significant economic importance; and
- Criterion 7 - Genera or species that serve a "flagship" function (i.e. high-profile species of cultural value, the protection of which will also protect large numbers of other species that share their habitats).

A. Lenders Requirements

EPFI's

The assessment of impacts upon terrestrial ecology will be made with due consideration to IFC Performance Standard 6 on Biodiversity Conservation and Sustainable Natural Resource Management which establishes requirements for protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources.

5. Soil, Geology and Groundwater

A. National Requirements

Soil

The soil quality standards referenced in the table below are from the Executive Regulations for the Prevention and Remediation of Soil Pollution of the Environment Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH. These standards set out the KSA limits of soil quality in terms of defining contamination and quality levels necessary for remediation.

It should be noted that the table below contains the most applicable soils standards from the Regulations based on the Project type. Other standards which are included in the Executive Regulations relating to aliphatic halogen compounds, other organic compounds and radioactive agents have not been included as they are not considered applicable to the Project.

Table A-13 Soil Quality Standards

Chemical substance	Units	Classification of the soil particles size										Remarks
		Coarse soil (>75 micron)					Fine soil (<75 micron)					
		Land use types										
		Natural area	Agricultural	Residential / parks	Commercial	Industrial	Natural area	Agricultural	Residential / parks	Commercial	Industrial	
		Action level										
pH (in 0.01M $CaCl^{2}$)	pH units	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	
Cyanide (free)	mg/kg	0.9	0.9	0.9	8	8	0.9	0.9	0.9	8	8	
Fluoride	mg/kg	2.0	2.0	2.0	2.000	2.000	200	200	200	2.000	2.000	
Sulphur (elemental)	mg/kg	500	500	500	500	500	500	500	500	500	500	
Metals												
Antimony	mg/kg	20	20	20	40	40	20	20	20	40	40	
Arsenic (inorganic) (As)	mg/kg	17	17	17	26	26	17	17	17	26	26	
Barium (non-barite) (Ba)	mg/kg	750	750	500	2,000	2,000	750	750	500	2,000	2,000	
Barite-barium	mg/kg	10,000	10,000	10,000	15,000	14,000	10,000	10,000	10,000	15,000	140,000	
Beryllium (Be)	mg/kg	5	5	5	8	8	5	5	5	8	8	
Boron (saturated phase extract) (B)	mg/kg	3,3	3,3	3.3	5	5	3,3	3,3	3,3	5	5	
Cadmium (Cd)	mg/kg	3,8	1,4	10	22	22	3,8	1,4	10	22	22	
Chromium (hexavalent) (Cr^{+6})	mg/kg	0.4	0.4	0.4	1.4	1.4	0.4	0.4	0.4	1.4	1.4	
Chromium (total)	mg/kg	64	64	64	87	87	64	64	64	87	87	
Cobalt (Co)	mg/kg	20	20	20	300	300	20	20	20	300	300	
Copper (Cu)	mg/kg	63	63	63	91	91	63	63	63	91	91	
Lead (pb)	mg/kg	70	70	140	260	600	70	70	140	260	600	
Mercury (inorganic)	mg/kg	12	606	606	24	50	12	606	606	24	50	
Molybdenum (Mo)	mg/kg	4	4	4	40	40	4	4	4	40	40	
Nickel (Ni)	mg/kg	45	45	45	89	89	45	45	45	89	89	
Selenium (Se)	mg/kg	1	1	1	2.9	2.9	1	1	1	2.9	2.9	
Silver	mg/kg	20	20	20	40	40	20	20	20	40	40	
Thallium (TI)	mg/kg	1	1	1	1	1	1	1	1	1	1	
Tin (Sn)	mg/kg	5	5	5	300	300	5	5	5	300	300	
Uranium (U)	mg/kg	33	23	23	33	300	33	23	23	33	300	

Chemical substance	Units	Classification of the soil particles size										Remarks
		Coarse soil (>75 micron)					Fine soil (<75 micron)					
		Land use types										
		Natural area	Agricultural	Residential / parks	Commercial	Industrial	Natural area	Agricultural	Residential / parks	Commercial	Industrial	
		Action level										
Vanadium (V)	mg/kg	130	130	130	130	130	1360	130	130	130	130	
Zinc (Zn)	mg/kg	200	200	200	360	360	200	200	200	360	360	
Hydrocarbons												
Benzene (C^6H^6)	mg/kg	0.078	0.073	0.073	0.078	0.078	0.046	0.046	0.046	0.046	0.046	Topsoil
Benzene (C^6H^6)	mg/kg	0.078	0.078	0.078	0.078	0.078	0.046	0.046	0.046	0.046	0.046	Subsoil
Toluene (C^7H^8)	mg/kg	0.12	0.12	0.12	0.12	0.12	0.52	0.52	0.52	0.52	0.52	Topsoil
Toluene (C^7H^8)	mg/kg	0.12	0.12	0.12	0.12	0.12	0.52	0.52	0.52	0.52	0.52	Subsoil
Ethylbenzene (C^8H^{10})	mg/kg	0.14	0.018	0.14	0.14	0.14	0.073	0.073	0073	0.073	0.073	Topsoil
Ethylbenzene (C^8H^{10})	mg/kg	0.14	0.14	0.14	0.14	0.14	0.073	0.073	0.073	0.073	0.073	Subsoil
Xylenes (C^8H^{10})	mg/kg	1.9	0.003	1.9	1.9	1.9	0.99	0.99	0.99	0.99	0.99	Topsoil
Xylenes (C^8H^{10})	mg/kg	1.9	1.9	1.9	1.9	1.9	0.99	0.99	0.99	0.99	0.99	Subsoil
Styrene (C^8H^8)	mg/kg	0.8	0.8	0.8	0.8	0.8	0.68	0.68	0.68	0.68	0.68	
F1: C6 to C10	mg/kg	210	24	24	270	270	210	210	2140	320	320	Topsoil
F2: C10 to C16	mg/kg	150	130	130	260	260	150	150	150	260	260	Topsoil
F3: C16 to C34	mg/kg	300	300	300	1,700	1,700	1,300	1,300	1,300	2,500	2,500	Topsoil
F4: C34 to C50	mg/kg	2,800	2,800	2,800	3,300	3,300	5,600	5,600	5,600	6,600	6,600	Topsoil
F1: C6 to C10	mg/kg	420	30	30	440	440	420	420	420	640	640	Subsoil
F2: C10 to C16	mg/kg	300	160	160	520	520	300	300	300	520	520	Subsoil
F3: C16 to C34	mg/kg	600	600	600	3,400	3,400	2,600	2,600	2,600	4,300	4,300	Subsoil
F4 C34 to C50	mg/kg	5,600	5,600	5,600	6,600	6,600	10,000	10,000	10,000	10,000	10,000	Subsoil

6. Groundwater

A. National Requirements

Under the MEWA standards for Protection of Aquatic Media from Pollution, the groundwater standards relate only for groundwater bodies that will be used for drinking water. In the absence of standards for non-drinking water groundwater bodies, the standards as outlined in Appendix B of the Ambient Water Quality Standards PME (2012) have been referenced in the table below.

Table A-14 Standards for Ambient Groundwater Quality

Parameter	Concentration Limit	Parameter	Concentration Limit
BOD	Not available	Carbon tetrachloride	0.005
COD	Not available	Chlorine (residual)	<0.0
Total Oil & Grease	0	Chlorinated hydrocarbons (total)	0.001
TKN (organic N)	5	Chloroform	-
TOC	-	Cyanide (free)	0.001
Phosphorus (total)	0.03	Fluoride	0.2
Phosphorus (PO_4)	-	Furans	$1x10^{-8}$
Ammonia (as NH_3)	0.03	Hexachlorobenzene	0.007
Chloride (as Cl)	-	Lindane	0.0002
Total inorganic nitrogen (as NO_2 & NO_3)	30	Mirex	$1x10^{-8}$
Sodium	150	MTBE	0.02
Sulphate	-	PAHs	0.0002
Sulphide	0.002	PCB	$1.9x10^{-8}$
Aluminium	0.2	Pentachlorophenol	0.0005
Arsenic	0.005	Aldrin	$2.2x10^{-8}$
Barium	1	Chlordane	0.002
Cadmium	0.005	DDT	$1.7x10^{-5}$
Chromium (total)	0.1	Dieldrin	$4x10^{-8}$
Chromium (hexavalent)	0.005	Endrin	0.001
Cobalt	0.05	Heptachlor	0.0004
Copper	0.05	Toxaphene	0.002
Iron	0.2	Phenols	0.005
Lead	0.005	Dioxins	$3x10^{-8}$
Manganese	0.1	Toluene	0.002
Mercury	0.001	TPH	0.2
Nickel	0.02	Vinyl chlorides	0.001
Silver	0.1	Xylenes	0.005
Zinc	0.02	E coli	<10 (count / 100ml)

B. Lenders Requirements

EPFI's

IFC Performance Standard 3 on 'Resource Efficiency and Pollution Prevention' requires the client and/or the Project to:

- Avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; and
- Prevent the release of pollutants to water and land due to routine, non-routine, and accidental circumstances, or when not feasible, minimize and/or control the intensity and mass flow of their release.

7. Ambient Marine Water Quality

A. National Requirements

Table 14 below presents the national standards for coastal waters that are applicable to the Project as outlined in the Implementing Regulations for Protection of Water Resources from Pollution issued by Royal Decree No. M/165 dated 19/11/1441 AH. The coastal water standards set out in the Implementing Regulations contain three (3) categories:

- **Normal/Public:** Coastal waters including the territorial sea and the adjacent and exclusive economic zone (EEZ) of KSA. All coastal waters are classified under this unless they meet the definitions of 'High Value' or 'Industrial' as outlined below.
- **High Value**: Coastal waters that have been declared protected areas locally or internationally by any competent authority (including but not limited to the National Centre for Wildlife Development and/or the Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA).
- **Industrial**: Coastal waters located near areas classified as industrial zones or in unclassified area with industrial activities

For the purpose of this Project, given that the ROP 1 is located outside of the SEZ boundary, the 'Industrial' standards are expected to be applied.

Table 14 Ambient Water Quality (Coastal)

Parameter	Unit	Coastal Water		
		Normal	High Value	Industrial
Physico- Chemical				
Temperature Differences Δ (*)	°C	3	2	4
Total Dissolved Solids (TDS)	mg/l	Normal level (**)	Normal level	Normal level
Turbidity	NTU	3	2	5
Salinity	%	Δ0	Δ0	Δ3
pH (***)	-	6.5-8.5 Δ0.2	6.5-8.5 Δ0.1	6.5-8.5 Δ0.3
Dissolved Oxygen (DO)	mg/l	Min.: 5	Min.: 5	Min.: 5
Chemical Indicators, Nutrients, Metals, Organics & Inorganics				
Aldrin	mg/l	2.2x10-6	2.2x10-6	2.2x10-6
Aluminium	mg/l	0.2	0.2	1

Parameter	Unit	Coastal Water		
		Normal	High Value	Industrial
Ammonia	mg/l	0.1	0.05	1
Arsenic	mg/l	0.05	0.05	0.069
Barium	mg/l	0.5	0.5	1
Benzene	mg/l	0.05	0.05	0.05
BOD	mg/l	15	10	20
Cadmium	mg/l	0.008	0.008	0.04
Calcium	mg/l	Normal level	Normal level	Normal level
Carbon Tetrachloride	mg/l	0.001	0.001	0.001
Chlordane	mg/l	4x10-6	3.2x10-7	0.00009
Chloride	mg/l	Normal level	Normal level	Normal level
Chlorine	mg/l	0.0075	0.0075	0.013
Chloroform	mg/l	0.13	0.13	0.13
Cobalt	mg/l	0.05	0.05	1
COD	mg/l	25	20	40
Copper	mg/l	0.003	0.003	0.0135
Cyanide (free)	mg/l	0.001	0.001	0.001
DDT	mg/l	1.7x10-5	1.7x10-5	1.7x10-5
Dieldrin	mg/l	4x10-6	4x10-6	4x10-6
Dissolved Oxygen (DO)	mg/l	Min.: 5	Min.: 5	Min.: 5
Endrin	mg/l	6x10-6	6x10-6	6x10-6
Fluoride	mg/l	1.5	1.5	1.5
Furans	mg/l	1x10-6	1x10-6	1x10-6
Heptachlor	mg/l	5x10-6	5x10-6	5x10-6
Hexachlorobenzene	mg/l	2.9x10-7	2.9x10-7	2.9x10-7
Iron	mg/l	0.5	0.1	1
Lead	mg/l	0.008	0.005	0.21
Manganese	mg/l	0.01	0.01	0.1
Mercury	mg/l	0.0004	0.0004	0.0001
Mirex	mg/l	1x10-6	1x10-6	1x10-6
Methyl tert-butyl ether (MtBE)	mg/l	5	5	5
Nickel	mg/l	0.05	0.05	0.2
Oils & Grease	mg/l	2	Max.: 1	3
Polycyclic Aromatic Hydrocarbons (PAH)	mg/l	0.003	0.003	0.003
Polychlorinated Biphenyls (PCBs)	mg/l	1.9x10-6	1.9x10-6	1.9x10-6
Pentachlorophenol	mg/l	0.00004	0.00004	0.005
pH (2)	pH	6.5-8.5 Max.: 0.2Δ	6.5-8.5 Max.: 0.1Δ	6.5-8.5 Max.: 0.3Δ
Total Petroleum Hydrocarbons	mg/l	0.3	0.2	0.5
Phenols	mg/l	0.05	0.05	0.1
Silvex (2,4,5-TP)	mg/l	-	-	-

Parameter	Unit	Coastal Water		
		Normal	High Value	Industrial
Total Organic Carbons (TOC)	mg/l	10	10	15
Salinity	%	0	0	3
Selenium	mg/l	0.071	0.071	0.29
Silver	mg/l	0.0019	0.0019	0.2
Sodium	mg/l	Normal level	Normal level	Normal level
Sulfate	mg/l	Normal level	Normal level	Normal level
Sulfide	mg/l	0.002	0.002	1
TCDD	mg/l	3x10-8	3x10-8	3x10-8
Toluene	mg/l	0.002	0.001	0.002
Toxaphene	mg/l	2x10-7	2x10-7	2.1x10-5
Trichloroethane	mg/l	0.01	0.01	0.01
Vinyl Chloride	mg/l	0.002	0.002	0.002
Xylenes	mg/l	0.005	0.005	0.005
Zinc	mg/l	0.08	0.08	0.09
Microbial				
Cyanobacteria	mg/l	5,000	5,000	5,000
E coli	Count/100ml	<500	<250	<500
Intestinal enterococci	Count/100ml	<200	<100	<200

*Temperature Differences (ΔT)

- It is the maximum temperature differences between the mixing zone - measured at the boundaries of the mixing zone determined according to Annex (5) to this regulation - and the waters adjacent to the mixing zone - measured outside the industrial coastal waters where the mixing zone is located, for example, in the public or the nearby high value coastal waters - and in the event that the mixing zone is located in non-industrial coastal waters, the temperature differences between the source of the discharge directly and the boundaries of the mixing zone are measured. The Center may also propose other standards for measuring the differences between temperatures in the ambient waters for approval by the ministry.

**Normal level:

- The normal level of concentration of the component in the ambient nature, that is not affected by any human activity. **Note:** The normal level does not have to be lower than the levels considered safe for human life or wildlife.

***pH differences

- The maximum pH differences between the mixing zone - measured at the boundaries of the mixing zone determined according to Annex (5) of the Implementing Regulation- and the waters adjacent to the mixing zone - measured outside the industrial coastal waters where the mixing zone is located, for example, in the public or the nearby high value coastal waters - and in the event that the mixing zone is located in non-industrial coastal waters, the pH differences between the source of the discharge directly and the boundaries of the mixing zone are measured. NCEC may also propose other standards for measuring the differences between pH in the ambient waters for approval by the ministry.

B. Lenders Requirements

General Environmental, Health and Safety Guidelines for Water and Sanitation projects (IFC, 2007), which includes desalination projects, provides the most relevant project specific guidance for this project. The applicable IFC Performance Standards are described else in this Appendix.

8. Solid Waste and Wastewater

A. National Requirements

Wastewater

The table below presents the national standards for wastewater prior to discharge as outlined in the Executive Regulations for Protection of Aqueous Media from Pollution issued by Royal Decree No. M/165 dated 19/11/1441 AH. It also consists of the allowable effluent levels for treated sanitary wastewater as per the Project RfP.

Table A-15 Permissible Limits for Wastewater Discharges

Parameter	Unit	Average Period	Allowable Discharge Limit to Soils/Land
Physical Chemistry			
Floating Matter	-	-	None
Temperature	Δ°C	Sample	Normal Level**
pH	pH units	Sample	6 - 8.4
Turbidity	NTU	Sample	5
Total Suspended Solids (TSS)	mg/l	30 Days	35
Total Dissolved Solids (TDS)	mg/l	Sample	2000
Heavy Metals			
Aluminium (Al)	mg/l	Annual Average of Monthly Sample	5
Arsenic (As)	mg/l	Annual Average of Monthly Sample	0.1
Barium (Ba)	mg/l	Annual Average of Monthly Sample	-
Beryllium (Be)	mg/l	Annual Average of Monthly Sample	0.1
Boron (B)	mg/l	Annual Average of Monthly Sample	0.75
Cadmium (Cd)	mg/l	30 Days	0.1
Chromium (Cr)	mg/l	Annual Average of Monthly Sample	0.1
Cobalt (Co)	mg/l	Annual Average of Monthly Sample	0.05
Copper (Cu)	mg/l	Annual Average of Monthly Sample	0.4
Iron (Fe)	mg/l	30 Days	-
Iron (Pb)	mg/l	Annual Average of Monthly Sample	5
Lead (Pb)	mg/l		0.1

Parameter	Unit	Average Period	Allowable Discharge Limit to Soils/Land
Lithium (Li)	mg/l	Annual Average of Monthly Sample	2.5
Manganese (Mn)	mg/l		0.2
Mercury (Hg)	mg/l	Annual Average of Monthly Sample	0.001
Nickel	mg/l	Annual Average of Monthly Sample	0.2
Selenium	mg/l	30 Days	-
Selenium	mg/l	Annual Average of Monthly Sample	0.02
Vanadium	mg/l	Annual Average of Monthly Sample	0.1
Zinc	mg/l	Annual Average of Monthly Sample	2
Organics and Inorganics			
Chlorine (residual)	mg/l	Sample	(0.1 – 0.5)
Cyanide	mg/l	-	0.05
Fluoride	mg/l	Annual Average of Monthly Sample	1
Phenols (Total)	mg/l	Annual Average of Monthly Sample	0.002
Total Organic Carbon (TOC)	mg/l	-	50
Total Kjeldahl Nitrogen	mg/l	-	5
Biochemical Oxygen Demand (BOD)	mg/l	30 Days	25
Chemical Oxygen Demand (COD)	mg/l	30 Days	150
Dissolved Oxygen (DO)	mg/l	Sample	Normal Level
Oil & Grease	mg/l	Sample	0
Nitrate Nitrogen (NO_3, N)	mg/l	30 Days	15
Phosphate (PO_4)	mg/l	30 Days	30
Ammonia (as NH_3)	mg/l	30 Days	1
Total Chlorinated Hydrocarbons	mg/l	-	0.1
Microbiological			
Total Coliform Bacteria	Count/100ml	30 Days	2,000
Viable Nematode Egg	-	30 Days	1

* Temperature Differences:

- In cases of cooling water suction and discharge: It is the maximum temperature differences between the cooling water being drawn (suction) and discharged (discharge).
- In cases of discharging treated wastewater: It is the maximum temperature differences between the treated wastewater being discharged and the boundaries of the mixing zone in the ambient water, according to Annex (5) to this regulation. The Centre may propose standards for measuring temperature differences for treated wastewater according to coastal and marine water categories and their characteristics for approval by the Ministry.

** Temperature Differences:

- Normal level: The normal level of concentration of the component in the ambient nature, that is not affected by any human activity. Note: The normal level does not have to be lower than the levels considered safe for human life or wildlife.
- (1) Temperature Differences: It is the maximum temperature differences between the treated wastewater being discharged and the receiving water. The Center shall propose standards for measuring the temperature differences of treated wastewater according to the types of surface water (sewage, lakes, or others) and their characteristics for approval by the Ministry.

***Provided that the temperature does not exceed 40°C in any section of the water body within 15m from the discharge location.

Appendix 4 of the Executive Regulations outlines treatment levels dependent on the activity. The level of treatment based on the type of discharge to the soil and land are shown in the tables below.

Table A-16 Wastewater Treatment Techniques

Treatment Level	Parameters to be removed	Example of treatment Process
A – Pre-treatment	Solids	Filtering solids
B – Primary Treatment	Solids as well as easily precipitated materials	Primary filtration
C – Secondary Treatment	Most solids and Biological Oxygen Demand (BOD)	Biological treatment, chemical treatment, ponds
D – Removing Nutrients	Nutrients after removing solids	Biological and chemical treatment
E - Disinfection	Bacteria and viruses	The use of ultraviolet rays, chlorination treatment

Table A-17 Discharge of Injection Options for Treated Wastewater

Discharge or injection options for treated wastewater	Minimum level of treatment	Recommended Level of Treatment
Discharge of treated wastewater to the soil/ lands		
Evaporation Ponds	C	C
Irrigation: - Agricultural Land - Irrigated green spaces - Injection into Groundwater	C	C, E
Leak to: - Natural Soil - Groundwater	C	C, D

B. Lenders Requirements

Waste

International financial institutions providing project finance will require adherence with the WBG/ IFC General EHS Guidelines. With regard to waste, these guidelines require that projects:

- Establish waste management priorities at the outset of activities.
- Identify EHS risks and impacts with regards to waste generation and its consequences.
- Establish a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.

- Avoid or minimize the generation waste materials, as far as practicable.
- Identify where waste generation cannot be avoided but can be minimized or where opportunities exist for, recovering and reusing waste.
- Where waste cannot be recovered or reused, identify means of treating, destroying, and disposing of it in an environmentally sound manner.

Where waste cannot be recovered or reused, identify means of treating, destroying, and disposing of it in an environmentally sound manner.

With regards to hazardous waste, IFC PS 3 requires the following:

- Adoption of GIIP for environmentally sound disposal while adhering to the limitations applicable to its transboundary movement; and
- When hazardous waste disposal is conducted by third parties, the PS requires the use of contractors that are reputable and legitimate enterprises, licensed by the relevant government regulatory agencies and obtain chain of custody documentation to the final destination. Also, the PS requires companies to ascertain whether licensed disposal sites are being operated to acceptable standards and where they are. Where this is not the case, companies should reduce waste sent to such sites and consider alternative disposal options, including the possibility of developing their recovery or disposal facilities at the project site.

Wastewater

The IFC/WBG General EHS Guidelines establish general requirements for direct or indirect discharge of wastewater from utility operations or storm water to the environment.

'Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or storm water should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment'.

However, wastewater effluent pollutant limits are only established for sanitary wastewater for discharge to the sanitary sewer systems. The following table provides the indicative values for treated sanitary wastewater effluent limits as established by the World Bank General EHS Guidelines (2007) (ref. Table 1.3.1 of IFC EHS Guidelines).

Table A-18 Indicative Values for Treated Sanitary Sewage Discharges

Pollutants	Units	Guideline Value
pH	pH Units	6 – 9
BOD	mg/l	30
COD	mg/l	125
Total Nitrogen	mg/l	10
Total Phosphorus	mg/l	2
Oil and Grease	mg/l	10
Total Suspended Solids	mg/l	50
Total Coliform Bacteria	MPN/100ml	400

9. Archaeology & Cultural Heritage

A. National Requirements

The Ministry of Tourism is responsible for the protection of the Kingdom's tourism, archaeological and heritage resource. The Minstry is responsible for the preservation, development and maintenance of artefacts and for enabling tourism's contribution to cultural and economic development. The Ministry has an absolute right to conduct archaeological investigations and determine best approaches for protection of resources within project developments.

B. Lenders Requirement

In accordance with the Equator Principles, the assessment will refer to applicable IFC Performance Standards on Social and Environmental Sustainability, specifically with due consideration of Performance Standard 8 – Cultural Heritage. PS8 aims to protect the adverse impacts of project activities and support its preservation and to promote equitable sharing of benefits from the use of cultural heritage.

Cultural heritage in this standard refers to:

- Tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values;
- Unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and
- Certain instances of intangible forms of culture are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.

10. Landscape and Visual Amenity

Specific KSA and Lender legislation regarding landscape and visual conditions does not exist however it is proposd to undertake the impact assessment with reference to the guidelines set out by the UK Landscape Institute 'Guidelines for Landscape and Visual Impact Assessment 3rd Edition' (2013). As such, the 'Landscape and Visual Assessment' assessment will distinguish between:

- Effects on landscape as a resource in its own right; and
- Effects on specific views and general visual amenity experienced by people.

11. Traffic & Transportation

A. Lenders Requirements

The assessment will be undertaken with due consideration of the recommendations set out within the IFC General EHS Guidelines Section 3.4 Traffic Safety, within Section 3: Community Health and Safety.

12. Socio-economic

A. Lenders Requirements

Several of the IFC Performance Standards have elements that relate to socio-economics. Key requirements for the assessment of socio-economic impacts are outlined in IFC Performance Standard 1 on Assessment and Management of Environmental and Social Risks and Impacts, Performance Standard 2 on Labour and Working Conditions and IFC Performance Standard 4 on Community Health, Safety and Security.

IFC PS 1 standard establishes requirements for the assessment of social risk and impacts associated with the project while IFC PS 2 & 4 establish requirements for the safeguard of the workforce and local community from potential risks associated with the project including impacts associated with introduction of communicable disease, loss of ecosystem function, site access and operation, material use etc.

13. Community Health, Safety & Security

A. National Requirements

Chapter 7 of the new Environmental Law 2020 includes the provisions of the Ministry for emergency planning; 'The Minister may take the necessary procedures and measures in response to any environmental emergency disaster or imminent danger related to the environment, as well as taking the necessary procedures and measures to prevent any of them from getting worse, in coordination with the relevant authorities.'. In addition, the Implementing Regulations for Environmental Permits for the Construction and Operation Activities requires the preparation of a project-specific emergency preparedness and response plan.

B. Lenders Requirements

The project lenders will require compliance with IFC Performance Standard 4: Community Health, Safety and Security. The objectives of IFC PS4 are to:

- To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances.
- To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

The project will therefore need to ensure:

- Suitable design of the facility and related infrastructure to ensure safe operation.
- Minimising the potential for community exposure to hazardous materials and substances that may be released by the project.
- Consideration of any third-party impacts to project emergencies and disaster scenarios (or vice versa impacts form external sources to the project), including preparing emergency response plans.
- Appropriate training of security personnel employed by the projects, including appropriate consideration of hiring protocols, training of staff, code of conduct, provision of weapons and weapons protocols.

IFC PS4 also has considerations for impacts to ecosystem services, however the project is not expected to impact such ecosystem services.

Equator Principles Guidance on Implementation of the Equator Principles During the Covid-19 Pandemic

The guidance recommends that the borrower should:

- Review potential risks on local communities, including direct and indirect impacts of COVID-19 and other impacts relating to worker interfaces and how any Project changes during this period might affect the community.
- Assess its mitigation approach to Project-related impacts.

- Identify opportunities to support communities mitigate wider COVID-19 risks/impacts either through new initiatives or building on existing programmes i.e. provision of food for vulnerable people in isolation, test kits medical facilities and equipment etc.

14. Labour & Working Conditions

A. National Requirements

Saudi Labour law is governed by:

- Royal Decree No. M/51 (23 Sha'ban 1426 / 27th September 2005).

The labour law includes terms and conditions of employment in Saudi Arabia required by employers and includes details of worker rights.

The Ministry of Labour ("MOL") approved amendments to the Labour Law on 5th April 2015 (Resolution No. 258), which was first published in the official gazette on 24th April 2015.

Currently, the Ministry of Human Resources and Social Development is the governing ministry in Saudi Arabia responsible for providing development, support, and protection for the Kingdom's community at large. It was established after the merging of the Ministry of Labour and Social Development with Ministry of Civil Service.

Human Rights

The Ministry of Human Resources and Social Development is the governing ministry in KSA responsible for providing development, support, and protection for the Kingdom's community at large. It was established after the merging of the Ministry of Labour and Social Development with the Ministry of Civil Service. Furthermore, the Kingdom established the Human Rights Commission, via Cabinet Resolution No. 207 of 8 Shaban 1426H (12 September 2005). The Human Rights Commission aims to protect and promote human rights in accordance with international standards.

Section 26 of the Basic Law of Governance states the Government is responsible for protecting human rights in accordance with the Shari'a Law that governs the country. Human Rights treaties ratified by the Kingdom include (according to Treaty Body Database, 2020 and the official website of the Kingdom's Human Rights Commission) :

- Convention against Torture and Other Cruel Inhuman or Degrading Treatment or Punishment (23 September 1997);
- Convention on the Elimination of All Forms of Discrimination against Women (7 September 2000);
- International Convention on the Elimination of All Forms of Racial Discrimination (23 September 1997);
- Convention on the Rights of the Child (26 January 1996);
- Optional Protocol to the Convention on the Rights of the Child on the involvement of children in armed conflict (10 June 2011):
- Optional Protocol to the Convention on the Rights of the Child on the sale of children child prostitution and child pornography (18 August 2010);

- Convention on the Rights of Persons with Disabilities (24 June 2008);
- The Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, (2007) (the implementation of which is monitored by The Standing National Committee to Combat Trafficking in Persons, established pursuant to Council of Ministers Decision No. 244 of 20 Rajab 1430H (13 July 2009));
- The Cairo Declaration on Human Rights in Islam (1990);
- The Riyadh Declaration on Human Rights in Peace and War (2003);
- The Covenant on the Rights of the Child in Islam (2006);
- The Arab Charter of Human Rights (2009); and
- The Geneva Convention (18 May 1963).

In addition, KSA is an ILO member state and has ratified 16 ILO Conventions.

B. Lenders Requirement

The following applicable IFC Performance Standards aim to identify and ensure that social and economic impacts of a project are addressed in the relevant areas, in particular:

- Performance Standard 2: Labour and Working Conditions;
    - Equal opportunity and non-discriminatory HR Policies and procedures appropriate to the size of the workforce.
    - Provision of clearly documented terms of employment and worker rights to all staff; including sub-contractor staff.
    - Provision of suitable labour accommodation (in accordance with the provisions of IFC & EBRD Guidelines on Worker Accommodation).
    - Implementation of a robust Occupational Health & Safety plan; and
    - Implementation of a grievance mechanism to ensure internal grievances can be raised in an easily accessible, understood and transparent process.

In accordance with IFC Performance Standard 2 (Labour and Working Conditions) there is a requirement to align with the following conventions:

- ILO Convention 29 on Forced Labour;
- ILO Convention 105 on the Abolition of Forced Labour;
- ILO Convention 138 on Minimum Age (of Employment);
- ILO Convention 100 on Equal Remuneration;
- ILO Convention 111 on Discrimination (Employment and Occupation); and
- UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families.

Human Rights Requirements

In line with EP IV requirements, the United Nations Human Rights Guiding Principles (HRGP) apply to the Project. HRGP II on “The corporate responsibility to respect human rights” recognises that it is the responsibility of businesses and corporations to respect human rights. It is a global standard of expected conduct for all business enterprises wherever they operate. It exists independently of a State’s ability and/or willingness to fulfil its human rights obligations and does not diminish those obligations. The foundational principles to take into consideration are (Guiding Principles on Business and Human Rights, 2011):

- Principle 11: Business enterprises should respect human rights. Business enterprises should avoid infringing on the human rights of others and should address adverse human rights impacts with which they are involved;
- Principle 12: The responsibility of business enterprises to respect human rights refers to internationally recognized human rights – understood, at a minimum, as those expressed in the International Bill of Human Rights and the principles concerning fundamental rights set out in the International Labour Organization's Declaration on Fundamental Principles and Rights at Work;
- Principle-13: The responsibility to respect human rights requires that business enterprises avoid causing or contributing to adverse human rights impacts through their activities, and address such impacts when they occur;
- Principle-14: The responsibility of business enterprises to respect human rights applies to all enterprises regardless of their size, sector, operational context, ownership and structure. Nevertheless, the scale and complexity of the means through which enterprises meet that responsibility may vary according to these factors and with the severity of the enterprise's adverse human rights impacts; and
- Principle-15: Business enterprises should have policies and processes appropriate to their size and circumstances in place.

The following Operational Principles should also be taken into consideration.

- Principle 16: Policy commitment;
- Principle 17 to 21: Human rights due diligence;
- Principle 22: Remediation; and

Principle 23: Issues of Context

Appendix D – AL-HARTANY's NCEC Certificate

Appendix E – Continuous Air Quality Survey Results

Appendix F – Noise Monitoring Results

Appendix G – Soil Quality Lab Analysis

Appendix H – Air Quality Modelling Report

Appendix I – Noise Modelling Report

Appendix J – Marine Survey Report

Appendix K – Marine Modelling Report

Appendix L – Project Layout

Appendix M – Hydrology and Flood Risk Study