50MW Photovoltaic Power Plant
Risha, Jordan

Volume 2: Environmental and Social Impact Assessment

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ACWA Power

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CONTENTS

LIST OF ABBREVIATIONS

Abbreviation	Meaning
As	Arsenic
BAT	Best Available Techniques
BMP	Best Management Practice
BOOT	Build, Own, Operate and Transfer
BOP	Balance of Plant
BS	British Standards
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CCR	Central Control Room
CCCW	Closed Circuit Cooling water
Cd	Cadmium
CESMP	Construction Environmental Social Management Plan
CN	Cyanide
CO	Carbon Monoxide
CO2	Carbon Dioxide
Cr	Chromium
Cu	Copper
DA	Degraded Airshed
dB(A)	A-weighted decibels
dB(C)	C-weighted decibels
ESMP	Environmental and Social Management Plan
EMS	Environmental and Social Management System
EPs	Equator Principles
EPC	Engineering, Procurement and Construction
EPFIs	The Equator Principle Financial Institutions
Hg	Mercury
IFC	International Finance Corporation
Laeq	A-weighted Equivalent Continuous Sound Level
Lamax	A-weighted Maximum Sound Level
MSDS	Material Safety Data Sheet
NEXI	Nippon Export & Investment Insurance
Ni	Nickel
NOx	Nitrogen Oxides
NO_2	Nitrogen Dioxide
O_2	Oxygen
OECD	The Organisation for Economic Co-operation and Development

Abbreviation	Meaning
OESMP	Operational Environmental and Social Management Plan
O&M	Operation and Maintenance
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometers.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometers.
RT	Radiographic Testing
Se	Selenium
ESIA	Environmental and Social Impact Assessment
SO_2	Sulphur Dioxide
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compounds
WHO	World Health Organisation
WWTP	Wastewater Treatment Plant
Zn	Zinc
5 Capitals	5 Capitals Environmental and Management Consulting

1 INTRODUCTION

ACWA Power intends to develop a 50MW (61.3MWpeak) Photovoltaic (PV) Power Plant (the 'Project') on land adjacent to the existing Risha Gas Power Plant in Mafraq Governorate, Risha, Jordan. The Project will generate 50MW of renewable electric power to be connected to the national electrical grid in Jordan.

The following document comprises the Environmental and Social Impact Assessment (ESIA) specific to the proposed Project pursuant to the EIA requirements of the Jordanian Ministry of Environment (MoEnv) and international lenders who will provide project financing, which includes the European Bank for Reconstruction and Development (EBRD). It is recognised that The International Finance Corporation (IFC) is a shareholder in ACWA Power and as such, this ESIA has also been prepared with consistency to IFC environmental and social requirements.

5 Capitals Environmental & Management Consulting (5 Capitals) has been appointed by ACWA Power to undertake the ESIA in order to gain project approval locally from the MoEnv, as well as ensuring that the project can demonstrate compliance with the necessary requirements for project finance lending. To ensure applicability with the local Jordanian requirements for ESIA, 5 Capitals has partnered with local consultant 'ECO Consult' who are a registered environmental consultant in Jordan.

1.1 Project Information

Table 1-1 Project Information and ESIA Team

Project Title	50MW Photovoltaic Power Plant – Risha, Jordan
Project Developer	ACWA Power
Point of Contact	Claire Guesdon, Business Development Manager Email: cguesdon@acwapower.com
Environmental Consultant	5 Capitals Environmental and Management Consulting, Dubai (UAE) ECO Consult, Amman (Jordan)
Point of Contact	Ken Wade, Director Environmental Planning Email: ken.wade@5capitals.com

Table 1-2 Key Project Parties and Main Project Agreements

Project Developer	ACWA Power
Project Company	Risha For Solar Power Projects PSC (Al-Risha Li Mashreea' Al Taqa Al Shamsia PSC).
EPC Contractor	Sterling & Wilson
Operation & Maintenance Company	Central Electricity Generating Company (CEGCO)
Off-taker	NEPCO

Power Purchase Agreement (PPA)	Power Purchase Agreement of 20-year Term, between the Project Company and NEPCO.
Transmission Connection Agreement (TCA)	Transmission Connection Agreement of 20-years between the Project Company and NEPCO.
Land Use Agreement	CEGCO has been granted by the Land Department of Jordan the right to use 200Ha of land for the development of a Solar PV/Wind power plant. Symbolic lease of JoD 8,000 per annum.

1.2 Project Location

The Proposed Project is to be located adjacent to the existing Risha Gas Power, approximately 370km east of Amman in the Mafraq Governorate. The site location is 4km away from the Jordanian/Iraqi border. The site is isolated and at least 15km away from the nearest semi-permanent residences located to the north on highway 10 (Amman to Baghdad Road).

The location of the project in the northern extent of Jordan is key for the proposed PV Plant due to the high levels of solar radiation in this region. As such, the development of this technology provides an opportunity for maximising natural renewable resources that can contribute to Jordan's energy diversification and sustainable development.

Figure 1-1 Project Location within Jordan

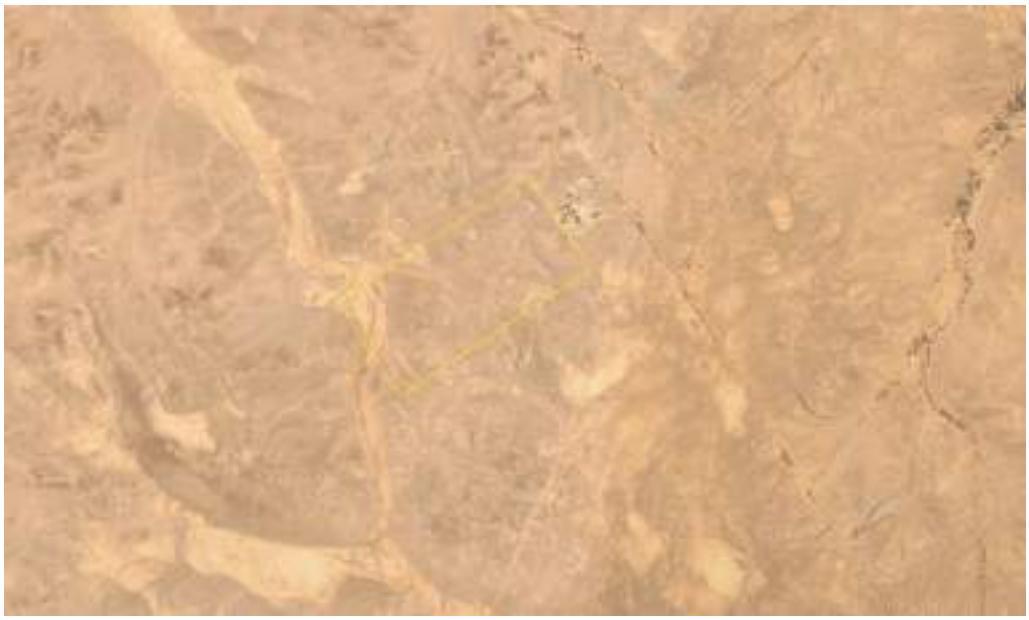
Satellite Image Source: Google Earth

Table 1-3 Approximate Project Coordinates

Plot Boundary	Northing (DMS)	Easting (DMS)
Northern Corner	32°34'5.07"	39°0'46.40"
Eastern Corner	32°34'32.11"	39° 0'24.72"
Southern Corner	32°33'28.57"	38°59'43.01"
Western Corner	32°33'55.60"	38°59'21.32"

The project site is situated adjacent to the south west boundary of the existing Risha Gas Power Plant. The existing power plant consists of five 30MW gas turbine units, generating electricity for transmission via the on-site substation and direct grid connection.

Figure 1-2 Project Location in Relation to Existing Gas Fired Plant



At present, it is understood that the facility is generating 60MW. The Risha gas power plant also includes an accommodation, recreation and dining area for operational CEGCO staff, who typically work on weekly shift patterns and are bussed to and from Amman.

1.3 Project Rationale

The Project will be developed in response to the increasing demand for electricity in Jordan, which is rising at an annual rate of 7.4%.

The Project will also provide an element of relief to Jordan's high dependence on imported fossil fuels. It will therefore support energy diversification and sustainable development in Jordan providing power directly to the baseload, whilst improving Jordanian energy security.

The Project will also contribute towards meeting Jordan's Renewable Energy policy target of 10% renewables in the energy mix by 2020 in line with the Ministry of Energy and Mineral Resources

(MEMR's) Energy Strategy. The Energy Strategy sets out the plan of action to meet and accommodate the rising demand for energy within Jordan between 2008 and 2020.

The project is in accordance with the 'Renewable Energy & Energy Efficiency Law' (Law No.13 of 2012), which has the following key goals:

- Exploiting renewable energy sources to increase the percentage share of renewables within the energy mix and diversification;
- Contributing to environmental protection and to assist in achieving sustainable development, including the reduction of greenhouse gas emissions; and
- Developing in country expertise in regard to Renewable Energy.

1.4 Project Alternatives

1.4.1 Location

The Land was attributed to ACWA Power by the Jordanian Department of Lands and Survey under the condition that the land would be used for a wind or a solar PV plant. After the first phase of evaluation, it appeared that Wind farms would not be able to reach as competitive a tariff as the Solar PV at Risha. Therefore the Solar PV plant was chosen as the most suitable form of renewables for the site.

The Site is located adjacent to existing overhead transmission lines as well as an existing substation. The location is also in an area that provides some of the highest levels of solar radiation in this region, maximising the efficiency of any solar photovoltaic project.

1.4.2 Technology

As a renewable energy project, the proposed PV technology is particularly attractive in comparison to fossil fuels and will contribute to meeting the Jordanian renewable energy targets, whilst ensuring that greenhouse gas emissions from energy production are minimised.

The type of PV Panel technology is from Tier 1 manufactures and are suitable for the sites temperatures and conditions. The only other alternative to the project is a 'no project' scenario which could result in energy deficiency for the country, and potentially increased demand for imports or fossil fuels with various associated environmental impacts.

1.5 ESIA Objectives

The following ESIA document has a number of objectives in relation to its preparation, use and application for the project. Objectives include the following:

- Identification of how the project complies with Jordanian Regulations and environmental standards;

- Identification of how the project compiles with EBRD requirements and relevant international standards;
- Identification of how the project complies with International Treaties and Conventions to which Jordan, is a signatory;
- The recording of baseline conditions prior to development at the site;
- The assessment of potential environmental impacts relating to the construction, commissioning and operational phases of the project;
- Ensuring that potential impacts are avoided or minimised through design and planning and the recommendation of mitigation and/or management measures;
- Consultation with stakeholders and the affected parties including public bodies and local populations regarding the project;
- Exploration of alternatives that can be used for the project leading to greater social and environmental gains.

1.6 ESIA – Key Team

The team of specialists that have provided input to the ESIA process are identified in the table below. This team has been selected according to relevant knowledge and experience in undertaking ESIA for EPFI's and according to Jordanian Legislation.

Table 1-4 ESIA Project Leads

Name	Project Position	Years of Experience	Qualifications	Nationality	Key Areas of Expertise
Kenneth Wade	Project Director	35	BSc (hons), MSc, CBiol, MIBiol,	British	ESIA, SEA, RAP, Due Diligence, Biology, Ecology, expert witness, liaison with EPFI.
Steven Bater	Project Manager	14	BSc (hons), MSc, CEnv, MIEMA.	British	ESIA, ESMS, contaminated land; water quality, waste management, environmental legislation and regulatory process.
Dima Maroun	Senior Environmental Consultant	10	BSc	Jordanian	ESIA, ESMS, Air Quality, Noise Assessments, Jordanian Legislation.
Max Burrow	Senior Environmental Consultant	7	BSc (hons).	British	ESIA Management, Noise Assessments, Air Quality, Socio-Economics.
Ibrahim Masri	Local Environmental Expert	6	BSc, MSc	Jordanian	ESIA, ESMS, Air Quality, Noise Assessments, Jordanian Legislation.

In addition to the team identified above, input to the ESIA has been received from the Jordanian Department of Antiquities. In accordance with the "Antiquities Law No. 21 for 1988 and its

amendments No. 23 for 2004", the DoA is the official governmental entity in Jordan responsible for the protection, conservation, and preservation of antiquities in Jordan.

The outcome of an archaeological assessment undertaken by the Department of Antiquities has been used to identify any potential adverse impacts and associated appropriate mitigation requirements.

A summary of relevant experience for each of the Project Leads is provided in the table below.

Expert/Project Position	Key Relevant Experience
Kenneth Wade Project Director	Ken leads the Environmental Planning team having more than 35 years of experience in the environmental field both as a Regulator, Operator and a Consultant in the UK for more than 20 years before moving to the Middle East. Ken has global responsibility for 5 Capitals' environmental delivery and is actively involved with Clients on most projects and has developed a reputation as a world-class expert with particular strengths in being able to match the needs of the financing body with those of the developer and the national regulator. Ken's wide ranging experience includes working with Clients on Power and Water projects from "cradle to grave" thus inputting at concept, feasibility, design, construction, operation as well as acquisition and decommissioning. In leading 5 Capitals' environmental delivery of Power and Water projects he has successfully overseen EIA, ESIA and SEIA projects throughout the MENA Region and sub-Saharan Africa as well in the Asia Pacific Region. Ken has prepared ESMPs and undertaken many environmental audits on behalf of the lenders. He has also directed stakeholder consultations in many countries including Vietnam, Morocco, Egypt, Saudi Arabia, Kenya, Uganda and Turkey all in accordance with World Bank/IFC requirements. Ken was historically a Regulator in the UK Water Industry for 11 years and led a specialist Water Quality and Biology team assessing lakes, reservoirs and rivers. He was a technical advisor for hydropower projects and for major schemes such as Cardiff bay Barrage. He published technical papers on river and lake impacts from industrial developments and post privatisation was a Consultant for the Water Industry major projects associated with upland reservoirs and coastal outfalls and treatment plants. He assessed many of these with EIA studies.
Steve Bater Project Manager	Steven Bater is a Principal Environmental Consultant with 5 Capitals working from Dubai and Bangkok. Steven is a Chartered Environmentalist with 14 years' experience. Steven has prepared in excess of 100 ESIA's for both private and government sectors ensuring compliance with environmental and social legislation and policy during study, design, build and operation. Steven has experience from the UK, MENA and ASEAN regions working to national and international requirements. Steven's role has often been technical specialist for ESIA and he has led detailed environmental assessments for air quality, contaminated land, cultural heritage, water quality, socio-economic effects, waste, landscape impacts and ecology. He has also held managerial responsibility for large teams of technical specialists and has overseen the environmental permitting for project values of over $54 billion.
Dima Maroun Senior environmental consultant	Dima has over 10 years' experience in the areas of environmental impact assessment, environmental management planning and implementation and water resource studies. She has acted as a Project Manager and Technical coordinator, and as an individual technical specialist in environmental monitoring. She has worked for both government and private sector clients. Dima has ample experience in undertaking numerous EIA's in Jordan over the past 10 years. She has experience Co-ordination and liaison with key governmental ministries, local authorities and other project stakeholders internationally, as well as with international funding agencies. She also has experience in the preparation and implementation of extensive public consultation programmed compatible with Jordanian, IFC and WB standards.

Expert/Project Position	Key Relevant Experience
Max Burrow Senior environmental consultant	Max is the Operations Manager and a Senior Environmental Consultant with 5 Capitals, working from Dubai and Bangkok with experience in the preparation of environmental studies & plans (e.g. EIA, ESIA & CEMP) for major industrial developments; construction auditing; specialist environmental reviews & surveys; field surveying and reviews of regional environmental standards. Max's work at 5 Capitals has been undertaken across the Middle East, ASEAN and North Africa region in regard to the relevant national and international standards, including Equator Principles and IFC/World Bank guidelines, where required by the client or lending institutions.
Ibrahim Maasri Local Environmental Expert	Ibrahim has over 6 years of professional experience as an environmental specialist. Ibrahim has been involved in Environmental and Social Impact Assessments (ESIA) for energy, infrastructure, and tourism projects. Specifically, he has successfully managed several environmental and social assessments for renewable energy projects (wind and solar) in Jordan all of which have achieved environmental clearance by the Ministry of Environment and EPFIs lenders (such as the IFC and EBRD). This includes ESIA studies for Arabia One (10MW solar PV), Saudi Oger (50MW solar PV), Al Rajef (85 MW Wind Farm), and many others.

Full CVs for project leads are provided in Appendix A.

2 ENVIRONMENTAL & SOCIAL ASSESSMENT REGULATION

2.1 National Requirements

The environmental clearance for the Project is subject to that of the MoEnv's requirements and which is governed by the "Environmental Protection Law No. 52 of 2006" and the "Environmental Impact Assessment Regulation No. (37) of 2005".

The Environmental Protection Law No. 52 of 2006 contains 27 articles that include definitions, general principles, objectives, and duties and powers of the MoEnv. It also sets the principles for cooperation and coordination between the Ministry and local, regional and international organizations that work in the environment field, in order to achieve the goals of protecting the environment and improve its various elements in a sustainable manner. As per this law, the MoEnv has the authority to prepare the environmental by-laws, regulations, directives and guidelines within Jordan.

A number of additional environmental regulations have been published pursuant to the Environmental Protection Law, which include environmental performance standards for use in predicting and monitoring compliance. The regulations that are potentially relevant to this project have been listed below.

- Regulation No.24 of 2005: Management, Transportation and Handling of Harmful and Hazardous Substances;
- Regulation No.25 of 2005: Soil Protection Regulation;
- Regulation No.26 of 2005: Environment Protection from Pollution in Emergency Situations Regulations;
- Regulation No.27 of 2005: Management of Solid Waste Regulation;
- Regulation No.28 of 2005: Air Protection Regulation;
- Regulation No.37 of 2005: Environmental Impact Assessment Regulations. This By-Law describes the procedures for conducting EIAs in Jordan, and also gives the MoEnv the responsibility to review and approve Scoping Reports and EIA study reports.

Other Jordanian laws that include environment or social related provisions and are applicable to the Project include:

- Law No. 21 of 1971: Public Health Law;
- Law No.51 of 2002: The Labour Law; and
- Law No.64 of 2002: The General Law of Electricity.

The specific numeric standards and limit values for environmental parameters have been referenced where appropriate to the projects impacts within the related sections of this ESIA. These specifically include:

- Ambient Air Quality, JS.1140/ 2006
- Industrial Wastewater, JS 202/2004
- Jordanian Guidelines for Prevention of Noise (2003)

In accordance with lender requirements, where specific standards do not exist, a best practice standard should be applied. This may apply to parameters such as soil contamination, where Jordan and the lenders have no specific standards/guidelines.

The Environmental Impact Assessment (EIA) Regulation No.37 of 2005 and its amendment in 2006 set out the process for conducting an EIA Study within Jordan. According to this law, "all agricultural, industrial, commercial, housing and tourism projects shall obtain an environmental approval from the Ministry of Environment (Article 4)". Any project, which may have a significant impact on the environment, must have a comprehensive EIA carried out, before permission to operate (or license to begin construction) can be given. Annex 2 and Annex 3 of this law list the projects that require a full EIA or a Preliminary (or Initial) EIA study. Typically, electrical generating plant projects fall under the category of projects requiring a full EIA study as listed in Annex 2.

According to MoEnv Regulation No.37 Annex 4, all EIAs have to take a comprehensive list of criteria into account. These criteria and how they have been addressed as part of this ESIA are presented in the table below.

Table 2-1 MoEnv Preliminary EIA Criteria and How These Have Been Addressed

MoEnv Annex 4 Criteria for Consideration	ESIA Chapter
Project overlaps with other projects and plans for residents.	Social and Economic Issues
The negative effects on the aesthetic aspects of the place.	Landscape and Visual Impacts
The negative effects on the endangered species on the flora and fauna or their habitats.	Ecology
Overlapping with the movements of fish and wild animals or on any of their habitats.	Ecology
Breaking declared national standards which relevant to solid and liquid wastes treatment.	Waste Management
Affect water quality	Water Quality and Drainage
Ground water depletion or reducing its quality.	Soil, Geology and Groundwater
Overlapping with ground water feeding.	Soil, Geology and Groundwater
Destroying or affecting ancient monument or on the culture of society.	Archaeology and Cultural Heritage
Encouraging the population growth and collecting a large number of people at this area.	Social and Economic Issues

MoEnv Annex 4 Criteria for Consideration	ESIA Chapter
Affecting the traffic movements (increasing it) in comparison with the current traffic size in the roads nets and its' capacity.	Traffic and Transportation
Immigrating of (relegating) a large number of people from their origin homes.	Social and Economic Issues
Encouraging the activities which need a large quantity of the fuel, water or all the type of energy.	Waste Management, Water Quality and Drainage, Soils, Geology and Groundwater.
Causing floods, divesting and large granite sediments.	Water Quality and Drainage
Raising the noise and vibrations limits in some place.	Noise and Vibration
Causing large geological risks on people and buildings.	Soils, Geology and Groundwater.
Enlarging sewer system to serve new developments projects.	Water Quality and Drainage, Soils
Constricting the fish habitats or the wild animals or the plants.	Ecology
Divide the natural organization of the current groups.	Ecology
Cause danger on public health, or use or produce or disposal harmful substances which cause risk on the human, animals, plants.	Soils, Geology and Groundwater.
Overlapping with the recreational, educational, scientific, religion uses.	Social and Economic Issues
Breaking any of ambient air quality standards or contributing in the infraction of the air quality.	Air Quality
To use the agriculture land in other uses, or reduce the land productivity.	Social and Economic Issues
Obstructing emergency plans.	Social and Economic Issues

2.2 International Conventions/Protocols signed or ratified by Jordan

Jordan is a signatory to, and has ratified, several international protocols and conventions with regards to environmental protection. As such Jordan is committed to the principles and policies therein. The proposed project must therefore comply with the environmental requirements of the following international treaties and conventions to which Jordan is a signatory:

Table 2-2 International Protocols and Conventions

Name of International Protocol/Convention	Signed/Ratified
Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2004
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (1998)	2002 (accession)
Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), 1997	2003 (accession)
United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD), 1994	1996
United Nations Convention on Biological Diversity (CBD), 1992	2012
United Nations Framework Convention on Climate Change (UNFCCC), 1992	1993
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989 and amendments in 1995	1989
Montreal Protocol on Ozone Depleting Substances, 1987 and Montreal Amendments (London 1990, Copenhagen 1992, Vienna 1995, Montreal 1997, Beijing 1999)	-
Vienna Convention for the Protection of the Ozone Layer, 1985	1989 (accession)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973	1978 (accession)
Convention Concerning the Protection of World Cultural and Natural Heritage, 1972	1975
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar), 1971	1977 (accession)

In addition to the above, Jordan contributes to other regional and international organisations that are concerned with the protection of the environment and conservation of natural resources, such as the United Nations Environment Program, World Health Organization, United Nations Food and Agriculture Organization, World Meteorological Organization and UNESCO.

2.3 Lender Requirements

It is understood that the Project is pursuing financing from the EBRD. EBRD has adopted an Environmental and Social Policy and a set of specific Performance Requirement (PRs) covering key areas of environmental and social performance. These reflect EBRD's commitment to promote environmentally sound and sustainable development in the full range of its investment and technical cooperation activities including compliance with EU environmental standards. As lender, the EBRD requires that the Project design, construction and operation meet the PRs. A description of the EBRD PRs is provided inTable 2-3.

Table 2-3 EBRDs Performance Requirements

Performance Requirement	Details
Performance Requirement 1	Assessment and Management of Environmental and Social Impacts and Issues This PR establishes the importance of integrated assessment to identify the environmental and social impacts and issues associated with projects and the client's management of environmental and social performance throughout the life of the project. It also establishes requirements for environmental and social assessment, environmental and social management systems, environmental and social policy and environmental and social management plan.
Performance Requirement 2	Labour and Working Conditions This PR recognises that for clients and their business activities, the workforce is a valuable asset, and that good human resources management and a sound worker-management relationship based on respect for workers' rights, including freedom of association and right to collective bargaining, are key ingredients to the sustainability of business activities. Projects are required to comply, at a minimum, with (i) national labour, social security and occupational health and safety laws, and (ii) the fundamental principles and standards embodied in the ILO conventions.4
Performance Requirement 3	Resource Efficiency and Pollution Prevention and Control This PR acknowledges the importance of using best available techniques and GIP to optimise resource use and efficiently prevent and control release of pollutants into the environment. This PR outlines a project-level approach to resource management and pollution prevention and control, building on the mitigation hierarchy, the principle that environmental damage should as a priority be rectified at its source, and the "polluter pays" principle.
Performance Requirement 4	Health and Safety This PR recognises the importance of avoiding or mitigating adverse health and safety impacts and issues associated with project activities on workers, project-affected communities and consumers and requires the following: "The Client shall take steps to identify and prevent accidents, injury and disease to workers and affected communities arising from or associated with, or occurring in the course of the project activities and prepare and implement preventative measures and plans to manage health and safety risks in accordance with the mitigation hierarchy approach and GIP."
Performance Requirement 5	Land Acquisition, Involuntary Resettlement and Economic Displacement This PR supports and is consistent with the universal respect for, and observance of, human rights and freedoms and specifically the right to adequate housing and the continuous improvement of living conditions. In cases where there has already been displacement as a result of conflict, this PR is guided by the Guiding Principles on Internal Displacement. This PR establishes requirements with regards to consultation, compensation of displaced persons, grievance mechanisms and displacement.
Performance Requirement 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources This PR recognizes the importance of conservation of core ecological functions of ecosystems and the biodiversity they support as well as the sustainable management of living natural resource. The assessment process will characterize the baseline conditions to a degree that is

Performance Requirement	Details
	proportional and specific to the anticipated risk and significance of impacts. The baseline assessment will consider, but will not be limited to, loss of habitat, degradation and fragmentation, invasive alien species, migratory corridors, overexploitation, hydrological changes and pollution.
Performance Requirement 7	Indigenous People This PR recognizes that projects can create opportunities for Indigenous Peoples to participate in and benefit from project-related activities that may help them fulfil their aspiration for economic and social development. In projects where Indigenous Peoples are likely to be affected, the client is required to carry out an assessment of impacts on Indigenous Peoples and to prepare an Indigenous Peoples' Development Plan.
Performance Requirement 8	Cultural Heritage This PR recognizes the importance of protecting cultural heritage for present and future generations. Both tangible and intangible cultural heritage are important assets for economic and social development. This PR includes requirements for screening of impacts on cultural heritage, avoiding those impacts, assessing the impacts that cannot be avoided and chance finds procedure as well as consultation with affected communities.
Performance Requirement 9	Financial Intermediaries This PR recognizes that Financial Intermediaries (FIs) are a key instrument for promoting sustainable financial markets and provide a vehicle to channel funding to the micro, small and medium-sized enterprise (SME) sector. Such FIs include private equity funds, banks, leasing companies, insurance companies and pension funds. The FI must put in place a clearly defined Environmental and Social Management System (ESMS), including an environmental and social policy and environmental and social procedures commensurate with the nature of the FI and environmental and social risks associated.
Performance Requirement 10	Information Disclosure and Stakeholder Engagement This PR recognizes the importance of an open and transparent engagement between the client, its workers, and local communities directly affected by the project and other stakeholders to promote sound and sustainable environmental and social performance. Stakeholder engagement can lead to improved financial, social and environmental outcomes, together with enhanced community benefits. GIP for ongoing stakeholder engagement involves: (i) public disclosure of appropriate information; (ii) meaningful consultation with stakeholders; and (iii) an effective procedure or mechanism by which people can make comments or raise grievances.

EBRD's latest Environmental and Social Policy (2014) outlines how the Bank will address the environmental and social impacts of its projects by defining the respective roles and responsibilities of both EBRD and its clients in designing, implementing and operating projects and setting a strategic goal to promote projects with high environmental and social benefits.

The EBRD Environmental and Social Policy categorizes projects to determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required.

The proposed 50MW Photovoltaic Power Plant (the Project) does not fall within any of the descriptions of Category A projects: 'projects with potentially significant adverse future environmental and/or social impacts which require a formalized and participatory environmental and social impact assessment process'.

It is therefore envisaged that the Project falls within Category B projects: 'projects with potential adverse future environmental and/or social impacts, which are typically site-specific, and/or readily identified and addressed through mitigation measures.

EBRD requirements for Category B projects include an assessment that is proportionate to the project's nature, size and location, as well as the characteristics of the potential impacts and risks. This assessment must characterise potential future adverse impacts associated with the project, identify potential improvement opportunities and recommend any measures needed to avoid, or where avoidance is not possible, minimise and mitigate adverse impacts.

ESIA – Stakeholder Engagement & Consultation

Effective stakeholder engagement and consultation are a key part of EBRD's Environmental and Social Policy and Performance Requirements. Suitable inclusion of engagement and consultation is required at all stages of the ESIA process in order to align with EBRD lending requirements.

ESIA Disclosure

As mentioned above, the proposed project is likely to be categorised as a Category B project. EBRD Performance Requirement 10 (Information Disclosure and Stakeholder Engagement), outlines the requirements for disclosure and consultation in regard to Category B projects. It is understood that EBRD will likely require a minimum 30-day disclosure period for the ESIA, during which time further consultations with identified stakeholders may be required.

2.3.1 EU Standards and Best Available Techniques (BAT)

Clients will structure the projects to meet relevant EU substantive environmental standards, where these can be applied at the project level. Certain projects that, due to their nature and scale, would be subject to the EU Industrial Emissions Directive and will be required to meet EU Best Available Techniques (BAT) and related emission and discharge standards, regardless of location (EBRD, Performance Requirement 3, 2014).

Where EU Standards do not Exist

Where no EU substantive environmental standards at project level exist, the client will identify, in agreement with the EBRD, other appropriate environmental standards in accordance with GIP. In addition, projects will be designed to comply with applicable national law, and will be maintained and operated in accordance with national laws and regulatory requirements. When host country regulations differ from the levels and measures presented in EU environmental requirements or other identified appropriate environmental standards, projects will be expected to meet whichever is more stringent (EBRD, Performance Requirement 3, 2014).

Labour and Working Requirements

Projects involving new facilities and operations are expected to meet EU substantive environmental standards or other agreed environmental standards, and national regulatory requirements from the outset (EBRD, Performance Requirement 3, 2014).

Projects are required to comply, at a minimum, with (i) national labour, social security and occupational health and safety laws, and (ii) the fundamental principles and standards embodied in the ILO conventions (EBRD, Performance Requirement 2, 2014).

2.3.2 International Finance Corporation (IFC)

It is further noted that the International Finance Corporation (IFC), part of the World Bank Group is a shareholder in ACWA Power. As such, ACWA Power projects are required to comply with the IFC environmental and social requirements in accordance with the IFC Policy on Environmental and Social Sustainability (2012), as per:

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

3 ESIA PROCESS

3.1 Delineation of Study Boundaries and Scope of Assessment

The ESIA has assessed the potential impacts related to the proposed projects construction phase, commissioning and operation.

The proposed project is located in a military controlled zone in the eastern extent of Mafraq Governorate, approximately 4.5km from the border with Iraq. The project land is currently owned by the Jordanian Government and will be leased on a 20-year land lease agreement between the Project Company and the Government of Jordan.

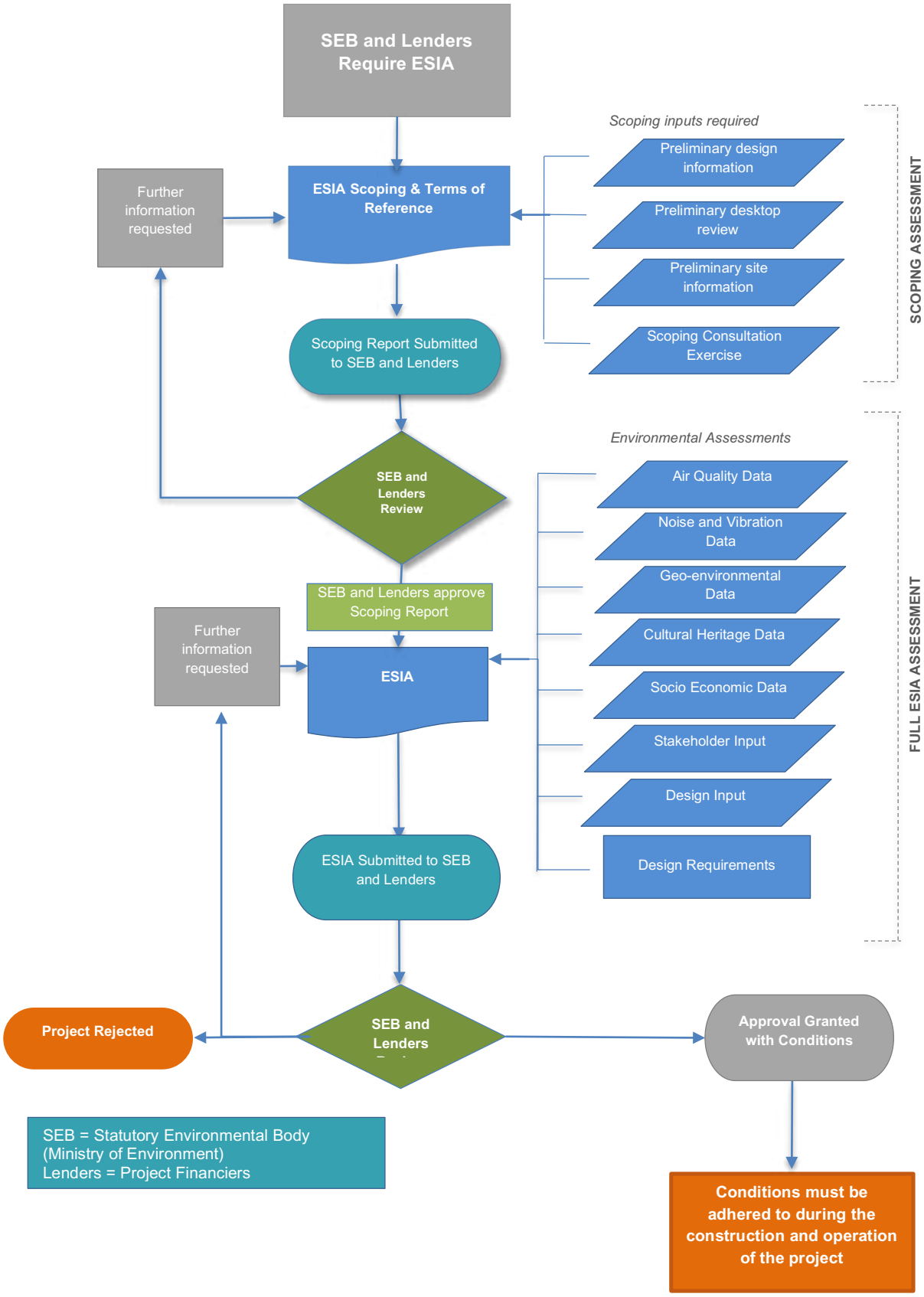
There is no involuntary resettlement, or required compensation relating to the purchase of the land. All activities in this area are strictly controlled and access can only be granted by prior approval from the military.

The scope of the ESIA includes the projects associated facilities. The associated facilities have been specified in the Project Description, these primarily include connections to existing facilities/infrastructure/utilities.

3.2 ESIA Process

The illustration in the following Figure provides an outline of the scoping and ESIA process for the project. It should be noted that conditions are likely to be established by both the Statutory Environmental Body (MoEnv) and the Lender (EBRD) that must be adhered to during the projects construction and operational phases.

Figure 3-1 Scoping/ESIA Process



3.3 Environmental Scoping Study/Terms of Reference (ESS/ToR)

The purpose of the Environmental Scoping Study/Terms of Reference (ESS/ToR) is to identify the key environmental issues and sensitive receptor sites at an early stage to ensure that the baseline surveys and investigations, and assessment techniques for the subsequent ESIA addresses these issues specifically. In addition, the ESS/ToR identifies the structure and content of the ESIA at an early stage, which may be subject to agreement by local regulators or lenders.

The Jordanian MoEnv 'EIA Technical Committee' has reviewed the ESS/ToR submitted to the Ministry of Environment on 11th April 2017 and approved on 19th April 2017 (correspondence included within Appendix B). The ESS/ToR identifies the methodology and scope of work which will be undertaken for the EIA study. There were no comments or additional requirements raised by the 'EIA Technical Committee' on the ESS/ToR. The Committee includes the following governmental entities:

- Ministry of Environment
- Ministry of Agriculture;
- Ministry of Health;
- Ministry of Water and Irrigation;
- Ministry of Municipal Affairs;
- Ministry of Public Works and Housing;
- Ministry of Planning and International Cooperation;
- Ministry of Energy and Mineral Resources;
- Ministry of Industry and Trade;
- Environmental Societies Association – the Association forms an umbrella for all environmental NGO's in Jordan to include the Royal Society for the Conservation of Nature (RSCN), Jordan Environment Society (JES), Nature Environment and Wildlife Society (NEWS), etc.

Similarly, members of the 'EIA Technical Committee' identified above will also be reviewing the ESIA upon submission.

3.4 Environmental & Social Impact Assessment (ESIA)

Please note: The term ESIA has been used throughout this document as it satisfies the environmental and social assessment requirements of both the MoEnv (normally referenced as an EIA) and prospective project lenders.

3.4.1 EIA Report Structure

In order to ensure inclusion of all applicable EBRD Performance Requirements, IFC Performance Standards and MoEnv requirements for environmental assessment, the ESIA has been structured in the following format:

Volume 1: Non-Technical Summary (in both Arabic and English)

Volume 2: Main Text, Tables, Figures and Plates

Volume 3: Framework: Environmental & Social Management and Monitoring Plan (ESMMP)

Volume 4: Technical Appendices

Volume 2 comprises the main text of the report and presents the methodology, findings, justification and conclusions of the ESIA process.

Environmental effects associated with the project have been categorised under relevant environmental disciplines (air quality, ecology, waste management etc.) and where appropriate potential impacts have been referenced against National Legislation, ERBD Performance Requirements, IFC Performance Standards and other appropriate international best practice.

Volume 3 comprises the framework Environmental & Social Management and Monitoring Plan (ESMMP), which provides detailed environmental actions and initiatives that will be developed within the contractors Construction Environmental & Social Management Plan (CESMP) and the proponents Operational Environmental & Social Management Plan (OESMP), and therefore will be implemented during the construction and operation phases of the project.

Volume 4 comprises Technical Appendices (laboratory results, consultation reports, baseline survey reports and applicable technical studies).

3.4.2 Impact Assessment Significance Criteria

In order to obtain a credible assessment of environmental impacts, the assignment of 'effect 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 international best practice 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);
- 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 effects, as follows:

- Step 1 – Evaluation of value/sensitivity of resource or receptor;

- Step 2 – Assessing the magnitude of the impact on the resource or receptor; a
- Step 3 – Determining the significance of effects.

3.4.3 Identification and Evaluation of Sensitive Receptors

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);
- **Human** receptors, such as stakeholders (i.e. users of dwellings, places of recreation, places of employment, community facilities or household relocation) and human systems (e.g. employment market, population disease susceptibility and disease communicability, exposure to toxicity of chemicals).

The environmental value (or sensitivity) of the resource or receptor has been defined by using the criteria below in Table 3-1:

Table 3-1 Environmental Value of Receptor or Resource

Value (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. • Locations or communities that are highly vulnerable to the environmental impact under consideration or critical for society (e.g. indigenous peoples, hospitals, schools).
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. • Locations or communities that are particularly vulnerable to the environmental impact under consideration (e.g. residential areas, vulnerable/marginalized groups).
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 get increase the stress of the underlying system, but evidence does not suggest that it is about to reach a critical point. • Locations or groups that are relatively vulnerable to the environmental impact under consideration (e.g. commercial areas).
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. • Locations or groups that show a low vulnerability to the environmental impact under consideration (e.g. industrial areas).
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. • Locations or groups that show a very low vulnerability to the environmental impact under consideration (e.g. industrial areas).

The existence of receptors that are legally protected (e.g. designated areas, protected habitats or species) will be taken into consideration for the assessment of the sensitivity of the receptors.

3.4.4 Identification and Evaluation of Potential Impacts

During the evaluation undertaken as part of the ESIA process, the following types of impacts have been considered:

- Direct Impacts - Potential impacts that may result from the construction and occupation of the Project acting directly on an environmental or social receptor (e.g. land take for construction of the camps);
- Indirect Impacts – Potential impacts which are not a direct result of a Project activity, often produced later in time or further removed in distance, but are normally a result of a complex pathway (e.g. dust deposition on vegetation which causes reduction in photosynthetic rates);
- Beneficial Impacts – 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, creating jobs during the construction and/or occupation phases of a project);
- Adverse Impacts – Impacts that are detrimental and have a negative influence on sensitive resources or receptors;
- Secondary Impacts - Potential impacts that may result from the implementation of protection measures applied to mitigate potential direct impacts;
- Event Related Impacts - Potential unplanned or accidental impacts stemming from an unintentional event such as fire, explosion, oil spill, etc.;
- Cumulative Impacts - The additive potential impacts that may result from the incremental potential impacts of the planned Project plus the potential impacts of reasonably anticipated future projects or future phases of a same development.

3.4.5 Defining Impact Magnitude

The magnitude of the impact has defined wherever possible in quantitative terms. The magnitude of an impact has a number of different 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, its frequency and
- its likelihood of occurrence where the impact is not certain to occur.

The criteria used for identifying the magnitude of impacts is provided within the table below.

Table 3-2 Criteria for Magnitude of Impacts

Magnitude of Impact	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 scale, 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 above 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.

3.4.6 Determination of Significance of Effects

The significance of effects is a combination of the environmental value (or sensitivity) of a receptor or resource and the magnitude of the project impact value (change). In other words, it is this product of the impact acting on the receptor that produces an environmental effect. The table below provides criterion used for determining the significance of environmental effects through consideration of the potential magnitude of impact and sensitivity of the associated receptor. Definitions of each significance categories are provided in Table 3-4.

Table 3-3 Criteria for Determining Significance of Effects

		Magnitude of impact (degree of change)				
		No Change	Negligible	Minor	Moderate	Major
Sensitivity of Receptor	Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or moderate	Moderate or Large	Very Large or Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Negligible or Slight	Slight	Slight or moderate
	Very Low	Neutral	Neutral	Negligible or Slight	Neutral or Slight	Slight

Table 3-4 Definition of Significance of Effects

Significance Category	Criteria
Very Large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
Large	Important considerations at a local scale but, if adverse, are potential concerns to the project and may become key factors in the decision-making process.
Moderate	These effects, if adverse, while important at a local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.
Slight	Local issue unlikely to be of importance in the decision-making process. Effects do not exceed statutory limits. Nevertheless, 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.

3.4.7 Mitigation Measures

The ESIA includes mitigation required subsequent to the findings of the detailed assessment undertaken as part of the ESIA.

3.4.8 Residual Impacts

Following assessment of the additional mitigation measures, the projects remaining (residual) impact following mitigation will be considered. The significance of such impacts is based upon the same criteria used to determine the impact significance before applying additional mitigation.

3.4.9 Consideration of Cumulative Impacts

Cumulative impacts are considered to be the combined environmental effects of the planned project plus any other approved projects within the same sphere of influence.

Given the lack of projects or the development of similar facilities in the Risha area (and wider region), it is not anticipated that the project result in specific or measureable cumulative impacts with other projects, facilities, strategies, policies or plans in the immediate future.

Where a potential for cumulative impacts exist, this will be addressed further in the report.

3.5 Supportive Environmental and Social Documentation

Although the ESIA is a key document in the environmental and social due diligence process for project approval and project finance, there is also a requirement to undertake wider analysis, planning or otherwise disclosure in order to manage critical impacts related to a project. These requirements are dependent upon the regulatory requirements locally or those required by the lenders, and are typically related to the likely scale of the project and significance of its impacts.

Such supportive documentation and a requirement for it has been outlined below under the relevant thematic sub-titles.

3.5.1 Stakeholder Engagement

Stakeholder engagement can be described as the systematic effort to understand and involve stakeholders and their concerns in the project activities and decision-making processes. Stakeholders are defined as any group or individual who can affect, or can be affected by, the project.

The main objectives for stakeholder engagement are:

- To inform the relevant stakeholders about the project;
- To capture views and concerns of the relevant stakeholders with regard to the project;

- To enhance ownership of the project within the host community;
- To provide a basis for stakeholder participation in impact identification and mitigation.

For projects that have environmental and social impacts, consultation is not a single conversation but a series of opportunities to create understanding about the project among those that are likely to be affected or might have an interest in it, and to learn how these stakeholders view the project and its related risks, impacts, opportunities, and mitigation measures. Listening to stakeholder concerns and feedback can be a valuable source of information to help identify environmental and social risks (real and perceived) and improve project design and outcomes of the ESIA and the project as an on-going long term process.

Effective stakeholder engagement and consultation are a key part of EBRD's Environmental and Social Policy and PRs. The EBRD PR10 on Information Disclosure and Stakeholder Engagement requires that '*Clients conduct stakeholder engagement on the basis of providing local communities that are directly affected by the project and other relevant stakeholders with access to timely, relevant, understandable and accessible information, in a culturally appropriate manner, and free of manipulation, interference, coercion and intimidation*'.

Stakeholder Engagement must involve the following elements:

- Stakeholder identification and analysis;
- Stakeholder Engagement Plan;
- Disclosure of information, meaningful consultation and participation;
- Grievance mechanism; and
- On-going reporting to relevant stakeholders.

Stakeholder Engagement for the Project has been proportionate to the nature and scale of its potential adverse impacts on the affected communities, the sensitivity of the environment and the requirements for consultation as per the MoEnv for EIA's. This has been in line and considerate to the Jordanian laws and requirements with respect to public information and consultation.

The IFC's Performance Standards state that 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.

Project Consultation and Engagement to Date

In accordance with MoEnv's "EIA Regulation No. (37) of the year 2005", a scoping session must be held for those projects which require a comprehensive EIA study; as the case with this Project. Public participation is one of the most important aspects in the Scoping/ESIA process as it directly involves the stakeholders whom are expected to be affected by the Project development. In general, the objectives of the scoping session include the following:

- Introduce the Project and its various components to the stakeholders and provide them with all available information at this stage;
- Allow stakeholders to participate in the process of scoping environmental and social impacts of the Project;
- Early consideration of stakeholders' concerns and fears regarding the nature and scale of anticipated impacts from the Project; and
- Allow stakeholders to comment on the scope of work and methodology that will be adopted for the ESIA study.

In accordance with the above and in coordination with MoEnv, the scoping session for the Project was held on 29 March 2017 at the Le Meridian Hotel in Amman. The list of invitees was identified jointly by the MoEnv and the 'ESIA team' taking into account all stakeholder groups which are likely to be affected by the Project directly or indirectly.

Attendees raised and discussed a number of issues and concerns, which were documented and addressed in the ESS/ToR and submitted to MoEnv on 11th April 2017, the report was approved on 19th of April 2017.

Consultation has also been performed the ESIA with local communities and local government representatives to identify any community concerns or opportunities associated with the project. Associated findings are documented within Section 14.

4 PROJECT BACKGROUND

4.1 Site Condition and Land Use

The following site conditions is based on the Site Visit conducted on 2nd May June 2017, the visit was undertaken by way of a site walkover survey.

The Land Lease Agreement was signed by the Project Company to use 200 Ha of land adjacent to the Risha gas turbine power plant for the purpose of developing the Solar PV/Wind power plant (ACWA Power is the majority shareholder of CEGCO). This land will be leased for a symbolic amount of 8,000 JoD per year.

The area of the proposed project site is depicted in the satellite image below. The structures to the north east of the proposed plot are of the existing Risha gas fired power plant.

Figure 4-1 Project Site (Outlined in Yellow)

Satellite Image Source: Google Earth

The majority of the proposed project site is barren and has a slight gradient from the northeast to the southwest. The topography slopes to a wadi within the western and central areas of the plot that is visible in the above satellite image. The wadi contains an amount of low-lying sporadic vegetation, which grows in the fluvial sandy deposits. Soils in the remainder of the site is made up of predominantly unconsolidated sands overlain by gravel deposits.

Plate 4-1 Typical Site Condition (view from Risha Gas Power Plant)

The wadi is visible in the photograph below due to the change in soil colour and low level vegetation.

Plate 4-2 Site Overview from South Looking North East towards the OHL and Gas Power Plant

Plate 4-3 Typical Site Condition in Wadi Area

The only anthropogenic feature within the project footprint is an existing 132kV overhead transmission line that originates from the existing Risha Power Plant substation (1 OHTL with pylons located at approximately 200m intervals), and passes through the proposed site. The OHTL is in place to transmit electrical energy generated from the existing Risha Gas Power Plant. The transmission line connects to the Jordanian electrical grid and provides users electricity in Amman.

Plate 4-4 High Voltage Power line

Figure 4-2 High Voltage Power Corridor Alignment (in red)

Satellite Image Source: Google Earth

A small area in the north east of the proposed project site has previously been subject to shallow excavation works and some tipping of rubble (considered to be inert during the site inspection). It is noted that this area of disturbed ground has a limited amount of low lying vegetation, expected to have grown due to the collection of rainwater in the excavations.

Plate 4-5 Shallow Excavations on site

It is also apparent that small areas of rubble waste have been tipped in the south west extent of the site, close to the wadi area. The rubble is considered to be inert.

4.1.1 Local Land Uses

There are no residential commercial or agricultural plots within the vicinity of the project site. The area is located within a military controlled zone and as such access is restricted.

Site visits undertake as part of the ESIA have identified that some of the wadis in the area are used to graze sheep, typically during the rainy season.

The area is generally barren, featureless, with few structures or indications of anthropogenic activity. Those notable land users in proximity to the project site are outlined below.

Risha Gas Power Station

The Risha Gas Power Station is a CEGCO owned and operated facility that comprises 5 single cycle gas turbines generating units, each with a nominal rated output of 30MW. The power plant is primarily fuelled by natural gas, but can also operate on diesel oil as back up. The plant started producing energy in 1989. It is understood from ACWA Power that in 2017 the Risha Gas Power Station has decommissioned several of its gas turbines and now only operates up to a capacity of 60MW.

Plate 4-6 Risha Gas Power Station and Accommodation Area

The Risha Gas Power Station is operated by CEGCO staff who work on weekly shifts and who stay on-site in accommodation at the Risha Gas Power Station. The accommodation comprises a series of 1-storey blocks that surround a central quadrangle. The central quadrangle has planted vegetation that is maintained and irrigated.

The accommodation area includes the following:

- Bedrooms with en-suite bathrooms;
- Kitchen Area;
- Communal Dining Area;
- Recreational Room.

Gas Well Exploration

The exploration of potential gas wells is an activity that has been undertaken in the immediate local area to the project, within the Risha Gas field that was discovered in 1987. According to various media report, BP started drilling in their concession area in Risha in June 2012 following an extensive seismic survey period. However, BP abandoned the exploratory wells in January 2014 due to poor results from its 2nd well.

The closest of these wells is located approximately 500m south of the site (see Plate below). The other gas well and small gas plant is located approximately 2km towards the Iraq border, further away from the proposed project site. The exploration activities have left several lined evaporation ponds in the area of the well heads, which have remnant water and waste sludge.

Plate 4-7 Gas Well Head

Figure 4-3: Location of Features

Satellite Image Source: Google Earth

4.1.2 Project Components

The PV Plant will consist of the following components:

- Solar field: Being the main component, it consists of a large group of semiconductor technology based silicon solar cells arranged in what is known as solar PV panel or solar module. PV Array convert impinging sunrays (photons) to electrons. The electrons' flow generates direct current (DC) electricity which gets collected and channelled into an electronic device "inverter" to invert the DC current into Alternating Current (AC) to be supplied to the grid;
- Racking: This is the structural component that supports the PV panels. These structures could be stationary (fixed) or movable utilizing a "tracking system";
- Tracking: This is a mechanical system attached to the racking system to enable it to track sun movement during the day and throughout the year. This could be a one or two axis tracking system;
- Other electric and/or electromechanical system components: Such as cables, inverters, transformers, switchgears and controls used to control and condition the power output of the solar field;
- Connection to the grid: Routing energy generated from the solar field to the national electricity grid.

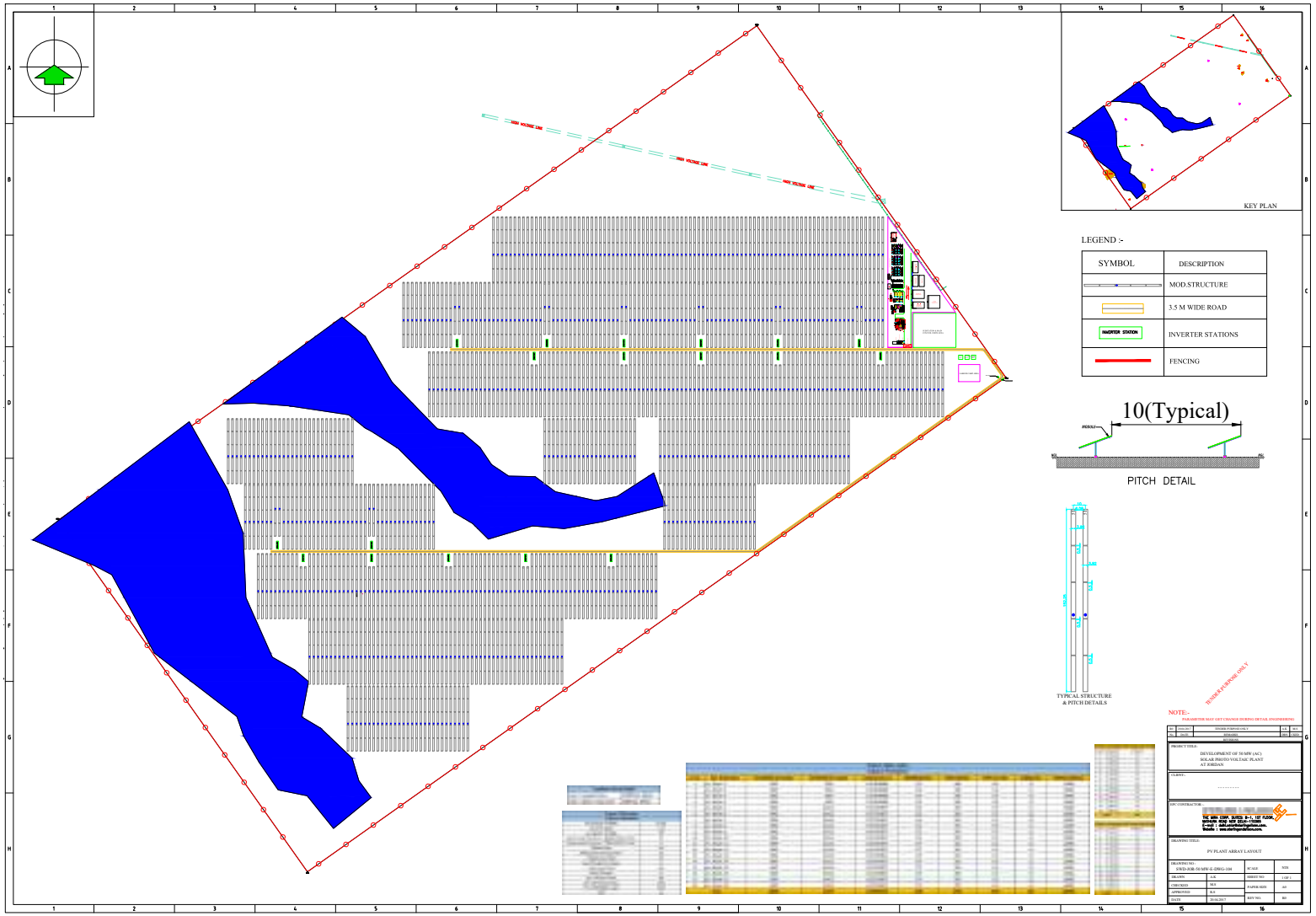
The ***Solar Field*** is a collection of solar panels. ***PV Array*** consists of multiple PV modules wired together and mounted onto a structure or metal frame to provide the optimum solar alignment. The structures will be constructed onto a hard-standing strip under each line of arrays, with shallow foundations into the underlying soils.

A ***PV Module*** consists of several individual PV cells wired together and enclosed in protective material called 'encapsulant', commonly made of ethylene vinyl acetate. To provide structural integrity, the encapsulated cells are mounted on a substrate frequently made of polyvinyl fluoride. Both ethylene vinyl acetate and polyvinyl fluoride are widely considered to be environmentally preferable to other chlorinated plastic resins. A transparent cover, commonly glass, further protects these components from weather. The entire module is held together in an aluminium frame. Most modules also feature an on board electrical junction box.

A single photovoltaic cell (***PV Cell***) comprises of a specially treated semi-conductor material (typically silicon) with separate front and back electrical contacts (positive and negative) that are connected to form a circuit. Upon exposure to light, electrons are knocked from the semi-conductor material under the photoelectric effect and are transported around the electrical contacts to form a direct current (DC).

The PV Plant will be connected to the Risha substation, at the North-East border of the Plant. The technical proposal incorporates interconnection facilities (in MV and HV) until the HV gantry incoming into the Offtaker's side of the 132 kV substation. The plant layout is provided overleaf.

Figure 4-4 Project Layout



4.1.3 Ancillary Facilities

Administration Building and Security

The administration building shall be part of the main control room (along with a work shop building and security room). The security room will have access to the sites security cameras. The site will include periphery lighting, but no external lighting. Security will not be armed.

Internal Roads

Internal roads to allow access within the project boundaries (for maintenance and cleaning etc.) will consist of 4m wide compacted gravel.

Panel Cleaning System

Panels will be cleaned by a truck fitted with a special tool (brush and water sprayer). Panels will only be cleaned as and when the level of soiling requires cleaning.

Waste Management

Small quantities of waste will be generated during the operations phase, and will comprise a small amount of administration and domestic wastes (e.g. office paper, some kitchen wastes). These wastes will be temporarily stored on site and removed by a licensed waste services company on a routine basis.

Wastewater Management

Wastewater from panel cleaning will either evaporate from the PV arrays or will drip to the underlying surface for infiltration or evaporation. The wastewater will consist purely of water and the dust that has naturally settled on the arrays. It will therefore be uncontaminated.

It is anticipated that sanitary and domestic wastewater will be collected in a septic tank on-site for periodic removal by a licensed wastewater contractor, who will transport the wastewater to a licensed wastewater treatment facility.

Drainage

The design is to consider potential requirements for any site drainage to accommodate surface water runoff.

Operations Accommodation

The plant will require 12 operational Staff. These staff members will be provided accommodation with the existing dormitories available for the Risha Gas Plant. These include twin room accommodation with private bathrooms, cafeteria, prayer and leisure room.

4.2 Associated Facilities

Overhead Transmission Lines (OHTL)

A Letter of Intent has been signed between MEMR & CEGCO/ACWA Power, authorizing ACWA Power to develop a Solar PV/Wind power plant of up to 50 MWe capacity and connect it to the existing Risha substation.

Due to the location of the existing Risha Gas Power Station, there is already an existing OHTL, which extends from the project site and links to the national Jordanian power grid. The project does not require an additional OHTL to be constructed, as the power output from the project will be transmitted to the existing line.

An approximate 20-30 meter long, 10 meter high line will be installed to connect the new HV gantry at the Project Site to the NEPCO gantry in the existing substation. There is no additional land requirement for this, and NEPCO will authorize the passage with the Government of Jordan, who currently own this land.

Access Road

An existing hardstanding road provides direct access to the Risha gas Power Station from Highway 10 (Amman to Baghdad Road). This will be the primary access road to the project site. No new access roads to the site are required.

Water Supply

The existing Risha Gas Power Station has a groundwater borehole that is used to draw water for process water purposes at the gas power station. The proposed PV project will use the same well and pumping station to draw water requirements for the project (i.e. for panel cleaning purposes and for flushing water in administration buildings).

A new connection to the pump station will be established and a pipeline installed to bring water to the project site. The Project will use this water for panel cleaning and sanitary use. During operation, it is anticipated that water requirements will be as follows:

1. 44 m3 / year for sanitary use;
2. 1,800 m3 / year for panel cleaning (allowing for 12 cycles);

Water for human consumption will be sourced through a separate provider (bottled water).

4.3 Construction Works and Manpower Requirements

4.3.1 Construction Phase

Timeline and Key Milestones

Construction is due to commence in November 2017 and due to complete in October 2018. Key project dates are provided in the table below:

Table 4-1 Key Project Milestones

Task	Date
Start of perimeter construction	November 2017
Ground Preparation	December 2018
Internal access road works	February 2018
PV Installation works	March 2018
Transmission Line Works	May 2018
Testing and Commissioning	August 2018
Initial Acceptance	October 2018

4.3.2 Construction Facilities

Access Road

No additional access roads are required to compliment the construction process.

Temporary Laydown Area

The laydown area is to be confirmed, but will be confined to within the project boundaries (shown in figure 4-4). Estimated area is approximately 100x220m.

Manpower & E&S

Peak manpower requirements are approximately 250 individuals (6 months into the project). Estimate manpower requirements for the duration of the project are provided in the table below.

Table 4-2 Estimated Manpower Requirements

Months	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18	Jun 18	Jul 18	Aug 18	Sep 18	Oct 18	Nov 18
Workers	25	50	75	100	150	200	250	175	120	75	30	25	20

Worker Accommodation

The solution for worker accommodation is not yet confirmed. It is expected that the Project Company will specify the necessary facilities and standards of facilities for worker accommodation in accordance with the IFC/EBRD Worker Accommodation Guidelines.

Water use during construction

Water will be required for civils works, including building construction. It is estimated that 2000 kl of water will be used during construction.

Potable water supplied during construction will be sourced through an external provider (tankers for domestic use from RO etc.).

4.4 Commissioning and Operational Phase

During the commissioning phase of the Project the solar plant will be tested for operability and connected to the grid. During the operational phase of the Project, the output from the solar plant will be supplied to the national grid. The electricity generation process will be controlled from the control room.

Manpower & E&S

The expected manpower requirements for this phase are 12 permanent workers. The photovoltaic plant needs a control room to control all process in the plant.

4.5 Decommissioning Phase

The decommissioning phase of the Project will involve dismantling and removal of the component of the solar plant as well as associated infrastructure, equipment and instruments. It will also include the demolition of structures such as office or storage house and the transportation of the debris material.

5 AIR QUALITY

5.1 Requirements for Assessment

During the scoping assessment, it was identified that potential impacts for air quality during the construction and operational phases of this project were anticipated to be minimal given the isolated nature of the site, construction requirements and that the plant will not require any emissions to air during operation. Therefore, it has not been deemed necessary to undertake any detailed assessment as part of the ESIA.

This chapter includes the potential minimal impacts derived during the scoping assessment for the purpose of identifying associated best practice measures that should be incorporated within the projects CESMP and OEMSP.

5.2 Standards and Guidelines

The standards listed below relate to those standards applicable to this project from the following sources:

- Jordanian Air Quality Standards (JS.1140/ 2006)
- European Commission Directive 97/68/EC - Non-Road Mobile Machinery (NRMM) standards
- European Commission Directive 2008/50/EC – Ambient Air Quality Standards
- IFC EHS Guidelines – Ambient Air Quality

5.2.1 Ambient Air Quality Standards

Jordanian Standards

The following table presents the Jordanian ambient air quality standards as established by the 'Ambient Air Quality' (JS.1140/ 2006):

Table 5-1 Jordanian Ambient Air Quality Standards

Pollutant	Averaging Period	Standard (ppm unless stated)	Number of Allowable Exceedances
Nitrogen dioxide (NO_2)	1-hour	0.210 (400µg/m³)	3 times in any consecutive 12 months
	24-hour	0.080 (164µg/m³)	-
	Annual	0.050	3 times in any consecutive 12 months
Carbon Monoxide (CO)	1-hour	26 (32,492 µg/m³)	3 times in any consecutive 12 months
	8-hour	9 (11,247 µg/m³)	3 times in any consecutive 12 months
Sulphur Dioxide (SO_2)	1-hour	0.300 (858µg/m³)	3 times in any consecutive 12 months
	24-hour	0.140 (400µg/m³)	1 times in any consecutive 12 months
	Annual	0.040 (114µg/m³)	-

Pollutant	Averaging Period	Standard (ppm unless stated)	Number of Allowable Exceedances
TSP	24-hour	260µg/m³	3 times in any consecutive 12 months
	Annual	75 µg/m³	-
PM_{10}	24-hour	120 µg/m³	3 times in any consecutive 12 months
	Annual	70 µg/m³	-
$PM_{2.5}$	24-hour	65 µg/m³	3 times in any consecutive 12 months
	Annual	15 µg/m³	3 times in any consecutive 12 months
H_2S	1-hour	0.030	3 times in any consecutive 12 months
	24-hour	0.010	-
O_3	1-hour	0.120	-
	8-hour	0.080	-

Source: Jordanian Standard 1140:2006
Note: *ppm conversions to µg/m³made at 0°C*

European Commission (EBRD) Standards

The following table presents the ambient air quality standards as established by the European Commission Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe, and previous Directives on air quality including 96/62/EC, 1-3 daughter Directives 1999/30/EC, 2000/69/EC, 2002/3/EC, and Decision on Exchange of Information 97/101/EC.

Table 5-2 European Commission Ambient Air Quality Standards (µg/m3 unless stated)

Pollutant	Averaging Period	Concentration	Permitted Exceedances per Year
Sulphur Dioxide (SO_2)	1-hour	350	24
	24-hour	125	3
Nitrogen Dioxide (NO_2)	1-hour	200	18
	Annual	40	n/a
Carbon Monoxide (CO)	Maximum Daily 8-hour mean	10 mg/m³	n/a
$PM_{2.5}$	Annual	25	n/a
PM_{10}	24-hour	50	35
	Annual	40	n/a
Ozone	Maximum Daily 8-hour mean	120	25 days averaged over 3 years
Lead	Annual	0.5	n/a
Benzene	Annual	5	n/a
Arsenic	Annual	6 ng/m³	n/a
Cadmium	Annual	5 ng/m³	n/a
Nickel	Annual	20 ng/m³	n/a
PAH	Annual	1 ng/m³ (expressed as concentration of Benzo(a)pyrene)	n/a

The standards detailed above have been prepared for compliance by EU Member States, of which Jordan is not. The principle behind the EC standards is for Member States to assess air sheds within their geographical boundaries and to prepare air quality management strategies for non-compliant air sheds. This is undertaken at the government level and is a driver for policy on air pollution regulation & standards.

International (IFC) Standards

IFC/World Bank General EHS Guidelines (2007) establish the ambient air quality standards in line with the World Health Organization (WHO) Air Quality Guidelines presented in Table 5-3.

Table 5-3 IFC/World Bank Ambient Air Quality Standards

Parameter	Standards per Averaging period (μg/m3 unless stated)	
	24 hour	Annual
Nitrogen Dioxide (NO_2)	200 (1 hour)	40
Sulphur Dioxide (SO_2)	125 (Interim target 1)	500 (10 minute guideline)
	50 (Interim target 2)	
	20 (guideline)	
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 (guideline)	20 (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 (guideline)	10 (guideline)
Ozone (O_3)	160 (interim target 1) (8 hour daily maximum)	-
	100 (8 hour daily maximum guideline)	

5.2.2 Air Emission Standards

European (EBRD) Standards

Diesel and spark emission engines installed in machinery greatly contribute to air pollution by emitting carbon oxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), and particulate matter. The following table presents the maximum permitted exhaust emissions from combustion engines installed in Non-Road Mobile Machinery (NRMM) as established by the European Commission Directive 97/68/EC. NRMM includes, but is not limited to, construction equipment (wheel loaders, bulldozers, truck-type loaders, hydraulic excavators, etc), material handling equipment, fork-lift trucks, road maintenance equipment (motor graders, road rollers, asphalt finishers) and mobile cranes.

Table 5-4 European Commission Maximum Permissible Emission Rates from NRMM

Net Power (kW)	Emission Limits (g/kWh) before Exhaust After-treatment Device				Emission Limits (g/kWh) after Exhaust After-treatment Device			
	CO	HC	NOx	PM	CO	HC	NOx	PM
130 < P < 560	5.0	1.3	9.2	0.54	3.5	1.0	6.0	0.2
75 < P < 130	5.0	1.3	9.2	0.70	5.0	1.0	6.0	0.3
37 < P < 75	6.5	1.3	9.2	0.85	5.0	1.3	7.0	0.4
18 < P < 37	-	-	-	-	5.5	1.3	8.0	0.8
Source: Directive 97/68/EC Measures against emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery, 1997								

International (IFC) Standards

IFC/World Bank General EHS Guidelines (2007) establish that pollutant emissions (i.e. CO, NOx, SO2, PM and VOCs) from land based mobile sources (i.e. on-road and off-road vehicles) should comply with national or regional programs.

Emission standards relating to mobile source non-road vehicle emissions are not prescribed in Jordan.

5.3 Observations and Baseline Conditions

5.3.1 Baseline Conditions

The eastern extent of Jordan in the Mafraq Governorate (particularly in the local project area) is characterised by extensive desert, which is largely flat, barren with shallow wadi's that create gentle undulations in the terrain. Vegetation in the area is sparse, low density and low-lying. This therefore results in exposed soils, which for the majority of the year are dry and directly affected by winds, which can suspend dust, causing a temporary degradation in air quality.

Given these conditions, dust and sand tends to become suspended during strong wind events, or where vortex's form. In particular, a number of whirlwinds are observed in the local area and were observed to cross the project are during the site visit in May 2016. Such phenomena result in the suspension of visual dust within the air-shed, and can suspend larger sized dust particles, causing a temporary degradation in air quality.

The proposed project site is located immediately adjacent to the existing Risha Gas Power Plant. Several power units at the Risha power plant have been decommissioned over recent years, however, several are still operational and are intended to remain in operation for a period of time. The combustion of Natural Gas is expected to result in impacts to ambient air quality at the project location, particularly with regards to emissions of NO_x and CO.

The nearby National Petroleum Company/British Petroleum Gas Plant and Wellheads are now closed and capped. As such there are not expected to be impacts from these facilities.

5.4 Sensitive Receptors

The project is located in close proximity to the Risha Gas Power Station and the CEGCO Accommodation area, which is used by staff at the existing power plant.

The same accommodation area will be used for staff from the proposed PV project.

Figure 5-1 Air Quality Receptor Locations

Satellite Image Source: Google Earth

Table 5-5 Air Quality - Receptor Sensitivity

Receptor	Receptor Sensitivity	Justification
Risha Gas Power Station	**Very Low**	The existing gas plant is an industrial facility that will be located adjacent to project site. As an industrial facility and as an emitter of air pollutants it is of low vulnerability to changes in ambient air quality.
CEGCO Accommodation Area	**High**	The CEGCO accommodation area is located approximately 450m north east of the project site. As a residential area with a semi-permanent residential work force.

5.5 Potential Impacts

5.5.1 Construction Phase

During construction, local ambient air quality may potentially be affected by increased dust, particularly during the site preparation stage (site clearance and earthworks) and by the exhaust fumes (gaseous and particulate) of construction vehicles, mobile equipment and temporary power generators. The typical air emissions resulting from these activities include: nitrogen oxides, sulphur dioxides, carbon monoxide, carbon dioxide, VOCs, particulates and BTEX.

The principle sources of particulate and gaseous emissions during construction will be:

- Excavations and earthworks, such as ground breaking, cutting, filling and levelling;
- Truck movements on unpaved, or compacted surfaces;
- Particulate dispersion from uncovered truckloads;
- Unregulated stockpiles;
- Vehicle and Construction equipment emissions (e.g. NO_x, SO_2, CO, CO_2 & VOCs, particulates and BTEX) and particulates from vehicles, generators and other mechanical equipment; and
- Stored VOCs and other volatile hazardous materials (e.g. paints).

Table 5-6 Potential Impacts - Construction

Potential Impact	Potential Impact Magnitude	Justification
Dust Generation (within 500m distance of project)	**Minor Negative**	<u>Site preparation</u> Dust resulting from construction activities typically comprises large diameter particles, which settle rapidly and close to the generation source. Far field dust impacts from construction works (>500m) are therefore considered unlikely. Depending on factors such as the meteorology (i.e. wind speed, wind direction and humidity), particle mass and moisture content of the soil, this will influence the dispersion of dust from activities such as excavating, handling of soil and the transfer of soil to trucks. Additional impacts will relate to the movement of soil where trucks are not effectively covered, or where vehicles are moving on unpaved surfaces. The magnitude of dust impacts from construction works will largely be based on the direction of the wind and the proximity of sensitive receptors to the wind direction. The wind direction in the project area tends to vary and could therefore disperse site generated dust in any direction. <u>Dust due to Equipment use and movement of trucks and material transportation</u> Except for vehicle movements on unpaved surfaces (e.g. along a site access road – if unpaved), dust due to the movement of trucks and material transportation should only occur where mitigation measures are not effectively implemented at the site, or by contractors bringing materials to the site (i.e. the sheeting/containment of truck and barge loads, wheel washing). Uncontained and/or un-sheeted trucks may be subject to losses of material where the containment is not effective (i.e. spills), or where wind or other air turbulence may disturb the contents and result in dispersion of material. Such

Potential Impact	Potential Impact Magnitude	Justification
		impacts have the potential to degrade local air quality in the immediate area of such movements, if particles become suspended. Given the expected large particle size of soil and the likely high moisture content of soil, such impacts are not expected to be widespread and will likely be minimised to the areas immediately surrounding transportation corridors only.
Gaseous Emissions	**Negligible Negative**	Vehicles and equipment that operate on liquid fuel will result in the emission of gases to air due to the combustion of fossil fuels. Such vehicles and equipment are likely to include, but not be limited to the following: • Excavators; • Graders; • Pavers; • Trucks; • Cranes; • Temporary Generators; and • Hand held equipment operating on liquid fuel. Air quality impacts relating to the use of the above are generally minor in magnitude for individual sources, however where old or ill-maintained equipment is operated, there is potential for noticeable and/or cumulative impacts to occur.
VOC's	**Negligible Negative**	A small volume 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 likely storage of such volatile substances will be in small volumes, any potential impacts will be limited to the project site and immediate adjacent areas. Impacts may occur to areas immediately outside of the site, where inappropriate storage or use of substances is in close proximity to the construction site boundaries.
Odour	**Negligible Negative**	On-site sanitation and toilet facilities will be required for site staff and at any accommodation areas (any accommodation would be located off-site). There is the potential for release of associated odour to the immediate surrounding areas associated with inappropriate containment and coverage associated with wastewater holding tanks. Any such impacts are likely to be temporary and limited to the project site and immediate adjacent areas.

Table 5-7 Potential Air Quality Impact Significance - Construction

Potential Impact	Potential Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Dust Generation (within 500m distance of project)	Minor Negative	Risha Gas Power Plant	Very Low	**Negligible**
		CEGCO Accommodation Area	High	**Slight**
Gaseous Emissions	Negligible Negative	CEGCO Accommodation Area	High	**Slight**
Generation of VOC's	Negligible Negative	CEGCO Accommodation Area	Very Low	**Negligible**
Generation of Odour	Negligible Negative	CEGCO Accommodation Area	Very Low	**Negligible**

5.5.2 Operational Phase

As the project is a photovoltaic (PV) plant, it will not include combustion related activities and as such will not result in direct emissions to the local air-shed.

Table 5-8 Potential Impacts - Operation

Potential Impact	Potential Impact Magnitude	Justification
Vehicle - Gaseous Emissions	**No Change**	Project vehicle movements are expected to be minimal, due to the small number of operational staff (i.e. expected to be less than 30 people) and low demand for deliveries and maintenance. As such, additional road traffic emissions will unlikely result in a noticeable impact above the existing vehicular emissions in the area and the emissions from the Risha Gas Power Plant.

Table 5-9 Potential Air Quality Impact Significance - Operation

Potential Impact	Potential Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Vehicle - Gaseous Emissions	No Change	Risha Gas Power Plant	Very Low	**Neutral**
		CEGCO Accommodation Area	High	**Neutral**

5.6 Mitigation Measures

5.6.1 Construction

Table 5-10 Air quality – Mitigation Measures Proposed for Construction Phase

Impact / Source	Mitigation Measure
Dust due to site preparation	Any land grading, excavations and moving of uncovered waste/materials should be undertaken during periods of low winds (<15 km/h)
	Material stockpiles higher than 5 metres will be avoided where possible, with dust suppression sprays being utilised on any piles during periods where the wind speed exceeds 15km/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.
	Dusty material stockpiles (i.e. any fine sands and powders) are to be located away from the site boundaries and be effectively contained.
	Dust generating activities such as stone cutting and grinding are to be undertaken away from the site boundaries and/or should be effectively screened.
	Powdery materials (e.g. cements) will be stored and transported in sealed containers.
Gaseous and Particulate	Construction roads in the site will be designated and made clear to the drivers with signage for directions and speed limits placed all along the roads.

Impact / Source	Mitigation Measure
Emissions from Vehicles	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. Dry wheel cleaning is recommended, unless adequately treated water can be reused.
	A visual assessment of dust emissions will be undertaken on a daily basis and actions taken to reduce emissions, where they are identified as excessive.
	Deliveries of equipment/plant to the site will be efficiently managed to reduce the number of trips.
	Exhaust fumes and particulates emitted from trucks and vehicles will be minimised by assuring the use of good condition vehicles. Vehicles entering the site for the first time will be inspected for their worthiness and where necessary will not be permitted to enter the site.
	Lorries and trucks engines will be turned off while waiting on site to minimise gaseous emissions. Air-conditioned or heated shelters should be provided for drivers in designated waiting, loading and unloading areas.
VOC Emissions	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.
	Fires and material burning will not be allowed on the Project site.
Odours	Adequate and sufficient sanitary facilities for site workers must be provided. The placement of the facilities should be downwind of residential areas and should be regularly maintained.

5.6.2 Operation

Table 5-11 Air quality – Mitigation Measures during the Operational Phase

Impact / Source	Mitigation Measure
Infrequent vehicular movements associated with inspection and maintenance.	Regular vehicle maintenance.

5.7 Residual Impacts

5.7.1 Construction

Table 5-12 Air Quality – Residual Impacts – Construction Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Dust from Earthworks <500 from site	Minor Negative	CEGCO Accommodation Area	High	Minor to Moderate	Yes	**Slight**
		Risha Gas Power Plant	Very Low	Minor	Yes	**Negligible**
Dust from Vehicle	Minor Negative	CEGCO Accommodation	High	Minor to Moderate	Yes	**Slight**

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Movements <500 from site		Area				
		Risha Gas Power Plant	Very Low	Minor	Yes	**Negligible**
Gaseous and Particulate emissions from Vehicles	Minor Negative	CEGCO Accommodation Area	High	Minor to Moderate	Yes	**Slight**
		Risha Gas Power Plant	Very Low	Minor	Yes	**Negligible**
VOCs Emissions	Negligible Negative	CEGCO Accommodation Area	High	Minor	Yes	**Negligible**
		Risha Gas Power Plant	Very Low	Negligible to Minor	Yes	**Negligible**

5.7.2 Operation

Table 5-13 Air Quality – Residual Impacts – Operational Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Infrequent vehicular movement associated with inspection and maintenance	Negligible	CEGCO Accommodation Area	High	Minor	Yes	**Slight**
		Risha Gas Power Plant	Very Low	Minor	Yes	**Neutral**

6 NOISE AND VIBRATION

6.1 Requirements for Assessment

During the scoping assessment, it was identified that impacts for Noise and Vibration during the construction and operational phases of this project were anticipated to be minimal given the isolated nature of the site, construction requirements and that the plant will not involve any discernible noise generation during operation. Therefore, it has not been deemed necessary to undertake any detailed assessment as part of the ESIA.

This chapter includes the potential minimal impacts derived during the scoping assessment for the purpose of identifying associated best practice measures that should be incorporated within the projects CESMP and OEMSP.

6.2 Standards and Guidelines

Jordanian Standards

The Ambient Noise Standards established in the Jordanian Guidelines for Prevention of Noise (2003) are applicable to the Project. The maximum allowable noise limits for both the daytime and night-time periods. in the different areas exposed to noise are presented in the table below.

Table 6-1 Jordanian Guidelines for Prevention of Noise, 2003

Area	Highest Permissible Limits of Equivalent Sound Level (dB(A))	
	Day	Night
Residential in Urban	60	50
Residential in Sub-Urban	55	45
Residential in Rural	50	40
Residential with Small industries, Offices and Public Buildings	65	55
Industrial	75	65
Schools, Hospitals, Mosques and Churches	45	35

European (EBRD) Standards

The European Commission Environmental Noise Directive (Directive 2002/49/EC) relating to the assessment and management of environmental noise and is the main EU instrument to identify noise pollution levels and to trigger the necessary action both at Member State and at EU level. The Directive applies to noise to which humans are exposed, particularly in built-up areas, in public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, hospitals and other noise-sensitive buildings and areas. It is important to note, however, that the Directive does not set limit or target values, nor does it prescribe the measures to be

included in the action plans, thus leaving those issues at the discretion of the competent Member State authorities.

International (IFC) Standards

Table 6-2 below indicates the Ambient Noise Standards as established by the IFC/World Bank General EHS Guidelines (2007) which are applicable to the Project, both during construction and operational phases. These relate to the most sensitive point of reception and not the plant boundary. Noise impacts should not exceed the levels presented above, or result in a maximum increase in background levels of 3 (dBA) at the nearest sensitive receptor location off-site.

Table 6-2 IFC Ambient Noise Level Guidelines

Receptor	One Hour LAeq (dBA)	
	Daytime 07:00 – 22:00	Night time 22:00 – 07:00
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70
Guideline values are for noise levels measured out of doors. ***Source:*** IFC EHS General Guidelines, 2007.		

6.3 Observations and Baseline Conditions

6.3.1 Noise

The project is subject to existing noise influences from the adjacent Risha gas Power Plant. The primary noise source are the gas turbines, which are largely un-attenuated (i.e. no acoustic covers or walls) and emit noticeable noise levels (the location of the plant relative to the project is shown in the figure below).

6.3.2 Vibration

In terms of a baseline, no noticeable vibrations were encountered at any time during the preliminary site visits. Equally, the power and water generation facilities in the local area, are not major vibration sources, as their key components do not comprise laterally or vertically moving mechanisms. Impacts from the rotational movement of the existing gas turbines are relatively minor and are not noticeable outside of the power plant boundary.

6.4 Sensitive Receptors

Sensitive receptors and local noise sources in proximity to the project are identified in the figure below.

Figure 6-1 Noise & Vibration Sensitive Receptors

Satellite Image Source: Google Earth

Table 6-3 Noise & Vibration Receptor Sensitivity

Receptor	Receptor Sensitivity	Justification
Risha Gas Power Station	**Very Low**	The Risha Gas Power Plant is an industrial facility located adjacent to project site. As an industrial facility and as a key source of noise it is of low vulnerability to noise impacts.
CEGCO Accommodation Area	**High**	The CEGCO accommodation area is conserved as a residential receptor located approximately 450m from the project site.

6.5 Potential Impacts

6.5.1 Construction Phase

Table 6-4 Potential Noise & Vibration Impacts - Construction

Potential Impact	Potential Impact Magnitude	Justification
Construction Site Noise	**Negligible Negative**	Construction activities will likely result in temporary and short duration increases in the noise and vibration levels emanating from the project site, access road and the laydown areas. Noise will be generated by construction and propagated to the surrounding areas via a range of processes. Pertinent construction activities at the project site in relation to noise are likely to include earthworks and movement of vehicles, Requirements for heavy plant and machinery are unlikely given the

Potential Impact	Potential Impact Magnitude	Justification
		relatively small scale construction requirements.
Access Road Noise	**Negligible Negative**	Increases in vehicle movements during construction may also lead to increases in the noise level and as such impacts to off-site receptors. The access road to site is in close proximity to the existing CEGCO accommodation area. As such, it is possible that noise impacts at this receptor may be discernible, above noise from the existing Risha power plant.
Vibration	**Negligible Negative**	Certain construction processes, particularly those involved with site preparation and civil works, e.g. breaking, piling, vibratory rollers etc. have the potential to create vibration within the vicinity of the works. As vibrations dissipate rapidly (due to losses of energy radiating 360 degrees from their source) the vibration impacts at the Risha gas power plant will likely be negligible. Further, there are not expected to be impacts at the CEGCO accommodation area.

Table 6-5 Potential Noise and Vibration Impact Significance - Construction

Potential Impact	Potential Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Construction Site Noise	Minor Negative	Risha Gas Power Station	Very Low	**Slight**
		CEGCO Accommodation Area	High	**Slight**
Access Road Noise	Minor Negative	Risha Gas Power Station	Very Low	**Slight**
		CEGCO Accommodation Area	High	**Slight**
Vibration	Negligible Negative	Risha Gas Power Station	Very Low	**Negligible**

6.5.2 Operational Phase

Table 6-6 Potential Noise & Vibration Impacts - Operation

Potential Impact	Potential Impact Magnitude	Justification
Operational Noise	**No Change**	As the proposed PV plant will not contain rotating, vibrating, or other major moving parts, impacts from noise are not expected.
Vibration	**No Change**	As the proposed PV plant will not contain rotating, vibrating, or other major moving parts, impacts from vibration are not expected.

Table 6-7 Potential Noise and Vibration Impact Significance - Operation

Potential Impact	Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Operational Noise	No Change	Risha Gas Power Station	Very Low	**Neutral**
		CEGCO Accommodation Area	High	**Neutral**

Potential Impact	Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Vibration	No Change	Risha Gas Power Station	Very Low	**Neutral**
		CEGCO Accommodation Area	High	**Neutral**

6.6 Mitigation Measures

6.6.1 Construction

Table 6-8 Noise – Mitigation Measures during Construction

Impact	Mitigation Measure
Construction Noise and Vibration	The contractors and their sub-contractors will, at all times, carry out all work in such a manner as to keep any disturbance from noise and vibration to a minimum.
	Activities emitting the highest noise levels will be undertaken during daylight hours between Sunday and Thursday.
	Where possible, the highest noise emitting activities should be undertaken in a central site area away from sensitive receptors. For example, fabrication of materials before moving to other areas.
	All operatives will be trained to reduce noise on site.
	Diesel engine vehicles and compression equipment will be equipped with effective silencers.
	Electrically powered plant will be preferred, where practicable, to mechanically powered alternatives. All mechanically powered and pneumatic plant should be fitted with suitable silencers.
	Where appropriate, bored piling techniques will be preferred to impact piling.
	Delivery vehicles will be prohibited from waiting outside the site with their engines running. The movement of heavy vehicles during the night will be avoided wherever practical.
	All construction plant will be maintained and operated according to the manufacturers recommendations, in such a manner to avoid causing excessive noise.
	Items of plant on site operating intermittently will be shut down in the intervening periods between use.
	Where appropriate, noise barriers /attenuation to be employed (e.g. for generators) to ensure that the maximum noise level at 1m distance from a single source will not exceed 85dB(A).
	Where noise levels exceed 85dB(A) noise protection devices will be provided to personnel on-site.

6.6.2 Operation

Table 6-9 Noise –Mitigation Measures for Operation

Impact	Mitigation Measure
Operational Noise	Where practicable, all noise generating equipment shall be sited away from the CEGCO Accommodation Area adjacent to the site.
	Deliveries and removals of waste are to be undertaken during daylight hours where possible.

6.7 Residual Impacts

6.7.1 Construction

Table 6-10 Noise and Vibration – Residual Impacts – Construction Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Construction Noise	Moderate Negative	CEGCO Accommodation Area	High	Minor	Yes	**Moderate**
		Risha Gas Power Station	Very Low	Negligible	Yes	**Slight**
Construction Vibration (including vehicle vibration)	Minor Negative	CEGCO Accommodation Area	High	Minor	Yes	**Slight**
		Risha Gas Power Station	Very Low	Negligible	Yes	**Negligible**
Construction Vehicle Noise	Negligible Negative	CEGCO Accommodation Area	High	Minor	Yes	**Slight**
		Risha Gas Power Station	Very Low	Negligible	Yes	**Neutral**

6.7.2 Operation

Table 6-11 Noise and Vibration – Residual Impacts – Operational Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Vehicle noise	Negligible Negative	CEGCO Accommodation Area	High	Minor	Yes	**Slight**
		Risha Gas Power Station	Very Low	Negligible	Yes	**Neutral**
Electrical Equipment	Negligible Negative	CEGCO Accommodation Area	High	Minor	Yes	**Slight**
		Risha Gas Power Station	Very Low	Negligible	Yes	**Neutral**

7 SOILS, GEOLOGY AND GROUNDWATER

7.1 Requirements for Assessment

During the scoping assessment, it was identified that impacts for Soils, Geology and Groundwater during the construction and operational phases of this project were anticipated to be minimal given the barren nature of the site, minimal historic past use, and that the plant will not involve any requirements for discharge to ground. Therefore, it has not been deemed necessary to undertake any detailed assessment as part of the ESIA.

This chapter includes the potential minimal impacts derived during the scoping assessment for the purpose of identifying associated best practice measures that should be incorporated within the projects CESMP and OEMSP.

7.2 Standards and Guidelines

7.2.1 Soil Quality

Jordanian Requirements

The applicable environmental legislations in relation to geology, soil and groundwater includes the following:

- Groundwater Control Regulation No. 85 for 2002 and its amendments thereof
- Jordanian Legislations Water Authority Law No. 18 for 1988 and its amendments thereof; and
- Instructions for the Protection of Water Resources Allocated for Drinking Purposes of year 2006.

As part of the national regulations, there are no guidelines establishing soil and groundwater quality standards. In the absence of established soil and groundwater standards in Jordan, reference to the internationally recognised Dutch Soil Guidelines is recommended. The Dutch Standards identify maximum allowable concentrations for contaminants in soil and groundwater. The soil remediation intervention values indicate when the functional properties of the soil for humans, plants and animals is seriously impaired or threatened. They are representative of the level of contamination above which a serious case of soil contamination is deemed to exist. Groundwater target values provide an indication of the benchmark for environmental quality in the long term, assuming that there are negligible risks for the ecosystem.

The Dutch Standards for the most significant pollutants are presented in the following table.

Table 7-1 Dutch Standards for Soil and Groundwater.

Parameters	Soil (mg/kg dry matter)		Groundwater (µg/l)	
	Target value	Intervention value	Target value	Intervention value
Heavy Metals				
Arsenic	29	55	10	60
Barium	160	625	50	625
Cadmium	0.8	12	0.4	6
Chromium	100	380	1	30
Copper	36	190	15	75
Lead	85	530	15	75
Molybdenum	3	200	. 5	300
Nickel	35	210	. 15	75
Zinc	140	720	. 65	800
Mercury	0.3	10	. 0.05	0.3
Hexavalent Chromium			.	
Other Inorganic Substances				
Chloride	-	-	100 mg/l	-
Cyanide free	-	20	5	1500
Cyanide Complex	-	50	10	1500
Thiocyanate	-	20	-	1500
Aromatic Compounds				
Benzene	-	1.1	. 0.2	30
Ethyl benzene	-	110	. 4	150
Toluene	-	320	. 7	1000
Xylene (sum)	-	17	. 0.2	70
Styrene (vinyilbenzene)	-	86	. 6	300
Phenol	-	14	. 0.2	2000
Cresols (sum)	-	13	. 0.2	200

The target values for soil are adjusted for the organic matter (humus) content and soil fraction <0.2 µm (lutum - Latin, meaning "mud" or "clay"). The values below are calculated for a 'Standard Soil' with 10% organic matter and 25% lutum.
A case of environmental contamination is defined as 'serious' if >25 m³ soil or >100 m³ groundwater is contaminated above the intervention value.
Source: Groundwater target values and soil and groundwater intervention values, 2009. Annex 1

European (EBRD) Requirements

The EBRD PR3 on Resource Efficiency and Pollution Prevention and Control establishes general requirements pollution prevention as follows:

- The assessment process must identify technically and financially feasible pollution prevention and control techniques that are best suited to avoid or minimise adverse impacts on human health and the environment and are appropriate to the nature and scale of the project's adverse impacts and issues; and

- The Project must meet the relevant EU substantive environmental standards, where these can be applied at the project level. Where no EU substantive environmental standards at project level exist, the Project will identify, in agreement with the EBRD, other appropriate environmental standards in accordance with GIP.

International (IFC) Requirements

IFC/World Bank General EHS Guidelines (2007) establish management approaches for land contamination due to anthropogenic releases of hazardous materials, wastes or oil, including naturally occurring substances in Section 1.8 Contaminated Land. Land is considered contaminated when it contains hazardous materials or oil concentrations above background or naturally occurring levels. Contaminated land is a concern because of the potential risks to human health and ecology as well as he liability that it may pose to the polluter/business owners. General management measures include:

- Land contamination should be avoided by preventing or controlling the release of hazardous materials, hazardous wastes or oil to the environment. When contamination of land is suspected, or confirmed during any project phase, the cause of the uncontrolled release should be identified and corrected to avoid further releases;
- Contaminated lands should be managed to avoid the risk to human health and ecological receptors. The preferred strategy for land decontamination is to reduce the level of contamination at the site while preventing the human exposure to contamination.

7.3 Observations and Baseline Condition

7.3.1 Soil

Observations of the soils during the site visit indicate a yellow/orange colour consolidated material with small – medium size mixed gravels and little organic material. A number of small rocks of basalt appearance overly the surface and are generally limited to pebble size.

Soils in the wadi/drainage areas are characterised by fine, consolidated sands, with little/no gravel.

Plate 7-1 Site Soils


7.3.2 Geology

The general Mafraq region is located within the Northern Plateau, which features basalt, tuff and alkaline rocks. Areas south west of Mafraq contain sedimentary chalk and Paleozoic limestone rocks which are hydraulically connected to basalt.

The geology at the site does not include any outstanding features of note.

7.3.3 Groundwater

Given the elevation of the project area, lack of local rainfall and lack of key wadi's & vegetation; groundwater in the project area is expected to be encountered at a substantial depth only. It is therefore not expected that surface activities in the local area are affecting the quality of the groundwater.

There are few local activities in this region of Jordan. As such, there are not expected to be many users of groundwater. One user of groundwater is known to be the Risha Gas Power Station, which abstracts water for industrial use at the plant and for domestic use at the CEGCO accommodation area.

The proposed project intends to use the same well at the Risha Gas Power Station to abstract water for PV panel cleaning purposes and for domestic use at the same CEGCO accommodation area.

7.4 Initial Conceptual Model and Preliminary Risk Assessment

A key element of considering potential risks associated with contaminated land is the development of a conceptual model for the site that describes its environmental features together with the expected interaction of potential contamination sources with the environment. This is done by undertaking a Source – Pathway – Receptor analysis of the site:

- Sources (S) are potential or known contaminant sources.
- Pathways (P) are environmental systems thorough which a contaminant could migrate e.g. human uptake, groundwater; and
- Receptors (R) are sensitive human and environmental receptors that could be adversely affected by a contaminant. e.g. construction workers, surface waters.

Where a source, relevant pathway and receptor are present, a pollutant linkage is considered to exist whereby there is a circumstance through which environmental harm could occur, a potential environmental liability is created and necessity for further environmental assessment can be identified. A summary of potential sources, pathways and receptors relevant to the site are described below and given alpha numeric codes for identification (e.g. S1 – Source 1).

Sources (S)

S1 - Several gas exploration wells (and a gas plant) have been established in the area surrounding the proposed site, including a wellhead (now caped and disused) approximately 500m to the south of the project site. The wellhead has a series of evaporation ponds that contain watery hydrocarbons and sludge, that were emitting a foul odour when standing in close proximity). The ponds appear to be well contained by the use of concrete bases and geo-textile liners, as shown in the image below.

S2 - The existing plant to the north east of the site is gas fired and therefore unlikely to store significant, volumes of soluble fuels. However, small chemical spills from operation or maintenance of machinery (hydraulic leaks etc.) and small scale leaks from stores for plant and vehicles could provide a source of contamination.

In addition to the above it was noted that the site of works contains sever small areas of rubble waste from minor, past excavations. Upon examination during the site visit, this rubble waste appeared to comprise only inert subsoil and rock from the natural geology found at the site. Therefore, no associated risk of contamination is considered to be attributable with these small piles of subsoil and rock.

Potential Pathways (P)

Migration of leachable contaminants to groundwater could be occurring as a consequence of leaks or uncovered contaminants moving into solution as a consequence of rainfall. However, it is noted that given that the principle sources of contamination identified above are outside of the site of proposed works and that the underlying geology is likely to result in to horizontal migration of pollutants, no contamination pathway leading to, or influenced by, proposed works are anticipated.

Receptors (R)

R1 - Construction and Maintenance Workers are likely to come into dermatological contact, and could also ingest, site soils.

R2 - Any contaminants found at ground level are likely to leach vertically to underlying sub-soils and groundwater

The following initial conceptual model has been developed to determine the level of risk of contamination that may exist at the project site. The conceptual model has been prepared based on observations during the site visit.

Table 7-2 Source – Pathway – Receptor Model

Potential Source	Potential Transport Pathways Associated with Project Site	Potential Receptor
S1 Existing power plant to the North East of the site.	There are no anticipated pollution pathways attributable to the project site and it is not	R2 Soils and underlying groundwater

Potential Source	Potential Transport Pathways Associated with Project Site	Potential Receptor
S2 Gas Well Head Evaporation Ponds	anticipated that the project will introduce any additional pollution pathways during construction or operation.	

The Contaminated Land Risk Assessment methodology used for this assessment is based on CIRIA C552 (2001) Contaminated Land Risk Assessment – A Guide to Good Practice, in order to quantify potential risk via risk estimation and risk evaluation, which can be adopted at the Phase I land contamination assessment stage. This will then determine an overall risk category which can be used to identify likely actions for the site.

Table 7-3 Source – Pathway – Receptor Analysis

Potential Source	Potential Receptor	Potential Transport Pathways Associated with Project Site	Likelihood of Source – Receptor Linkage	Potential Consequence of linkage	Risk Classification
S1 Existing power plant to the North East of the site. S2 Gas Well Head Evaporation Ponds	R2 Soils and underlying groundwater	None anticipated	**Low likelihood**. Given the absence of unanticipated pollution pathway it is by no means certain that the project would encounter contaminated materials.	Mild In the instance that a pollution pathway was evident, associated consequences are anticipated to be easily preventable through excavation control and material remediation.	Unlikely Circumstances are such that it is improbable that contaminated material will be encountered during the development of the project.

Given the unlikelihood of encountering contaminated material within the project site, the associated potential for impacts can be classified as Neutral.

Table 7-4 Soil, Geology & Groundwater - Receptor Sensitivity

Receptor	Receptor Sensitivity	Justification
Soil	**Low**	Site soils are a dominated by a consolidated mix of gravels and sands with no organic content or moisture retention properties.
Groundwater	**High**	Groundwater is expected to be encountered at substantial depth. Given the scarcity of groundwater resource in the region, this potential resource is considered to be of a high value.

7.5 Potential Impacts

7.5.1 Construction Phase

Table 7-5 Potential Soil, Geology & Groundwater Impacts - Construction

Potential Impact	Potential Impact Magnitude	Justification
Spills and Leaks Associated with Construction	**Negligible Negative**	Effects to soils could occur where there is direct interaction of hazardous materials & wastes, chemicals and fuels with soils and/or groundwater. Such interactions may occur due to: <u>Leaks and Spillage</u> Soil will be susceptible to contamination from various sources during the construction phase. The main sources of contamination are typically those places along the handling and processing of products where liquid waste and hazardous liquids/materials can escape into the soil. These are commonly associated with the transport, handling and storage of such materials and the potential threat of releases and spills into the ground. The risk of accidental spillage and leakage of various chemical products, are often attributable to storage areas of the construction site as well as during the transportation of such materials on and off the site. Improper methods of storing, transferring, and handling of these products can result in spillage to the ground and result in soil contamination. <u>Inadequate Waste Management</u> Construction of the proposed development will involve activities that generate solid and small quantities of hazardous waste, as well as potential liquid wastes. Waste generated during these activities poses a threat to the site soils. Of particular concern is the management of hazardous waste generated during the construction phase. Although the hazardous fraction of construction waste such as used oil, machinery lubricants and paints will represent a very small proportion of the total amount of construction waste, it will require special attention. 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 contamination increases. Minimal volumes of fuels and chemical will be required for the installation of the PV Array. Associated risks are easily manageable through the implantation of best practice that would be considered standard content for any robust CESMP.

Table 7-6 Potential Soil, Geology & Groundwater Impact Significance - Construction

Potential Impact	Impact Magnitude	Receptor	Receptor Sensitivity	Impact Significance
Spill and Leaks Associated with Construction	Negligible Negative	Soil	Low	**Slight**

7.5.2 Operational Phase

Table 7-7 Potential Soil, Geology & Groundwater Impacts - Operation

Potential Impact	Potential Impact Magnitude	Justification
Spill and Leaks Associated with Operation	**Negligible Negative**	Specific project impacts to soil, geology and groundwater are not expected during the operational phase as the site will be static and there will likely be no, or very little use (or storage) of any hazardous materials, liquids or fuels. Associated risks are easily manageable through the implantation of best practice that would be considered standard content for any robust OESMP. Potential risks of concern during the operational phase are expected to be limited to the management and storage of hazardous materials/wastes/wastewater, chemicals and any fuels.
Groundwater Abstraction	**Negligible Negative**	Groundwater will be abstracted from the existing Risha Gas Power Station well for use on site and at the CEGCO accommodation area. Given the lack of groundwater users locally, and the expected minor volumes of abstraction (total of 1,844m^3 per year) impacts to groundwater abundance are expected to be negligible.

Table 7-8 Potential Soil, Geology & Groundwater Impact Significance - Operation

Potential Impact	Potential Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Spill and Leaks Associated with Operation	Negligible Negative	Soil	Low	**Slight**
Groundwater Abstraction	Negligible Negative	Groundwater	High	**Slight**

7.6 Mitigation Measures

7.6.1 Construction

Table 7-9 Soil and Groundwater – Mitigation Measures during Construction

Impact	Mitigation Measure
Spillage/ Leakage	All permanent or semi-permanent hazardous materials storage areas must have suitable leak tight bunding, to contain 110% of the total stored volume, in the event of a spill or leakage.
	A spill prevention and spill response plan will be established in line with the EPC Contractor's site specific CESMP. The plan will outline methods for the prevention of incidents, response and remediation of any contamination. A framework for emergency response and contingency plan is provided in the Framework Environmental & Social Management & Monitoring Plan – Volume 3.
	The clean-up of any spillage or leakage will be made by spill absorbents, available at all hazardous material storage locations on the site. Absorbents and other clean up material/provision will be contained within accessible and clearly marked spillage kits. Training on spillage response will be provided to the relevant site personnel.
	Refuelling of equipment and tanks (e.g. in construction laydown areas) should only be conducted in designated areas following specified procedures, and not at machinery work locations to minimise potential spillages.

Impact	Mitigation Measure
Storage and waste management	All hazardous materials or waste being temporarily stored outside of its designated storage areas should be kept in well-equipped, leak-tight containers with drip protection to avoid leaks to the ground.
	Wherever possible, the quantity of chemicals and fuel stored on site will be kept to a minimal practical level. Infrequently used chemicals will be ordered in suitable quantities only when required.
	Excavated materials will be kept in stockpiles for as short a time as possible.
	Hazardous materials will not be stockpiled, only temporarily stored for removal by a licensed hazardous waste carrier.
	Minimise the size and height of the stockpiles as far as possible.
	A mandatory training programme for site personnel should be employed to increase awareness of chemical management protocols including proper handling and storage of chemicals, emergency response and contingency plans.

7.6.2 Operation

Table 7-10 Soil and Groundwater – Mitigation Measures during Operation

Impact/ Source	Mitigation Measure
Spillage	Storage areas for hazardous material will be sealed, covered and paved with secondary containment such as bunded walls, leak tight collection reservoirs, leak tight flooring, and correct shelving / cabinets in order to prevent spillage and leakage into the ground.
	The storage tanks of fuels/chemicals will be properly maintained and stored within a bunded area of 110% of their storage capacity.
	Established spill emergency and contingency plan
	Mandatory training program for employees to increase their awareness of chemical management protocols including proper handling and storage of chemicals, emergency response, contingency plans and appropriate PPE.
Storage and waste management	A dedicated storage for large volumes of solid and liquid (especially for hazardous waste) material from several sources is recommended. This storage area will be provided with leak tight flooring, secondary containment as bunded walls, leak tight collection reservoirs and correct shelving/cabinets to prevent spillage.

7.7 Residual Impacts

7.7.1 Construction

Table 7-11 Soil, Geology and Groundwater – Residual Impacts – Construction Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Excavation Activities	Negligible Negative	Local Soil Quality	Very Low	Negligible	Yes	**Neutral**
		Groundwater	Medium	Minor	Yes	**Neutral**
Leaks and Spillage	Moderate Negative	Local Soil Quality	Very Low	Minor	Yes	**Neutral**

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
		Groundwater	Medium	Moderate to High	Yes	**Neutral**
Inadequate Waste Management	Moderate Negative	Local Soil Quality	Very Low	Minor	Yes	**Neutral**
		Groundwater	Medium	Moderate to High	Yes	**Neutral**

7.7.2 Operation

Table 7-12 Soil, Geology and Groundwater – Residual Impacts – Operational Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Spills and Accidental Release	Moderate Negative	Local Soil Quality	Very Low	Minor	Yes	**Neutral**
		Groundwater	Medium	Moderate to Major	Yes	**Neutral**

8 ECOLOGY

8.1 Requirements for Assessment

During the scoping assessment, it was identified that impacts for ecology and nature conservation were anticipated to be minimal given the barren nature of the site, minimal vegetative cover and no association with any designated sites.

However, the site date used for the ecological assessment undertaken during the scoping stage is approximately 3 years old. The scoping stage therefore determined the requirement for an ecological walkover survey in order to provide up to date information to inform the ESIA.

The ecological assessment undertaken as part of the ESIA has included:

- a desktop assessment in order to identify any designated areas or important habitats/species that could be associated with the project area; and
- a walkover survey to identify habitat types, floral species composition and any evidence of fauna within the project site.

The walkover survey was conducted on the 2nd of May 2017.

8.2 Standards and Guidelines

Jordanian Requirements

The applicable national legislation that provide requirements for the protection, conservation and management of the ecological environment, including biodiversity, fauna and flora is as follows:

- Law No. 52 of 2006 on Environmental Protection;
- Law No. 43 of 2008 on the Regulation for Categorizing Wild Birds and Animals Banded from Hunting;
- Law No. 44 of 2002, the Agriculture Law which covers the protection of various environmental elements including soil, flora and fauna;
- Law No. 71 of 1971 for the Preservation of forests and soil; and
- Law No. 113 of 1973 for the Protection of Birds and Wildlife and Rules Governing Hunting.

The Royal Society for the Conservation of Nature (RSCN) was established in 1966 and was the first non-profit organization to deal with biodiversity protection. RSCN is responsible for enforcing biodiversity and wildlife protection laws, the implementation of the International Convention on International Trade in Endangered Species (CITES) and the management of nature reserves in Jordan.

European (EBRD) Requirements

The EBRD PR6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources establishes general requirements for the conservation of biodiversity and sustainable management of living natural resources covering aspects such as the assessment of issues and impacts on biodiversity.

Where applicable, the Project will intend to follow the targets set out by the EU Biodiversity Strategy including the Habitats Directive 92/43/EEC, the Birds Directive 2009/147/EC and the EU Regulation 1143/2014 on Invasive Alien Species. It is noted however that the targets are unlikely to be triggered by the Project due to the nature and scale of the Project and the existing ecological conditions within the Project site.

International (IFC) Requirements

IFC Performance Standard 6 on Biodiversity Conservation and Sustainable Natural Resource Management establishes requirements for protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources.

8.3 Observations and Baseline Condition

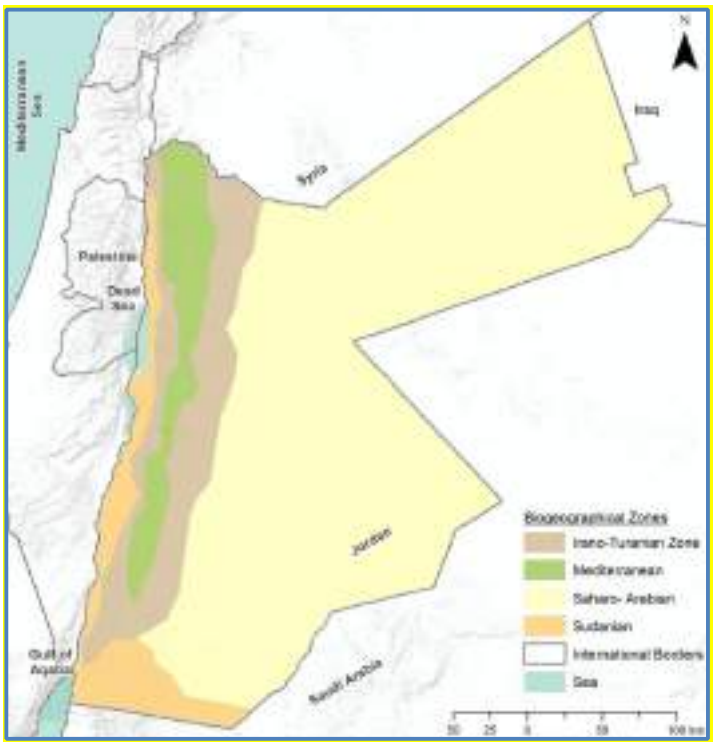
8.3.1 Designated Sites

There are no known conservation areas within the site of proposed works. The closest designated site is Burqu Important Bird Area (IBA) which is located approximately 70km to the north west of the project site of works. This IBA includes a near-permanent, spring-fed freshwater pool (200 ha) which is a major source of water for wildlife. Proven or probable breeding bird species include *Buteo rufinus, Aquila chrysaetos, Alectoris chukar, Cursorius cursor, Charadrius leschenaultii, Ramphocoris clotbey, Eremophila bilopha and Oenanthe lugens*. Burqu IBA is an important water source for large numbers of raptors during autumn migration, e.g. *Circus pygargus*, and a wide variety of waders.

8.3.2 Habitats

The site visit undertaken on the 2nd of May identified a harsh, arid ecological habitat commensurate with that of the Irano-Turanian Biogeographic region. The site is holds little evidence of wildlife activity and biodiversity is minimal.

Figure 8-1 Bio-Geographic Regions of Jordan



Source: Jordanian Ministry of Environment

The project site is typical of the Saharo-Arabian Biogeographic region in that the majority of the site consists of open gravel plain with minimal to no vegetation cover.

Vegetation is relatively abundant within the 2 areas of wadi found within the project. During the site visit on the 2nd of May, areas of wadi were clearly delineated by the extent of vegetation.

Plate 8-1 Vegetation Confined to Wadis

Vegetated areas (associated with wadis) found within the project site are identified within the figure below.

Figure 8-2 Vegetated areas within the Project Site.

No evidence was identified to suggest any areas of long standing open water, no aquatic vegetation (or associated remains) or sediment deposits were identified from the site visit undertaken on the 2nd of May

Value attributed to the habitat within the site of works has been devised according to the Ratcliffe criteria (Ratcliffe, D.A. 1977 A Nature Conservation Review, Cambridge University Press) and is presented in the table below.

Table 8-1 Ecological Value of Site of Proposed Works

Size	Size of proposed works is approximately 2km^2
Diversity	Habitat is dominated by barren open land that is sparsely vegetated and supports minimal diversity of flora and fauna.
Rarity	Habitat and species identified are common to the Irano-Turanian region.
Naturalness	Area has not had any previous signifanct anotropogenic use.
Typicalness	Site of proposed works is typical of the area. Vegetation structure is typical to the Irano-Turanian region.
Fragility	Pioneer species present are suitable to the barren, arid conditions.
Recorded History	Historical mapping provided in section suggests the area has been subject to minimal change.
Position in geographical	The site is unlikely to be supportive of any adjacent habitats or any areas of conservation value.

or ecological unit	
Potential Value	The arid conditions, poor soil structure, similarity to the wider open landscape and minimal species diversity render the site of little future ecological value.

Flora

The majority of the site of works is free from any vegetation cover with the exception of areas of wadi. The plants observed during the site visits were limited to 5 pioneer and 1 crop species, these are listed in the table below.

Table 8-2 Plant Species Identified from Site

Name	Site Image	Site Abundance Category	Conservation Significance
Gymnarrhena micrantha		Occasional	None – common pioneer species to the region.
Anthemis pseudocotula		Occasional	None – common pioneer species to the region.
Scorzonera Undulata Vahl		Occasional	None – common pioneer species to the region.

Name	Site Image	Site Abundance Category	Conservation Significance
Anacyclus clavatus - White		Occasional	None – common pioneer species to the region.
Sonchus Tenerrimus L.		Occasional	None – common pioneer species to the region.
Hordeum sp.		Abundant	None – crop species not native to area.

None of the vegetation identified from site is of any known conservation value and is unlikely to be associated with any designated site.

Fauna

The harsh environment, minimal vegetation cover and poor foraging opportunities minimise opportunities for fauna within the site of works. However, arid habitats such as these can support reptiles, small mammals, birds and invertebrates.

During the site walkover, a small, active rodent burrow was identified within the proximity of an area of wadi. This burrow is likely to have been created by a *Gerbillus* or *Meriones* sp. Such

rodents are common in the desert areas of the region, and will forage on seeds and small insects (likely to be associated within the areas of wadi).

Also, 2 Arabian Darkling Beetle's (*Pimelia Arabica*) were identified within the wadi areas within the project boundary. This beetle is very common throughout the Arabian Peninsula. These beetle feeds on seeds and foliage, relying on decayin plant matter in larval stage

No other evidence of any terrestrial fauna was noted from the project site.

Figure 8-3 Evidence of Fauna Onsite

Avi-Fauna

The open and barren nature of the project site presents minimal opportunity for foraging or nesting for avifauna. Only 2 common sparrows (*Passer domesticus*) were noted within the project site. Several more were seen amongst the CEGCO accommodation area where they were feeding off scraps from the kitchen.

No bird other species were noted during the site visit. Given the open and barren nature of the site, it is unlikely that the site has any supportive function for migratory birds associated with the Burqu IBA located over 70km away.

8.3.3 Consultation Outcomes

RSCN was a consultee included in the consultation exercises completed on the 11th of April and 2nd of May. RSCN did not identify any ecological significance associated with the proposed project site.

8.4 Receptors

The table below outlines the identified receptors in relation to biodiversity as well as the determined sensitivity of those receptors.

Table 8-3 Ecology – Sensitivity of Receptors

Receptor	Sensitivity	Justification
Site Flora	**Low**	The site supports a few pioneer floral species, none of any ecological or conservation value
Site Fauna	**Low**	Rodent populations are likely to be sparse and supported predominantly by current anthropogenic activity within the site of works.

8.5 Potential Impacts

8.5.1 Construction

The proposed project design has been prepared to ensure that solar arrays can be located outside of the areas of confirmed wadi (please refer to Figure 4-4). Therefore, as a consequence loss of vegetation within the project site will be substantially minimised. The majority of site preparation works will be restricted to open, barren areas that are predominantly free of any vegetation or ecological value.

Table 8-4 Ecology – Magnitude of Construction impacts

Impact	Magnitude	Justification
Reduced biomass	**Negligible Negative**	Dust generation and vehicle access across the site could result in damage to vegetation associated with wadis.

Table 8-5 Ecology - Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Reduced biomass	Negligible	Site Flora	Low	**Negligible**
	Negligible	Site Fauna	Low	**Negligible**

8.5.2 Operation

Areas of open soil will remain enabling opportunity for the pioneer species of vegetation in the region.

The use of water in cleaning the PV Array could influence the degree of drought stress for vegetation in the site, potentially resulting in an increase in species diversity.

Burrowing small mammals could return to the site.

Table 8-6 Ecology – Magnitude of Operational impacts

Impact	Magnitude	Justification

Impact	Magnitude	Justification
Increased water availability	**Negligible Beneficial**	Increased water availability is only likely to have any effect for pioneer species at the base of PV foundations.

Table 8-7 Ecology - Significance of Operational Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Increased water availability	Negligible	Site Flora	Low	**Negligible**
	Negligible	Site Fauna	Low	**Negligible**

8.6 Mitigation Measures

8.6.1 Construction

Table 8-8 Ecology – Mitigation Measures during the Construction Phase

Impact	Mitigation
Reduced biomass	The Project Layout has been adjusted to avoid any construction in the areas of wadi. During construction activities, encroachment into areas of wadi shall be minimised at all times. Dust generation shall be minimsed in accordance with the requirements identified within the air quality section.

8.6.2 Operation

Table 8-9 Ecology – Mitigation Measures during the Operation Phase

Impact	Mitigation
Increased water availability	Ecological monitoring shall be included as part of the OESMP to include date, timing and details of any sightings of any unusual site fauna.

8.7 Residual Impacts

8.7.1 Construction

Table 8-10 Ecology – Residual Impacts – Construction Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Reduced biomass	Negligible	Site Flora	Low	Negligible	No	**Negligible**

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
	Negligible	Site Fauna	Low	Negligible	No	**Negligible**

8.7.2 Operation

Table 8-11 Ecology – Residual Impacts – Operational Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Increased water availability	Negligible	Site Fauna	Low	Negligible	No	**Negligible**

9 ARCHAEOLOGY AND CULTURAL HERITAGE

9.1 Requirements for Assessment

During the scoping assessment, there were no records of any past cultural heritage or previous archaeological finds confided within the proximity of the project. However, the risk of encountering buried archaeology at the project site was unknown.

As part of the preparation of the ESIA, the Ministerial Department of Antiquities in Jordan (DoA) undertook an assessment for the potential risk associated with encountering archaeological artefacts within he project site.

9.2 Standards and Guidelines

Jordanian Requirements

The Law of Antiquities and Archaeology (Law No. 21 of 1988) main law concerning cultural heritage in Jordan and outlines the management measures to protect and conserve the archaeological richness of Jordan. Specific requirements include:

- The excavation within a distance less than 1 km from an archaeological location is banned (Article 3);
- A project location must be free from any archaeological materials, before any excavations, in order to avoid any penalty defined by this law.

European (EBRD) Requirements

The EBRD PR 8 for Cultural Heritage outlines requirements for the protection, management and sustainable use of tangible and intangible cultural heritage. The requirements mainly focus on the assessment process, the management of impacts (including a chance finds procedure) and the consultation with affected communities and other stakeholders.

International (IFC) Requirements

In addition to complying with applicable law on the protection of cultural heritage, including national law implementing the host country's obligations under the Convention Concerning the Protection of the World Cultural and Natural Heritage, the IFC requires the identification and protection of cultural heritage by ensuring that internationally recognized practices for the protection, field-based study, and documentation of cultural heritage are implemented.

9.3 Observations and Baseline Condition

Jordan is blessed with a variety of cultural qualities, relics and archaeological features. Such notable sites of archaeological importance include Petra (UNESCO World Heritage Site), The

ancient city of Jerash, The Roman Theatre and other remains in Amman, the Byzantine site of Um er-Rasas (UNESCO World Heritage Site), Karak Fort, and Wadi Rum (UNESCO World Heritage Site) amongst others.

On a local scale, the lands within the Mafraq Governorate have sites of historical relevance dating back to the bronze age, with archaeological sites including: Al-Fudayn, Umm Al-Jimal, Hayyan al-Musharraf, Umm Al-Surab, Sama Al-Sarhan, Rahab and the Umayyad Palace Qasr Burqu'. Mafraq is also located on the road linking Egypt, Palestine and Arabian Peninsula, with access links to Syria and onwards to Europe (Source: Ministry of tourism and Antiquities, Department of Antiquities).

During the site visit undertaken on the 2nd of May 2017, no signs or visual evidence of cultural/archaeological artefacts, objects or structures were identified within the Project site. The Jordanian DoA conducted a desk study of the site and have issued a letter confirming that there are no known archaeological remains that will be effected within the project site (Appendix D).

9.4 Receptors

Table 9-1 Archaeology and Cultural Heritage – Sensitivity of Receptors

Receptor	Sensitivity	Justification
Undiscovered artefacts within the Project Area	**Low**	The likelihood of encountering any artefacts within the project site has been confirmed as minimal.

9.5 Potential Impacts

9.5.1 Construction

Construction activities, particularly those relating to earthworks and excavations have the potential to cause disturbance or damage to any unknown buried archaeological or cultural features. The resulting impacts may result in the loss of such features or degradation of their preserved quality.

Table 9-2 Archaeology and Cultural Heritage - Magnitude of Construction Impacts

Impact	Magnitude	Justification
Damage to undiscovered artefacts	**Minor Negative**	There is a minimal risk that the site of works will harbour undiscovered artefacts. If this is the case, excavation activities associated with construction could result in the damage or destruction of such artefacts.

9.5.2 Operation

Impacts during operation are not anticipated, as there will be no further excavation or earthwork activities at the project site.

9.6 Mitigation Measures

9.6.1 Construction

Table 9-3 Archaeology and Cultural Heritage – Mitigation during Construction

Impact	Mitigation
Damage to undiscovered artefacts	The EPC contractor will prepare and implement a chance finds procedure as part of the CEMP.

9.7 Residual Impacts

9.7.1 Construction

Table 9-4 Archaeology and Cultural Heritage – Residual Impacts - Construction

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Damage to undiscovered artefacts	Minor Negative	Undiscovered artefacts	Low	Moderate	Yes	**Slight.**

10 LANDSCAPE AND VISUAL IMPACTS

10.1 Requirements for Assessment

During the scoping assessment, it was identified that landscape and visual effects during the construction and operational phases of this project were anticipated to be minimal given the isolated nature of the site, the lack of any significant landscape features, and that lack of any notable visual receptors (CEGCO accommodation area already looks on to the Risha Gas Power Plant). Therefore, it has not been deemed necessary to undertake any detailed assessment as part of the ESIA.

This chapter includes the potential minimal impacts derived during the scoping assessment for the purpose of identifying associated best practice measures that should be incorporated within the projects CESMP and OEMSP.

10.2 Landscape and Visual Standards and Guidance

Specific legislation is in regard to landscape and visual impacts is not in place within Jordan.

The consideration of impacts and identification of best practices has been in undertaken with reference to the guidelines set out by the UK Landscape Institute 'Guidelines for Landscape and Visual Impact Assessment, 3rd Edition' (2013).

10.3 Observations and Baseline Condition

10.3.1 Landscape Character

The site topography is consistent with the wider region and generally has low gradient undulations across the open landscape. The gentle slopes lead to shallow wadi channels into which runoff drains during rainfall events. The immediate local landscape has minimal vegetation, and this is only of a low-lying nature in the wadi/drainage areas. The primary character is defined by the orange/brown soils and gentle undulations across the landscape intersected by wadis.

Besides the existing Risha Gas Power Plant, overhead transmission line and Gas production plant/wells (now closed and capped), the proposed site is isolated from other features, settlements and anthropogenic activities. The site is located in close proximity to the Jordanian border with Iraq, however this does not reflect any change in the surrounding landscape, although there are noticeable border features, e.g. fences, patrol tracks and occasional checkpoints.

Plate 10-1 Gentle Undulations of the Local Landscape

10.3.2 Visual Impacts

Several anthropogenic features are clearly visible within the local area and from the site itself. These features are obvious due to their vertical intrusion within the flat landscape and include the high voltage cable corridor, Risha Gas Power Plant and the gas well heads (to a lesser extent). Such examples can be seen in the Plates above and below.

Plate 10-2 Local Visual Impacts

As described above, the structures of the power and water facilities, as well as the OHTL have resulted in an amount of disturbance to the visual envelope of the landscape which are also apparent at night due to the lighting effects.

There are however very few visual receptors locally, which are limited to the CEGCO accommodation area, as such there are few impacts.

10.4 Sensitive Receptors

Table 10-1 Landscape and Visual Impacts – Sensitive Receptors

Receptor	Sensitivity	Justification
Landscape Character	**Very Low**	The landscape in the general project area is predominantly open, extensive with a lack of defining features, points of interest or notable landmarks. The type of landscape is abundant in this area and extends for a number of kilometres in all directions. The landscape in the immediate project area has several existing industrial features (Risha Gas Power Plant, Gas Plant, Well Heads and Over Head Transmission Lines), and provides an isolated industrial character in this area. As such, the landscape character is slightly degraded in this area.
Visual Amenity from CEGCO Accommodation Area	**Very Low**	The visual amenity from the CEGCO accommodation area is reduced by the location of the existing in industrial facilities and features locally.

10.5 Potential Impacts

10.5.1 Construction Phase

One of the first stages of construction activities will result in preparation of the site. The proliferation of such activities throughout the construction period and across the will result in major land use changes, with the subsequent installation of the PV Array.

The movement of heavy construction vehicles and earthworks on sandy surfaces are also likely to result in dust generation and the resulting haze may disturb the visual envelopes of receptors.

Impacts to landscape character will also occur at night where the addition of lighting during construction will illuminate this area that has previously been free of any light sources. The addition of light and eventual widespread use of lighting across the construction site will result in a night time light haze being emitted in the air above the general site area.

Table 10-2 Potential Landscape and Visual Impacts - Construction

Potential Impact	Potential Impact Magnitude	Justification
Visual impacts associated with construction activities	**Moderate Negative**	Construction activities will result in the loss of any vegetation on site, but not in the overall topography of the area. Construction machinery, boundary fencing and new laydown /site offices will change the landscape character to an industrial/working area feel during construction, as will the development of infrastructure.
Light Pollution	**Minor Negative**	Construction flood lights will increase the illumination in the area, with potential light spill outside of the site area.

Table 10-3 Potential Landscape and Visual Impacts Significance - Construction

Potential Impact	Potential Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Visual impacts associated with construction activities	Minor Negative	Landscape Character	Very Low	**Negligble**
		Landscape Character		
Light Pollution	Minor Negative	Visual Amenity from CEGCO Accommodation Area	Very Low	**Negligble**
		Landscape Character		

10.5.2 Operational Phase

The development of the Project with the installation of grid like PV arrays is likely to distort the existing undeveloped landscape character. A key change will result from the loss of the view to the characteristics bright orange/brown soils, as these will be replaced with a view of dark coloured flat PV arrays, occupying an expansive area. Due to the low-lying design of the PV Plant, with the PV arrays will not exceed 3-4m in height, views across the wider landscape are unlikely to be significantly impacted.

It is envisaged that only minimal lighting will be required at night-time for security purposes since workers will not be at the site during dark periods. Impacts due to lighting may result in minimal changes to the night-time landscape character and views of the site.

PV Array are intended to absorb light and the design thereof should result in minimal reflection. The likelihood of associated impacts is therefore considered negligible.

Table 10-4 Landscape and Visual - Magnitude of Operational Impacts

Impact	Magnitude	Justification
Visual Change	**Negligible Negative**	The proposed project will result in a significant change to current visual condition for residential properties to the north of the site. This impact is not considered to significant given the current barren nature of the landscape and lack of any particular features of interest.
Glare/Reflection	**Negligible Negative**	Uncontrolled and persistent reflection/glare from the project could result in occasional disturbance.
Light Pollution	**Negligible Negative**	There will be a measureable change in the visual amenity of the area at night, particularly for the residences and other properties overlooking the site.

Table 10-5 Landscape and Visual - Significance of Operational Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Visual Change	Minor Negative	Visual Amenity from CEGCO Accommodation Area	Very Low	**Negligible**
Glare/Reflection	Negligible Negative	Visual Amenity from CEGCO Accommodation Area	Very Low	**Negligible**
		Landscape Character	Very Low	**Negligible**
Light Pollution	Minor Negative	Visual Amenity from CEGCO Accommodation Area	Very Low	**Negligible**
		Landscape Character	Very Low	**Negligible**

10.6 Mitigation Measures

10.6.1 Construction

Table 10-6 Landscape and Visual – Mitigation Measures during the Construction Phase

Impact	Mitigation
Visual impacts associated with construction activities	Occupiers of the CEGCO accommodation area should be well informed in advance of any onsite construction activities.
Light Pollution	The CESMP shall include measures for reduced light spill (such as the use of shielded luminaires, flat glass lanterns and positioning of lighting to avoid unnecessary illumination outside of the site of works.

10.6.2 Operation

Table 10-7 Landscape and Visual – Mitigation Measures during the Operational Phase

Impact	Mitigation
Visual Change	Local residents and the air base have been consulted regarding the proposed project. No variations or additions relative to visual change have been requested. The OESMP will include consideration of any suitable mitigation measures to minimise visual impacts of the plant during operation.

Impact	Mitigation
Light Pollution	Lighting provision shall not be excessive or unnecessary. Light fittings shall be directional as deemed appropriate for their use and intended areas of illumination. Lighting column and lighting head design should be chosen to limit back spill and any unwanted light spill to other site areas or, those areas off the site. Minimise illumination of building facades for aesthetic purposes. Strictly monitor the light intensity, direction and duration of lighting. Design and install lighting such that light bulbs and reflectors are not visible from public viewing areas. Lighting should not cause reflected glare.
Glare/Reflection	Panels will incorporate anti-reflective materials to reduce the likelihood of any potential impacts associated with glare/reflection.

10.7 Residual Impacts

10.7.1 Construction

Table 10-8 Landscape and Visual – Residual Impacts – Construction Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Visual impacts associated with construction activities	Minor Negative	Landscape Character	Very Low	Negligble	Yes	**Negligble**
		Landscape Character				
Light Pollution	Minor Negative	Visual Amenity from CEGCO Accommodation Area	Very Low	Negligble	Yes	**Negligble**

10.7.2 Operation

Table 10-9 Landscape and Visual – Residual Impacts – Operational Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Visual Change	Minor Negative	Visual Amenity from CEGCO Accommodation Area	Very Low	Negligible	Yes	**Negligible**
Glare/Reflection	Negligible Negative	Visual Amenity from CEGCO Accommodation Area	Very Low	Negligible	Yes	**Negligible**
		Landscape Character	Very Low	Negligible	Yes	**Negligible**

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Light Pollution	Minor Negative	Visual Amenity from CEGCO Accommodation Area	Very Low	Negligible	Yes	**Negligible**
		Landscape Character	Very Low	Negligible	Yes	**Negligible**

11 SURFACE WATER & DRAINAGE

11.1 Requirements for Assessment

During the scoping stage of the project, it was identified that 2 significant wadi areas are located within the project site. In order to identify the extents of these wadis and identify any potential surface water drainage impacts associated with the project, the scoping assessment identified the need for a Hydrology study to be undertaken to inform the outcome of the ESIA.

A hydrology study for the project was performed in February 2017 in order to delineate the extents of each wadi area within the project site according to:

- local meteorological conditions; and
- site topography.

This study has subsequently been used to inform mitigation requirements for the project.

11.2 Standards and Guidelines

Jordanian Standards

Water resources in Jordan are managed by the Jordanian Water Authority. The legislations and Standards related to groundwater, drinking water and wastewater reuse are:

- Jordanian Standard 202/1991 'Industrial Wastewater Reuse Criteria'.
- Water Authority Law No. 18 of 1988
- Underground Water Control Bylaw No. 85 of 2002
- Drinking Water Instructions of 1981

No wastewater reuse is anticipated for the proposed project and therefore these standards have been omitted form this ESIA. Wastewater Management is addressed in the chapter "Resource Management and Waste Management".

European (EBRD) Requirements

The EBRD PR3 on Resource Efficiency and Pollution Prevention and Control establishes general requirements for wastewater management as follows:

- The Project must seek to minimise water usage in order to minimise wastewater generation;
- The Project must identify technically and financially feasible techniques for reusing and recycling effluents in accordance with GIP, which should be implemented as part of the project design.

The European Commission highlights the importance of water re-use as a method of reducing the abstraction of water. The European Commission states the following in regard to water re-use:

'The potential role of treated wastewater reuse as an alternative source of water supply is now well acknowledged and embedded within European and national strategies. Water reuse is a top priority area in the Strategic Implementation Plan of the European Innovation Partnership on Water, and maximisation of water reuse is a specific objective in the Communication "Blueprint to safeguard Europe's water resources".

International (IFC) Requirements

IFC/World Bank General EHS Guidelines (2007) establish general requirements for direct or indirect discharge of process wastewater, wastewater from utility operations or storm water to the environment.

As the proposed project does not require direct or indirect discharge of wastewaters, these standards have been omitted from this ESIA.

11.3 Observations and Baseline Conditions

11.3.1 Storm Water Management

The site is open, barren and has generally not been influenced by human activity. As such, there are no specific provisions on-site for storm water management (i.e. storm water collection or drainage systems).

Under rainfall conditions, storm water will either infiltrate to site soils, or depending on the permeability of soils (or extent of saturation) will runoff via the natural slopes to larger channels (wadis) and collection areas.

The extent of rainfall infiltration to soils is expected to be low due to the hardened and consolidated soil surfaces in the project area. Under intense rainfall conditions, it is likely that the rate of rainfall will exceed the rate of infiltration, and hence will result in the occurrence of overland flow.

11.3.2 Flooding

Gentle slopes are dominant in the project area where the general catchment slopes are less than 0.6%. The hydrology study identified that during the rainy season, the runoff water runs in the deeper wadis with a maximum water depth around 20-30 cm and then spreads over the shallower channels.

On the day of the site visit (2nd May 2016) no evidence was identified to suggest any areas of long standing open water, no aquatic vegetation (or associated remains) or sediment deposits were identified.

Figure 11-1 Shallow Wadi (Indicative channel/drainage area)

Satellite Image Source: Google Earth

Photographs of the wadi are shown below. These areas are characterised on the site by low-lying vegetation and sandy soils, rather than topsoil's overlain by gravels.

Plate 11-1 Shallow Wadi

11.4 Sensitive Receptors

Table 11-1 Surface Waters and Drainage – Sensitive Receptors

Receptor	Sensitivity	Justification
Wadi within and adjacent to project boundary	**Low**	The Wadi within the project boundary does not provide a water resource for any local communities, support any assemblages of important habitats or act as a tributary to any water courses, lakes or freshwater ecosystems. The Wadi holds water only during periods of rainfall, which then is lost partly to evaporation and peculation to the underlying groundwater.
Adjacent land use including neighbouring gas fired power plant.	**High**	Interference with natural surface water flows associated with the Wadi could result in changes in Wadi alignment and of flooding new areas adjacent to the Wadi during periods of heavy rain. Lands adjacent to the Wadi are similar to the project area in that they are made up of consolidated sands and gravel with minimal agricultural value. However, extensive changes to current surface water flows could result in flooding of the neighbouring gas fire power plant to the north east with associated disruption in operation and potential for mobilisation of associated contaminants.

11.5 Potential Impacts

11.5.1 Construction Phase

Wastewater typically produced during construction includes sanitary/domestic wastewater, cement wash down, other plant cleaning/rinsing effluents, vehicle maintenance and the mixing of oils/lubricants in the wastewater (i.e. as a result of equipment washing).

Although construction activities are restricted to 12 months and will be temporary, the impacts from poor wastewater management could lead to long-term and significant impacts to the soils/groundwater local resources.

Sanitary and Domestic Wastewater Generation

It is anticipated that there will be approximately 250 workers on-site at the peak period of the construction. Quantities of sanitary wastewater have been estimated as an average of 100 litres/person/day, which equates to a predicted 25,000 litres of wastewater per day at peak construction periods.

In the event of inappropriate storage (e.g. broken pipes and leaking tanks), handling or transportation of such wastewater (e.g. spills), there is the potential for contamination to soil, groundwater or surface waters. Impacts could be significant, but temporary in nature.

Storm Water Runoff

Periodic rainfall events may cause wash-off from stockpiles and chemical stores to ground, particular in such an arid environment where rainfall events may not have been planned for.

Any realignment or blockage to existing wadi's could result in partial flooding of adjacent land areas.

The proposed project design has been prepared to ensure that solar arrays can be located outside of the areas of confirmed wadi (please refer to Figure 4-4). Therefore, as a consequence, the existing, natural surface water drainage for the area is unlikely to be influenced by the proposed project.

Table 11-2 Potential Surface Waters and Drainage Impacts - Construction

Potential Impact	Potential Impact Magnitude	Justification
Pollution of Wadi from Spill and Leaks Associated with construction activities.	**Negligible Negative**	Spills and leaks from fuels and chemicals during the construction phase could be mobilised to Wadi areas during periods of rainfall. Associated pollutants are then likely to accumulate within soils and sediments associated with the Wadi. However, in the instance of any pollution event, any associated ecological impacts or risks to human health are extremely unlikely. Risks associated with construction phase leaks and spills can be readily managed through standard best practice that would be expected to be incorporated within a project's CESMP.
Wadi realignment and/or flooding.	**Minor Negative**	Grading activities and/or the stockpiling of materials could result in the realignment of the Wadi area and result in localised flooding with potential adverse impacts for the construction site and neighbouring power plant.

Table 11-3 Potential Surface Waters and Drainage Impacts Significance - Construction

Potential Impact	Potential Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Pollution of Wadi from Spill and Leaks Associated with construction activities.	Negligible Negative	Wadi within and adjacent to project boundary	Low	**Slight**
Wadi realignment and/or flooding	Minor Negative	Land use outside Wadi	High	**Moderate**

11.5.2 Operational Phase

Table 11-4 Potential Surface Waters and Drainage Impacts - Operation

Potential Impact	Potential Impact Magnitude	Justification
Pollution of Wadi from Spill and Leaks Associated with operational activities.	**Negligible Negative**	Spills and leaks from minor fuel and chemical stores required for the operation of the plant could be mobilised to Wadi areas during periods of rainfall. Associated pollutants are then likely to accumulate within soils and sediments associated with the Wadi. However, in the instance of any pollution event, any associated ecological impacts or risks to human health are extremely unlikely. Risks associated with operations phase leaks and spills can be readily managed through standard best practice that would be expected to be incorporated within a project's OESMP.

Table 11-5 Potential Surface Waters and Drainage Impacts Significance - Operation

Potential Impact	Potential Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Pollution of Wadi from Spill and Leaks Associated with operational activities.	Negligible Negative	Wadi within and adjacent to project boundary	Low	**Slight**

11.6 Mitigation Measures

11.6.1 Construction

Table 11-6 Surface Waters and Drainage – Mitigation Measures for Construction

Impact	Mitigation Measure
Storm water run-off	All Construction Works will be limited to the designated construction areas. These areas are located away from the Wadis. According to the proposed construction plans, the following mitigation measures have been put in place: • All PV panels will be placed around the wadi and not in it, • No roads will be constructed across the existing wadi
Pollution of Wadi from Spill and Leaks Associated with construction activities.	All staff should be aware of the spill response plan, know the location of the spill response equipment, and know step-by-step instructions for response to spills.

11.6.2 Operation

Table 11-7 Surface Waters and Drainage – Mitigation Measures for Operation

Impact	Mitigation Measure
Storm Water Runoff	Storm water will be managed to prevent uncontrolled gullying and localised flooding. No activities or vehicles will be permitted in the wadi.
Use of water for cleaning of PV Array	Cleaning of PV Array shall be restricted to the use of clean waters that do not pose risk to the environment. Associated runoff will be allowed to evaporate leaving no risk of contamination. An alternative cleaning method is dry cleaning (by brush only). This could eliminate the requirement for use of water during maintenance.

11.7 Residual Impacts

11.7.1 Construction

Table 11-8 Surface Waters and Drainage - Construction Phase Residual Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Storm Water	Minor Negative	Wadi within and adjacent	Low	Minor to Moderate	Yes	**Neutral**

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Runoff		to project boundary				
		Land use outside Wadi	High	Minor to Moderate	Yes	**Slight**

11.7.2 Operation

Table 11-9 Surface Waters and Drainage - Operations Phase Residual Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Storm Water Runoff	Negligible	Wadi within and adjacent to project boundary	Low	Negligible	Yes	**Neutral**
		Land use outside Wadi	High	Negligible	Yes	**Neutral**
Use of water for cleaning of PV Array	Negligible	Wadi within and adjacent to project boundary	Low	Negligible	Yes	**Neutral**
		Land use outside Wadi	High	Negligible	Yes	**Neutral**

12 RESOURCE REQUIREMENTS AND WASTE MANAGEMENT

12.1 Requirements for Assessment

During the scoping assessment, it was identified that impacts associated with resources and waste management during the construction and operational phases of this project were anticipated to be minimal given the construction and operational requirements of the plant. Therefore, it has not been deemed necessary to undertake any detailed assessment as part of the ESIA.

This chapter includes the potential minimal impacts derived during the scoping assessment for the purpose of identifying associated best practice measures that should be incorporated within the projects CESMP and OEMSP.

Solid Waste

Solid Waste can typically be defined as substances which have been discarded or neglected and which cannot be put to good or beneficial direct use. Solid wastes are typically segregated into two key streams: hazardous and non-hazardous solid wastes.

The construction and operation of the proposed project will generate solid wastes; of which some will be hazardous. These may potentially impact upon existing local waste management services and facilities, as well as having secondary effects upon the quality of soils, surface water and potentially groundwater. Secondary environmental impacts of waste (i.e. impacts to air quality, soil and groundwater quality) are discussed in the relevant sections of this ESIA, where appropriate.

During the Baseline Study in the Scoping / ToR Phase of the project, it was found that the impacts on Resource Use and Waste Management during the Construction and Operational Phases of this project were negligible and will be scoped out of the ESIA. Therefore, this chapter lists possible impacts to Resource Use and Waste Management for the purpose of presenting good practice mitigation measures.

This section of the ESIA is concerned with the appropriate management of the waste generated during construction and operations phase, particular with regard to its handling.

12.1.1 Standards and Guidelines

Jordanian Requirements

In accordance to law "Municipalities Law No.13 of 2007", solid waste in management by the local municipalities. Jordanian Regulation No.27 of 2005 concerns the Management of Solid Waste Regulations. The regulations set out provisions which govern the management of solid waste in

such a manner to protect the environment and public health. The Regulations specifically state that:

'Every party that conducts Solid Waste Management activities or from whose activities Solid Waste results shall be obligated to:

A. *Provide the qualified manpower resources for Solid Waste Management and public safety measures for its workers.*

B. *Provide the vehicles, containers and equipment needed for Solid Waste Management.*

C. *Monitor the collection of Solid Waste and setting the route thereof, and transportation thereof to locations designated for disposal thereof.*

D. *Place containers in the appropriate locations and maintain them, and replace them when destroyed.*

E. *Take the measures necessary to prevent hazardous waste reaching Solid Waste containers and transportation means.*

F. *Keep regular records in which are listed the quantities and sources of Solid Waste, and the methods of treatment thereof, and the vehicles operating in this field.*

G. *Supervise sorting, excavation and landfill activities, and monitoring the compliance with the stipulations appearing in Solid Waste Management contractors' contracts.*

H. *Forbid the burning of Solid Waste or the disposal thereof in an exposed manner.'*

Jordanian Regulation No.24 of 2005 concerns the Management, Transportation and Handling of Harmful and Hazardous Substances Regulations. The annex to this regulation, lists the banned substances, restricted substances and harmful & hazardous wastes, relevant to this regulation.

In addition, Article 11 of Regulation No.26 of 2005 for the Protection of the Environment from pollution in Emergency Situations Regulations states that:

'Facilities handling hazardous substances shall submit regular reports to the Local Operations Committee indicating the quantity, quality, potential hazard and location of such substances, as well as the location of control equipment therein.'

In accordance with this, an inventory of substances used on site that are listed in regulation no. 24, is required to be submitted to the Local Operations Committee.

Additionally, the following national regulations are also applicable:

- Instruction for Management and Handling of Consumed Oils, 2003;
- Instruction for Hazardous Waste Management, 2003; and

- Jordanian Standard 431/1985 on General Precautionary Requirements for Storage of Hazardous Materials.

European (EBRD) Requirements

The EBRD PR3 on Resource Efficiency and Pollution Prevention and Control establishes general requirements waste management as follows:

- The Project must strive to avoid the generation of hazardous and non-hazardous waste materials and reduce their harmfulness as far as practicable. Where waste generation cannot be avoided, the waste must be reused, recycled or recovered, or used it as a source of energy. Where waste cannot be recovered, or reused, the waste must be treated and disposed of it in an environmentally sound manner;
- The Project must identify technically and financially feasible alternatives for the environmentally sound disposal of any hazardous waste considering the limitations applicable to transboundary movement; and
- When waste disposal is transferred offsite and/or conducted by third parties, chain of custody documentation to the final destination must be obtained and only contractors that are reputable and legitimate enterprises licensed by the relevant regulatory agencies must be commissioned. The Project must ascertain whether licensed disposal sites are being operated to acceptable standards. Where this is not the case, alternative disposal options must be considered, including the possibility of developing their own recovery and disposal facilities at the project site.

The European Commission has extensive legislation in regard to solid waste that includes the following:

- Waste Framework Directive 2008/98/EC;
- Hazardous Waste Directive 91/689/EEC; and
- Waste oils Directive 75/439/EEC.

International (IFC) Requirements

IFC/World Bank General EHS Guidelines (2007) establish general requirements for Waste Management in Section 1.6, whilst Section 1.5 covers Hazardous Materials Management. The waste management guidelines state that facilities that generate and store wastes should practice the following:

- Establish waste management priorities at the outset of activities based on an understanding of potential;
- Identify EHS risks and impacts and consider 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 of 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; and
- Where waste cannot be recovered, or reused, identify means of treating, destroying, and disposing of it in an environmentally sound manner.

12.1.2 Waste Characterisation

Waste can exhibit certain characteristics according to the process stream from which it is generated and any pre-treatment processes that are undertaken. Different types of waste require different management and disposal techniques according to the potential risk that the material poses to human health or the environment. In order to categorise the different risks to these receptors, it is often useful to demarcate the streams into 3 main categories that effectively equate to the level of the management and disposal which are required for each:

- **Hazardous waste -** materials which pose a potential hazard to the environment or health of employees or the general public;
- **Non-hazardous wastes** - solid materials which are not hazardous and degrade, chemically or biologically in the environment; and
- **Non-water soluble wastes** - materials that do not breakdown in the environment, and are otherwise inert.

Hazardous waste refers to waste with properties that pose danger or can be potentially harmful to human health or the environment.

- Ignitibility - Ignitable waste can create fires under certain conditions, are spontaneously combustible, or have a flash point less than 60 °C (140 °F). Examples include waste oils and used solvents.
- Corrosivity - Corrosive wastes are acids or bases (pH less than or equal to 2, or greater than or equal to 12.5) that are capable of corroding metal containers, such as storage tanks, drums, and barrels.
- Reactivity - Reactive waste are unstable under "normal" conditions. They can cause explosions, toxic fumes, gases, or vapours when heated, compressed, or mixed with water. Examples include lithium-sulphur batteries and explosives.
- Toxicity - Toxic waste are harmful or fatal when ingested or absorbed (e.g., containing mercury, lead, etc.).

12.2 Observations and Baseline Conditions

12.2.1 Resource Requirements

Comparative to traditional thermal power plants, the resource requirements from solar PV are anticipated to be minimal. During operation, no fuel source is required to be transported to site as the plant operates from light.

The principal operational resource requirement will be water that is necessary for sanitary use by site staff and for cleaning of the PV Array. Jordan has one of the lowest levels of water resource availability, per capita, in the world. It is also anticipated that water scarcity will become even more of a challenge in the future with an increasing population and climate change predictions leading to uncertainty over future precipitation levels and groundwater recharge for the region. Management of water resources is therefore a key issue for Jordanian authorities.

12.2.2 Waste

Solid waste generation in Jordan is growing rapidly due to significant 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 Jordan, it is vital to consider the methods for handling, storage and management of waste generated in conjunction with progress in the country's economy.

The closest demolition and construction waste landfill will be outlined in the Waste Management Plan as part of the CESMP and OESMP when this is established on a site-specific basis by the EPC Contractor and O&M Company.

Hazardous waste is managed and regulated by the Ministry of Environment. In accordance with the "Environmental Protection Law No. (52) of the year 2006" hazardous waste must be transported and disposed at designated landfills which are approved by the MoEnv through private companies which are also approved by the Ministry. In Jordan, there is currently one landfill for disposal of hazardous waste – the Swaqa Hazardous Waste Treatment Facility which is located in the Amman Governorate.

12.2.3 Wastewater

Wastewater management varies in Jordan and is dependent on geographical, location and access to sewerage infrastructure and access to treatment facilities. This results in varied wastewater management across Jordan due to the varied prevailing conditions and development of infrastructure.

The proposed project location is extremely isolated and there are not expected to be any provisions for sewerage infrastructure or treatment at the project site, or in the general project region.

Wastewater at the existing Risha Gas Power Plant is collected as sanitary and domestic wastewater in a septic tank on site, which is collected by a licensed wastewater contractor as necessary, for removal to a wastewater treatment facility.

12.3 Potential Impacts

12.3.1 Construction Phase

Water Use

It is anticipated that there will be approximately 250 workers on-site at the peak period of the construction. Quantities of sanitary wastewater have been estimated as an average of 100 litres/person/day, which equates to a predicted 25,000 litres of wastewater per day at peak construction periods.

Waste

Construction of the proposed Project will involve activities such as site clearance; limited excavating and back filling; constructing the boundary fence, site offices, MEP works and some civil works for roads and infrastructure etc.

Waste streams likely to be associated with the project are listed in the Table below.

Table 12-1 Anticipated Waste Streams Associated with the Construction Phase

Waste Type	Construction
Inert	Subsoil and Rock
	Glass
Non-Hazardous	Concrete and cement
	Asphalt
	Scrap metal
	Wood
	Plastic
	Packaging
	Sewage and grey water from construction workers
	Water from washing of vehicles and equipment.
	Municipal waste from construction workers
Hazardous	Resins and paints
	Waste oils
	Waste solvents and thinners
	Waste fuel and chemicals.
	Batteries
	Used spill kits and clean up materials.

Minimal quantities of waste are anticipated to be generated from the site given the minimal requirements for excavation and relatively simple construction recreants. However, proper management is required in order to reduce associated impacts such as uncontrolled dispersion and distribution leading to land contamination and water pollution.

Wastewater

Wastewater typically produced during construction includes sanitary/domestic wastewater, cement wash down, other plant cleaning/rinsing effluents, vehicle maintenance and the mixing of oils/lubricants in the wastewater (i.e. as a result of equipment washing).

Although construction activities are restricted to 13 months and will be temporary, the impacts from poor wastewater management could lead to long-term and significant impacts to the soils/groundwater local resources.

Sanitary and Domestic Wastewater Generation

In the event of inappropriate storage (e.g. broken pipes and leaking tanks), handling or transportation of such wastewater (e.g. spills), there is the potential for contamination to soil, groundwater or surface waters. Impacts could be significant, but temporary in nature.

Table 12-2 Resource Use and Waste - Magnitude of Construction Impacts

Impact	Magnitude	Justification
Non Hazardous wastes	**Minor**	Given the size of the project and required material quantities, it is not anticipated that construction will generate significant quantities of waste. However incorrect handling could result in loss to ground and subsequent contamination of soils and groundwater.
Hazardous Wastes	**Major**	Low volumes of hazardous wastes will be generated, and if not appropriately disposed or handled may result in significant contamination and environmental degradation.

Table 12-3 Resource Use and Waste - Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Non Hazardous wastes	Minor	Soil	Very Low	**Negligible or Slight**
		Groundwater	Medium	**Slight**
Hazardous Wastes	Major	Soil	Very Low	**Slight**
		Groundwater	Medium	**Moderate or Major**

12.3.2 Operational Phase

Water Use

It is anticipated that there will be approximately 13 workers on-site at the peak period of the construction. Quantities of sanitary wastewater have been estimated as an average of 100 litres/person/day, which equates to a predicted 1,300 litres of wastewater per day at peak construction periods.

PV Array will need to be periodically cleaned to maintain optimal efficiency. The project is proposing the use of a bespoke truck fitted with a special tool (brush and water sprayer) intended to limit water demand for cleaning to the absolute minimum. It is estimated that approximately 150m^3 of water will be required to adequately clean all PV Array. The required frequency for cleaning will be largely dependent on meteorological conditions (humidity, precipitation, dust storms etc.) and panels will only be cleaned as and when the level of soiling requires. Assuming that cleaning is required once a month, the annual water use requirement is anticipated to be 1,800 m^3.

It is proposed that water to be used for sanitary purposes and for cleaning of the PV Array will be drawn from the groundwater well currently utilised by the adjacent gas fired plant.

Comparative with the demands of a traditional thermal power plant, the water requirements for the proposed project are anticipated to be inconsequential for the local aquifer.

Waste

The nature of the proposed PV plant means that minimal waste will be generated from everyday operations other than those involved in cleaning processes or from office/domestic waste. The equipment used in the operational processes (e.g. PV arrays, enclosures and electrical connections) does not generate waste, unless components are specifically replaced during maintenance activities.

The facility will typically generate the following hazardous and non-hazardous wastes:

Table 12-4 Anticipated Waste Streams Associated with the Operational Phase

Waste Type	Operation
Non-Hazardous	PV arrays/modules, mounting frames, cables
	Sewage and grey water from operational staff
	Water from the washing of panels.
	Municipal waste from construction workers
	General domestic waste from offices and staff canteens
Hazardous	Resins and paints
	Domestic scale Batteries
	Used spill kits and clean up materials.

It is not anticipated that PV arrays/ modules will contain any hazardous materials (PCBs or asbestos etc.). The principal component of PV panels is silicone, which is inherently inert.

Wastewater

The operational processes of the PV Plant will not entail the use of significant quantities of water and as a result this will not generate significant quantities of wastewater. Water during operation is only likely to be used for sanitary/domestic purposes, as well as PV panel cleaning and general

cleaning/maintenance activities. PV panel cleaning will be responsive according to the level of soiling to the panels (likely to be variable according to weather conditions),

Sanitary and domestic wastewater will be stored in a septic tank prior to removal and treatment at a licensed wastewater treatment facility.

Table 12-5 Resource Use and Waste - Magnitude of Operation Impacts

Impact	Magnitude	Justification
Non Hazardous wastes	**Minor**	The low number of staff employed at the site and type of daily activities will only generate small volumes of waste.
Hazardous Wastes	**Minor**	The PV will generate small quantities of hazardous wastes most likely attributable to use of lubricating oils and cleaning products.

Table 12-6 Resource Use and Waste - Significance of Operation Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Non Hazardous wastes	Minor	Soil	Very Low	**Negligible or Slight**
		Groundwater	Medium	**Slight**
Hazardous Wastes	Minor	Soil	Very Low	**Negligible or Slight**
		Groundwater	Medium	**Slight**

12.4 Mitigation Measures

12.4.1 Construction

The mitigation measures detailed below refer to both hazardous and non-hazardous wastes. While some mitigation measures are specific to either hazardous or non-hazardous waste streams, many measures are applicable to both and therefore this section does not consider these measures separately, unless specified.

In order to minimise the impacts resulting from waste generation during the construction phase, the total amount of construction waste generated must be reduced to the greatest possible extent. The following mitigation measures will contribute to the reduction of overall waste generated by the Project.

Table 12-7 Resource Use and Waste – Mitigation Measures during the Construction Phase

Impact / Source	Mitigation Measure
Solid Waste Generation	Waste prevention can be achieved through proper planning with dedicated low-waste design, efficient material use involving careful selection, accurate ordering of materials, and effective process control.
	Reuse and recycling allows the recovery of usable components for subsequent use or for sale. Disposal of waste to landfills must be considered as the least preferable option and

Impact / Source	Mitigation Measure
	should only be resorted to for waste streams that cannot be recycled or reused.
	Ordering materials that have reusable packaging and/or in bulk can significantly reduce waste generated. Refillable containers should be used, where possible, for collection of waste fluids such as waste oil, hydraulic oils, and used grease.
On Site Waste Management	Waste management on site will be consistent with the CESMP and Site Waste Management Plan. As a minimum, it will include the following: - Separation of waste streams to facilitate re-use and recycling; - Adequate storage facilities for all waste in designated areas; - Procedures and rules for waste handling; - Mandatory training program for employees to increase their awareness of waste management protocols including proper handling and storage of waste, and emergency response and contingency plans.
	Food waste: Must be stored within a sealed metal or plastic skip or bin, in order to prevent vermin gaining access; Lightweight waste e.g. paper, cardboard, plastics: Must be stored within a skip sealed with a secured tarpaulin/netting sufficient to prevent any material being dispersed; Heavy waste: To be contained within an open skip, providing that segregation occurs effectively enough to remove all lightweight material that could be blown away, or food waste; Hazardous waste: Adequate hazardous waste storage in sealed containers stored in dedicated storage areas 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.
	All storage areas must be well organised and waste appropriately managed through segregation of hazardous and non-hazardous waste. Waste within each category should be further segregated by type (paper, plastic, metal, etc.) and whether the material is recyclable or non-recyclable. Construction waste should be separated into combustible and non-combustible, and all flammable substances must be kept away from sources of ignition.
	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. On-going housekeeping training should be provided to all staff on the importance of the need to avoid littering.
	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 Arabic. Wherever possible, chemicals will be kept in their original container.
Waste Contractors	Licensed recycling and waste management contractors and facilities should be identified prior to the commencement of construction. Where appropriate arrangements will be made prior to the commencement of construction in regard to removals.
	Only licensed waste transporters and waste management facilities will be engaged. The EPC Contractor will maintain copies of the waste management licensed on site.
	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.

12.4.2 Operation

Waste management during the operational phase will be managed through the implementation of a Site Waste Management Plan that will be consistent with the OESMP and this ESIA.

Suitable implementation of controls and procedures for handling, storage, transport and disposal of waste can prevent the generation of significant amounts of waste during operation. It is recommended that prevention or reduction at source, followed by reuse and recycling methods must be implemented on site to reduce the residual impacts of waste generated as a result of the Project.

Table 12-8 Resource Use and Waste – Mitigation Measures during the Operational Phase

Impact / Source	Mitigation Measure
Solid Waste Generation	Waste prevention can be achieved through proper planning with dedicated low-waste design, efficient material use involving careful selection, accurate ordering of materials, and effective process control.
	Reuse and recycling allows the recovery of usable components for subsequent use or for sale. Disposal of waste to landfills must be considered as the least preferable option and should only be resorted to for waste streams that cannot be recycled or reused. - Use high quality raw material to reduce the quantities of waste generated; - Regeneration of used oils; - Reduce packaging of materials and order in bulk. If appropriate, request supplier to minimise packaging; - Recycle paper, metal, plastic and packaging; - Implement a recording system for the amount of wastes generated on-site; - Undertake regular inspections, audits, and monitoring of waste streams generated to ensure that all necessary mitigation measures are being implemented; - Mandatory training program for employees to increase awareness of waste management including proper waste; Training and orientation on waste minimisation, segregation and proper good housekeeping practice at the beginning of work and at regular interval should be conducted.
On Site Waste Management	Waste management on site will be consistent with the OESMP and Site Waste Management Plan. As a minimum, it will include the following: - Separation of waste streams to facilitate re-use and recycling; - Adequate storage facilities for all waste in designated areas; - Procedures and rules for waste handling; - Mandatory training program for employees to increase their awareness of waste management protocols including proper handling and storage of waste, and emergency response and contingency plans.
	Food waste: Must be stored within a sealed metal or plastic skip or bin, in order to prevent vermin gaining access. Lightweight waste e.g. paper, cardboard, plastics: Must be stored within a skip sealed with a secured tarpaulin/netting sufficient to prevent any material being dispersed; Heavy waste: To be contained within an open skip, providing that segregation occurs effectively enough to remove all lightweight material that could be blown away, or food waste; Hazardous waste: Adequate hazardous waste storage in sealed containers stored in dedicated storage areas 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.

Impact / Source	Mitigation Measure
	All storage areas must be well organised and waste appropriately managed through segregation of hazardous and non-hazardous waste. Waste within each category should be further segregated by type (paper, plastic, metal, etc.) and whether the material is recyclable or non-recyclable. Construction waste should be separated into combustible and non-combustible, and all flammable substances must be kept away from sources of ignition.
	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. On-going housekeeping training should be provided to all staff on the importance of the need to avoid littering.
	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 Arabic. Wherever possible, chemicals will be kept in their original container.
Waste Contractors	Only licensed waste transporters and waste management facilities will be engaged. The operator will maintain copies of the waste management licensed on site.
	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.

12.5 Residual Impacts

12.5.1 Construction

Table 12-9 Resource Use and Waste – Residual Impacts – Construction Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Non Hazardous wastes	Minor	Soil	Very Low	**Negligible or Minor**	Yes	**Neutral**
		Groundwater	Medium	**Minor**	Yes	**Neutral**
Hazardous Wastes	Major	Soil	Very Low	**Minor**	Yes	**Neutral**
		Groundwater	Medium	**Moderate or Major**	Yes	**Neutral**

12.5.2 Operation

Table 12-10 Resource Use and Waste – Residual Impacts – Operational Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Non Hazardous wastes	Minor	Soil and Groundwater	High	Minor or Moderate	Yes	**Neutral**
Hazardous Wastes	Minor	Soil and Groundwater	High	Minor or Moderate	Yes	**Neutral**

13 SOCIO-ECONOMICS

13.1 Requirements for Assessment

The scoping stage for the project identified minimal likelihood for socio-economic impacts given that the proposed project is located in an isolated, military controlled zone. However, given the associated 2km^2 of proposed land-use change, the scoping assessment determined a requirement for consultation with local interest groups and key stakeholders in the region in order to identify any key issues of concern and identify any potential for significant impacts.

The consultation team has arranged and conducted several meetings with key stakeholders in order to introduce the proposed project, discuss anticipated impacts and identify major issues and concerns which may arise from the development of the project.

The consultation team provided information on the project description, location and components as well as aerial maps. Consultation was undertaken through bilateral meetings on the 11th of April 2017 and 2nd of May 2017.

Stakeholders were identified according to local and regional groups likely to demonstrate interest in the project. Stakeholders have been identified from:

- People and social groups who will be directly or indirectly affected by the project (such as local communities);
- People and social groups who may participate in the implementation of the project (such as investors and lenders); and ;
- People and social groups whom are not affected by the project development per se may but have a possibility to influence and make decisions on implementation of the project and/or may have an interest in the Project.
- People and social groups who will be directly or indirectly affected by the project (such as local communities);
- People and social groups who may participate in the implementation of the project (such as investors and lenders); and ;
- People and social groups whom are not affected by the project development per se may but have a possibility to influence and make decisions on implementation of the project and/or may have an interest in the Project.

This chapter of the ESIA includes outcomes and feedback received from this consultation.

13.2 Standards and Guidelines

EBRD

The notable PR's that will apply to this project include:

- Performance Requirement 1: Assessment and Management of Environmental and Social Impacts and Issues;
- Performance Requirement 10: Information Disclosure and Stakeholder Engagement.

IFC

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 1: Assessment and Management of Environmental and Social Risks and Impacts;

In line with IFC requirements, IFC Performance Standard 2 (Labour and Working Conditions) will be complied with, which includes overall alignment to the following conventions:

- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize;
- ILO Convention 98 on the Right to Organize and Collective Bargaining;
- 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 182 on the Worst Forms of Child Labour;
- ILO Convention 100 on Equal Remuneration;
- ILO Convention 111 on Discrimination (Employment and Occupation);
- UN Convention on the Rights of the Child, Article 32.1; and
- UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families.

Although Performance Standard 7: Indigenous Peoples, falls under this chapter (Socioeconomics), it will not be addressed in this project as there are no Indigenous People in Jordan.

13.3 Observations and Baseline Condition

13.3.1 Local/Site Based Observations

Local Residences & Population

The project site is extremely remote and located within a military controlled zone close to the Jordan – Iraq border. There are few (if any) permanent settlements within 15km of the project site, and a small number within 150km of the site.

The nearest residential receptor is the small CEGCO accommodation area at the existing Risha Gas Power Plant. The accommodation area is 450m from the proposed PV project site and houses workers at the gas fired power plant, who are transported to the power plant on a weekly shift basis by CEGCO.

Figure 13-1 Location of Nearest Residences

Satellite Image Source: Google Earth

Project Land Use

The project location is within a military controlled zone, with land belonging to the Jordanian Government.

CEGCO has been granted by the Land Department of Jordan the right to use 200Ha of land for the development of a Solar PV/Wind power plant. Symbolic lease of JoD 8,000 per annum.

During the initial site visit, observations were made in regard to the informal use of land in the wider area by a limited number of local people grazing sheep. It is understood that these local people are granted permission by the military to graze sheep on the wider lands, as there is a general lack of vegetation for grazing in this region.

Nearest Population Centre

The nearest known population centre is the town of Ruwaished, located approximately 70km to the west of the project site. This town has a population of approximately 14,000 people with local economy being based primarily on Agriculture.

13.3.2 Consultation Outcomes

Information provided below identifies findings from consultation, including how requests from the local community have been addressed

Consultee: Ministry of Interior

Contact: Al Ruwaished Mutasarrifat

Land Use

- Head of Mutasarrifat has expressed his concerns regarding the proposed location of the Project, as it is distantly situated in a military-restricted area 5km to the west of the Iraqi-Jordanian borders (known as Karama Borders).
- Given the proximity of the Project site to the borders, local nomads are not allowed to access such premises, which are provisioned by the JAF. Accessing such sites by the Developer will need to be coordinated with JAF to obtain their permit.

Socio-Economic Conditions

- The local communities of Al-Ruwaished had relied on transboundary trading before the Iraqi-Jordanian borders were declared as closed military zones. The closure dealt a blow to the Jordanian exports. With water resources are depleting and unstable desert climate dominates in the region – leading to deterioration of the agricultural sector, the socio-economic situation in Al-Ruwaished is just getting worse. Head of Mutasarrifat has also stated that the industrial sector in Al-Ruwaished is as well worse-off, where the closest factory is located in Mafraq city 210 km to northwest of the district.
- Recent reports and statistics indicate very severe poverty and unemployment rates.
- Head of Mutasarrifat suggested that the ESIA should include certain recommendations to be taken into account by the Developer to include:
    - Job opportunities needed for the proposed project should be targeted at the local communities of the Al-Ruwaished to the greatest extent possible;
    - Financially support the charities and NGOs to advance the development of the new opportunities;
    - Rehabilitate the services and facilities of the existing charities to widen the range of served population.
- According to Mutasarrifat, most of the local communities of the Al-Ruwaished belong to the following tribal affiliations: Ghayath, Al-Sharfat, Al-Masaeed, Al-Athamat, Al-Zbaid, Bani Khaled, Al-Na'yyem and Al- Rwattha.

Community, Health, Safety and Security

- Given the Proximity to the borders (located around 5km to east) and instability in the region, the site is at high risk, which exposes onsite workers and personnel to inevitable occupational threats. Based on such potential negative impacts, Head of Mutasarrifat advises the Developer (through ECO Consult Consultation Team) to consider relocating the site to a much closer location to the Al-Ruwaished village, so that to ensure HSE measures are maintained to the greatest extent possible.

Education

- According to Head of Mutasarrifat, the closest university to the Al-Ruwaished district is Aal Al-Bayt University, which is located at a distance of approximately 210 Km to the northwest. Given the remoteness of higher education institutes and the lack of appropriate public transportation system, that is affordable by the locals, people are discouraged from travelling for long distances to pursue a higher degree.

Consultee: Ministry of Municipal Affairs (MOMA)

Contact: Al-Ruwaished Municipality - Municipal Representatives from the following governmental entities: 1. Al-Ruwaished Water Directorate 2. National Aid Fund 3. Al-Ruwaished' s Social Development Unit (SDU)

Community, Health, Safety and Security

- Head of Municipality and members of the municipal board expressed their concerns regarding the location of the Project, which – from their perspective – might be at high risk given its proximity to Iraqi border.

Infrastructure and Utilities

- According to the municipal board, there is one Dumpsite (the Al-Ruwaished Dumpsite) that is in a very poor condition. The Dumpsite use to receive around 30 tonnes/day of solid waste and wastewater, however, this rate has an increase due to the settlement of Syrian influx in the district. It is noteworthy to mention that incineration is the only landfilling technique implemented by the municipality. Despite the huge amounts the Dumpsite receives, the municipality has only one loader that is in operation serving the communities of the Al-Ruwaished district. Due to lack of loaders and compactors, domestic solid wastes are accumulated at the point of collection leading to serious environmental and health problems. When asked whether the Dumpsite will be able to receive and treat construction wastes from the Project's various construction activities, Head of Municipality indicated that the Dumpsite has first to be rehabilitated and upgraded in a well-engineered manner to be able to receive such kinds of wastes.

Socio-Economic Conditions

- Head of Municipality discussed the main factors leading to severe unemployment and poverty rates and these are summarized as follows:

- Lack of qualified and educated individual;
- Dry climates are dominant in the area; thus, limiting agricultural activities;
- Poor education system;
- Scarcity of industrial establishments.

- Head of Municipality also stated that the population has dropped drastically in the past few years due to the high unemployment and poverty rates. Head of Municipality and members of the municipal board recommends the Developer to consider investing in establishing Vocational Training Centres (VTCs) to hire and train on-the-job and qualify unemployed individual for work.

Consultee: Non- Governmental Organizations

Contact: Al-Ruwaished Women Charity

Scio-economic Conditions

- According to latest statistics by DOS, Al-Ruwaished district is ranked one of the major poverty pockets in the Kingdom with poverty at 69.9% of the population in 2010. This measure has been ever increasing mainly due to the closure of the Iraqi-Jordanian Borders (Known as Karama). In addition, unemployment rates have witnessed a drastic rise in the past 4 years, during which the borders have been closed. It is noteworthy to mention that unemployment is rather greater among women than among men. According to the Head of Charity, minor private industrial and commercial establishments present in the area which are limited to retail shops and small-scale industries (i.e. garage, carpentry, metal works, etc.). Head of Charity also stated that most of the Al-Ruwaished local communities receive financial support from the National Aid Fund. In addition, the Charity's Treasurer expressed that the geographical extent of the Al-Ruwaished district deters the youth to enroll in the military service; which is considered a major employment sector in most-southern and northeastern governorates. Moreover, the gents stated that there is a very limited number of community based organizations (CBOs) and charities within the district. As informed by the Head of Charity, main employment sectors in the Al-Ruwaished district are ranked as (descending): Military and Public Service; Education and Health; Commerce and Trade; small-to-medium retail shops; and Livestock herding.
- Finally, the Head of Charity addressed some development schemes that need to be realized in the near future:
    - Establish dedicated vocational training centres (VTCs) to qualify women and men for work;
    - Establish a development fund to encourage the locals, especially the youth and women, to start new businesses;
    - Establish literacy centres;
    - Adopt and finance domestic production enterprises;
    - Rehabilitate the educational programs and support the academic systems financially;

- Hands-on the awareness programs implemented by the charity to eradicating the unemployment problem; and
- Provide electricity for the locals at a lower tariff.

Al-Mawwadah WI Rahmah Charity

Socio-Economic Conditions

- The Head of Charity expressed her gratitude for reaching out to her organization, stating that charity organizations in Al-Ruwaished suffer from governmental and social neglect and dereliction. The Head of Charity set forth the main reasons causing very high unemployment rates in the district and these are driven by the following challenges:
    - Recess in the Agricultural Sector due to scarcity of available water resources. The Head of Charity articulated that some groundwater resources exist in Salhiyyeh sub-district, all which are owned by the government and are currently not subject to any domestic use. The Head of Charity expressed that creating an alternative source of water will pave the way for the locals to cultivate their lands;
    - Despite the paucity of industrial establishments, most of the labour working in the industry and commerce are outsourced from other governorates;
    - The district has been suffering years of impoverishment and privation since the closure of the Iraqi- Jordanian borders 4 years ago; and
    - Most of the unemployed women are from the economically-active segments; that progressively strive for a job but cannot find one;
- The Head of Charity further stressed that the local communities of the Al-Ruwaished suffer from very high poverty rates and most of the population rely on financial aids from the National Aid Fund, providing examples on how deprived certain segments of the community really are; for instance, there are more than 500 households in the Al-Ruwaished sub-district alone having no source of income and who are also not registered, whereas only a very little proportion raise livestock for living. It is noteworthy to mention that only registered individuals (Citizens with an ID number, in other words) are considered for funding by the National Aid Fund. The Head of Charity suggested a number of recommendations which are described as listed below:
    - Fund the development projects suggested by the charity; mainly focusing on primary domestic products to include, for example, yoghurt production factories;
    - Fund Women-targeted enterprises focusing on domestic crafts such as sewing factories; and
    - Provide alternative source of water to be utilized for agricultural purposes;
- Moreover, The Head of Charity expressed her utter support for the project and hopes that it brings the local community many benefits in return. However, The Head of Charity conveyed some recommendations to be taken into consideration by the developer in the process of developing their Social Responsibility Program and these are summarized below:
    - Provide fair and cheap means of transportation for construction workers and operation personnel from and to the Project site; and

- Targeting the job opportunities offered by the Project at the local communities to the greatest extent possible.

Ahl El Khair Charity

Socio-Economic Conditions

- The Head of Charity reiterated the points made in earlier sections regarding the scarcity of economic establishments within the district. The Head of Charity justified the main reasons behind the high unemployment rate, stating that – for instance - most public and private institutions set a Higher School Certificate "Tawjihi" or/and a higher degree certificate as a primary requirement for the recruitment process, whereas a very high number of the population did not reach high school education.
- The Head of Charity expressed that the charity would appreciate it if the developer would take the initiative to fund the societal development programs of the charity (such as grazing reserves, steel welding shops, poultry farming, etc.) as part of the developer's Social Responsibility Program.

RSCN

- Based on consultations with RSCN, no issues of environmental or ecological concern were raised in regard to the development of the project.

Figure 13-2 Local Community Representatives Consulted

Name	Position	Entity
Governmental Organizations		
Dr. Mousa Abu Agooleh	Head of Municipality	Al Ruwaished Municipality
Faisal Bane Khaled	Municipal Board Member	Al Ruwaished Municipality
Tasha Bani Khaled	Municipal Board Member / Head of Al Ruwaished SDU	Al Ruwaished Municipality
Naser Abu Agooleh	Municipal Board Member	Al Ruwaished Municipality
Mohammed Ghazi	Municipal Board Member	Al Ruwaished Municipality
Suleiman Al-Harahsheh	Municipal Board Member / Al Ruwaished Water Directorate's Representative	Al Ruwaished Municipality
Eng. Emad Bashtawi	Personnel Manager	Al Ruwaished Municipality
Mohammad Mazen	Legal Department Director	Al Ruwaished Municipality
Ali Tawalbeh	Technical Manager	Al Ruwaished Municipality
Mofreh Tayeh	Administrative Manager	Al Ruwaished Municipality
Suleiman Al- Bajeh	Secretary	Al Ruwaished Municipality
Majid Hamad	Financial Manager	Al Ruwaished Municipality

Name	Position	Entity
Non- Governmental Organisations		
Sayel Al Suheim	Head of Charity	Al Ruwaished Women Charity
Nimer Abu Fawwaz	Treasurer	Al Ruwaished Women Charity
Ms. Thnayya Al Khaldi	Head of Charity	Al Mawwadeh Wil Rahmah Charity
Ms. Boshra AL Ghayath	Head of Charity	Ahl El Khair Charity
Nashat Hamidan	Manager of Ecological Research Centre	RSCN
Eng. Qusai Qa'qaa	Operation and Maintenance, Head of Department	CEGCO

13.4 Sensitive Receptors

Figure 13-3 Socio-Economics - Sensitive Receptors

Receptor	Sensitivity	Justification
Regional Community	**Low**	The project site is extremely isolated and the nearest population centre is approximately 70km from the site. The possibility for any adverse impacts for the regional community Is unlikely.

13.5 Potential Impacts

13.5.1 Construction Phase

The construction of the proposed project will generate a number of jobs for construction workers and skilled labourers. Positive impacts will therefore occur as a result of increased local employment, dissemination of skills to the local workforce and purchase of local good and services to stimulate the local economy.

Nuisance to Residents and Project Perception

During the construction phase the potential exists for associated with increased disturbance due from noise, degradations in ambient air quality, increased traffic, loss of landscape and loss of visual amenity. This is particularly true for the accommodation area provided for the adjacent gas fired power plant. This site provides for approximately 20 individuals who work at the plant on a shift basis. The site is always occupied and it is understood that shifts are approximately 2 weeks on 2 weeks off.

There are no towns or villages within the proximity to the project (the closest population centre being 70km away) the likelihood for associated impacts is therefore minimal.

Population Influx

The construction phase of the project will require approximately 250 labourers and other project staff at the peak of construction activities. Where possible it Is expected that a number of workers will be sourced locally (i.e. from within Mafraq Governorate), however it is likely that a number of staff from other areas of Jordan may be required due to the lack of local populations in the project area; particularly for specialist and skilled positions.

The source of sub-contractor staff is largely unknown but it is anticipated that the majority will be local Jordanian, with perhaps some specialist companies requiring expertise from overseas workers.

The requirement for staff and labourers at the construction phase will therefore result in a small population influx to the local project areas, where local workers are not available. Estimations in regard to the influx populations of workers are difficult to make due to several unknown factors at present, including the availability of appropriate labour locally, as well as the requirements of sub-contractor companies employed for the various aspects of the work on-site. As the project is located in a military controlled zone with strict access permissions, it is not expected that Secondary impacts as a result of worker influx will result in impacts, as there are no local populations.

The influx of workers therefore will lead to a small temporary rise in the local population during the construction phase. Secondary impacts as a result of local population increase have the potential to disrupt the community dynamics and the provision of services, as well as factors such as crime, littering and other undesirable behaviours.

Demand on local services

The anticipated influx of 250 people for up to 13 moths in unlikely to result in substantial increase in demand for local service. Some minor benefits may be experienced by private sector services, such as retail, and trading within nearby towns etc. with increase in clientele.

Demand on Utilities

Minimal increased demand on local utilities is anticipated given the requirement of no more than 250 people for 13 months. Risks associated with shortage of electricity; leading to instability of the power network, littering and waste dissemination, increased wastewater releases to the environment, reduced coverage of telecommunications networks and internet are considered minimal.

Land Use Change

Examination of the site indicates no evidence that development of the project will give rise to involuntary resettlement of local populations or direct displacement of formal or informal economic activities. The land is currently unused and a land lease agreement is already in place between the government of Jordan and CEGCO.

The results from site visit, and historic mapping identifies that the site has had no previous significant development, transport or agricultural use. Given the desert nature of the site, it is anticipated that the site has never previously been used for human activity. The area surrounding the site, as well as the site has been known to be used for Grazing sheep in the past.

Table 13-1 Potential Socio Economic Impacts - Construction

Potential Impact	Potential Impact Magnitude	Justification
Nuisance to Residents and Project Perception	**Negligable Negative**	How the regional community is likely to perceive development in the area is unknown. However, given that this is a renewables project, it is likely to be better received that a fossil fuels fired thermal plant.
Population Influx	**Negligible Negative**	Given the relatively small number of site staff required, the short construction duration and the distance to the nearest population centre, negligible impacts are anticipated.
Education of Locals	**Negligable Positive**	The project will introduce opportunity for training for site staff in regards to vocational skills, health and safety and knowledge regarding the associated technology.
Demand on local services and utilises	**Negligible Negative**	Given the relatively small number of site staff required, the short construction duration and the distance to the nearest population centre, negligible impacts are anticipated.
Land Use Change	**Negligible Negative**	Given the relatively poor nature of the site soils and isolation of the project site, the development of the site for power generation is unlikely to have any discernible impacts on land use.

Table 13-2 Potential Socio Economic Impacts Significance - Construction

Potential Impact	Potential Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Nuisance to Residents and Project Perception	Negligable Negative	Regional Community	Low	**Slight**
Population Influx	Negligible Negative	Regional Community	Low	**Slight**
Education of Locals	Negligable Positive	Regional Community	Low	**Slight**
Demand on local services and utilises	Negligible Negative	Regional Community	Low	**Slight**
Land Use Change	Negligible Negative	Regional Community	Low	**Slight**

13.5.2 Operational Phase

Increased capacity of cleaner electrical energy

The completion of the proposed project will result in the secure provision and increased capacity of electrical energy to the population of Jordan reduce Jordan's dependency on fossil fuel generated power.

Employment Opportunities

The operational phase of the project will require 12 staff in order to effectively manage the day-to-day operations and maintenance of the power plant. There will be a requirement for both skilled and unskilled labour, as well as specialist positions for technical staff.

Training and Dissemination of Skills

Staff employed at the plant will benefit from the provision of training and dissemination of skills specific to their roles. This may include specialist training or training on the job, as well as the implementation of international best practices into daily working methods (e.g. occupational health and safety and environmental considerations).

Demand on local services

Given the minimal requirement for operational personnel the project is unlikely to the place any additional discernible demands on local services.

Table 13-3 Potential Socio Economic Impacts - Operation

Potential Impact	Potential Impact Magnitude	Justification
Increased Capacity of cleaner electrical energy	**Moderate Positive**	Principle objective of the projective to supply clean electrical energy to the population of Jordan,
Employment Opportunities	**Negligible Positive**	Permanent job creation will be available for skilled and unskilled positions, with a preference to local populations in recruitment policy.
Training and Dissemination of Skills	**Negligible Positive**	Dissemination of know-how among the operation and maintenance work force including vocational skills associated with health, safety and environment knowledge.
Demand on local services and utilises	**Negligible Negative**	Given the relatively small number of site staff required and the distance to the nearest population centre, negligible impacts are anticipated.

Table 13-4 Potential Socio Economic Impacts Significance - Operation

Potential Impact	Potential Impact Magnitude	Receptor	Receptor Sensitivity	Potential Impact Significance
Increased Capacity of cleaner electrical energy Employment Opportunities	Moderate Positive	Regional Community (and national population)	Low	**Slight**
Training and Dissemination of Skills	Minor Positive	Regional Community	Low	**Slight**
Demand on local services and utilises	Minor Positive	Regional Community	Low	**Slight**
Increased Capacity of cleaner electrical energy	Negligible Negative	Regional Community	Low	**Slight**

13.6 Mitigation Measures

13.6.1 Construction

Socio-Economic – Mitigation Measures during the Construction Phase

Impact / Source	Mitigation Measure
Population Influx	Population influx will be minimised where possible by employment of local populations at the construction phase. The projects recruitment policy will ensure a preference for local workers to be employed.
	First Aid facilities and clinic room will be available to construction personnel on-site. This will reduce demand upon existing local services in regard to the additional population during construction.
Employment Opportunities	The projects recruitment policy will ensure a preference for local populations to be employed.
	The HR Policy will be prepared to ensure consistency in line 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 sub-contractor company HR policy as part of their contractual arrangements.
Training and Dissemination of Skills	All project workers will receive induction training at the project, as well as vocational specific training for on-sit construction works.
	All workers will receive training in regard to health and safety, as well as environmental awareness.
	Tool-Box talks will be conducted before work on each day to ensure workers are reminded of key topics.
Education of locals	Community liaison officers will be available for informal and formal discussions regarding the project where it is expected that an amount of knowledge in regard to the project will be conveyed.
Demand on Utilities	Site sanitary wastewater will be collected in septic tanks and removed by a licensed contractor for treatment off-site.
	Telecommunications will likely be enhanced through the placement of temporary receiving stations/masts on-site.
	Licensed waste contractors will be engaged to remove all waste from the site for re-use, recycling, recovery or disposal off-site.

13.6.2 Operation

Table 13-5 Socio-Economic – Mitigation Measures during the Operational Phase

Impact / Source	Mitigation Measure
Employment Opportunities	The projects recruitment policy will ensure a preference for local populations where appropriately skilled workers are available locally (or if unskilled positions are available).
	The HR Policy will be prepared to ensure consistency in line with local labour laws and international ILO and UN conventions.

Impact / Source	Mitigation Measure
	It is recommended that key supply chains are monitored periodically during operations to ensure that material, goods and service providers do not employ forced or child labour, whilst ensuring the suppliers have a suitable occupational health and safety record.
Training and Dissemination of Skills	All plant personnel will receive induction training at the project, as well as vocational specific training for their duties.
	All workers will receive training in regard to health and safety, as well as environmental awareness. Training will be updated on a yearly basis as a minimum.
	Workers will be encouraged to develop their careers and may be provided with opportunities to attend training courses and other career development processes.
Education of locals	Community liaison officers will be available for informal and formal discussions regarding the project where it is expected that an amount of knowledge in regard to the project will be conveyed.

13.7 Residual Impacts

13.7.1 Construction

Table 13-6 Socio-Economic – Residual Impacts – Construction Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Population Influx	Negligible Negative	Community Services	Low	Slight	Yes	**Slight**
Employment Opportunities	Negligible Positive	Welfare of Local Population	Low	Slight	Yes	**Slight**
		Local / Regional Economy	Low	Slight	Yes	**Slight**
Training and Dissemination of Skills	Minor Positive	Welfare of Local Population	Low	Slight	Yes	**Slight**
		Local / Regional Economy	Low	Slight	Yes	**Slight**
Education of Locals	Negligible Positive	Welfare of Local Population	Low	Slight	Yes	**Slight**
Demand on Local Services and Utilities	Negligible Negative	Welfare of Local Population	Low	Slight	Yes	**Slight**
Land Use Change	Negligible Negative	Military Land	Low	Slight	No	**Slight**

13.7.2 Operation

Table 13-7 Socio-Economic – Residual Impacts – Operational Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Employment Opportunities	Negligible Positive	Employment	Medium	Slight	Yes	**Slight**
		Services	Medium	Slight	Yes	**Slight**
Training and Dissemination of Skills	Minor Positive	Education	Low	Slight	Yes	**Slight**
Education of Locals	Negligible Positive	Education	Low	Slight	Yes	**Slight**

14 COMMUNITY HEALTH, SAFETY & SECURITY

14.1 Requirements for Assessment

Project related activities can result in the increase of risks associated to the local communities who live and work in the areas of impacts surrounding projects. In particular, certain projects may have specific impacts upon vulnerable groups, which need to be assessed.

This chapter has been specifically included to outline and assess the impacts relating to the safety and security of the local community who live and work in the surrounding area and may be subject to project related impacts.

The majority of secondary impacts relating to the local community in terms of air quality, noise, waste etc., have been addressed in specific chapters elsewhere in this ESIA. This chapter therefore concentrates more specifically on the potential emergency impacts that could relate to the project and the security of the project to avoid instances of trespass, or other misdemeanours.

The methodology aims to cover the lender requirements for community safety and security (as below) as well as the general Jordanian requirements.

The 'Emergency Preparedness and Response Plan' for the project will ensure many risks relating to the projects construction and operation are covered in regard to community safety and security, whilst outlining what response will be taken for certain situations. The 'Emergency Preparedness and Response Plan' will be prepared by the EPC Contractor and O&M Company for the constriction and operational phases of the project respectively.

14.2 Standards and Guidelines

The applicable environmental Legislation in relation to socio and economic issues which will be considered as part of the ESIA include the following:

Jordanian Requirements

- Public Health Law No. 47 for 2008
- Environmental Protection Law No. 52 of 2006

Lender Requirements

EBRD

The notable PR's that will apply to this project include:

- Performance Requirement 4: Health and Safety;
- Performance Requirement 10: Information Disclosure and Stakeholder Engagement.

IFC

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 4: Community Health, Safety and Security;

IFC's EHS Guidelines for Thermal Power Plants also address industry-specific impacts on the social and economic aspects of the site and surrounding context, specifically:

- Occupational Health and Safety; and
- Community Health and Safety.

14.3 Observations and Baseline Condition

Given the lack of residences and local populations in the project region, and the location of the project in a controlled military area, there are few risks considerations and observations that can be made in regard to local people.

Security

The existing industrial facilities in the Risha area are located within a military controlled zone, where access can only be gained via permit from the military. The existing Risha Gas Power Station employs security at its main entrance.

Transportation

The proposed site can only be accessed by a single road that has a direct link to Jordanian Highway 10 (Amman to Baghdad Highway). Upon exiting Highway 10 the road can only be accessed after passing through a military checkpoint, and as such there is limited access other than to those who are authorised to work at the existing power plant as such, the traffic flow on the road is very low and is likely to be less than 100 vehicle trips per day.

The road link between Highway 10 and the project site is a narrow 2-way hard standing road of moderate quality, however it lacks safety features such as crash barrier, lighting or stud reflectors. The road runs across several embankments with culverts for drainage flows within local wadis and water collection points.

14.4 Potential Impacts

14.4.1 Construction Phase

All construction projects have potential risks relating to public safety that could arise, particularly in regard to the use of high powered equipment, heavy construction plant, excavations, transportation amongst others, including fire and pollution releases.

Public risks during construction have the potential to result in isolated incidents, which could be of a devastating magnitude to a person or group of people in the wrong place at the wrong time.

Given the relatively small construction phase and the isolation of the project relative to any significant population centres, risk to the public is considered minimal, but nevertheless must not be ignored. The construction phase may present an unwanted opportunity for local communities to access the site, in terms of trespassing, with associated risks to those working at the site and those who are trespassing. Under such circumstances there is potential for incidents to occur particularly as a construction site is a high-risk area and should only be accessed by trained personnel who are wearing adequate personal protective equipment.

The project site will make allowances for appropriate security to avoid trespass, taking into consideration the local presence of national military.

Anticipated transport to/from the site, vehicles, machinery, construction equipment and associated activities do not present any unusual risks that would not ordinarily be anticipated for any small-scale construction site and it is anticipated that potential risks can be adequately documented and manged through the preparation and implementation of the project's:

- Occupational Health and Safety Management System,
- Emergency preparedness and Response Plan,

14.4.2 Operational Phase

The project will carry few risks that could result in impacts to public safety, as the project will be static and contained within a fenced area.

Given that there are no requirements for any large-scale chemical or fuel stores, there is minimal opportunity of widespread risks that could potentially affect the wider communities and the environment as a single event (e.g. large scale oil spills, explosions etc.).

As is consistent with the construction phase, the O&M Contractor (CEGCO) will undertake a security risk assessment to determine the appropriate level of security require at the facility. Security arrangements will be guided by UN Code of conducts for law enforcement officials and UN basic principles on the use of Force and Firearms by law enforcement officials (if staff are armed). In addition to this, security personnel will receive internal training in regard to grievances, reporting such grievances and dialogue with any members of the local community.

Traffic flows from the operation of the PV plant will generally be low and less abundant than those during construction, mainly due to the limited number of trips required for day-to-day operations. Trips to the site may be required for the following reasons:

- Operational staff commutes;
- Maintenance Activities;
- Waste and wastewater removals;

- Miscellaneous Deliveries.

Discernible impacts to traffic volumes, vehicle classification, or safety as a result of operational traffic flows are not expected.

Please Note: Due to issues for community, health safety and security being associated with risk from improper management rather than a potentially defined impact, associated significance is not assessed further. Risks will be managed through effective planning and the communication of the above-mentioned plans and with interaction with local communities via relevant communication channels and dialogue.

14.5 Mitigation

14.5.1 Construction

Impact	Mitigation
Emergency Situations	Risks to public safety will be appropriately addressed and prepared for in the operational 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.
Security	The project will employ its own security staff who will provide 24*7 security control across the site and dedicated security staff at gatehouses.
	The project will be fenced prior to construction including internal fencing to segregate the project areas from residential areas.
	All vehicles entering the site will require pre-approved clearance and will need to registered to enter the site. 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 ensure that unauthorised access cannot be gained.
	Project personnel will only be provided access to the construction site with valid ID cards and permits to work in line with HSE requirements of the site. People trying to gain unauthorised access to the site without appropriate permits and PPE will not be permitted, or will be ejected.

14.5.2 Operation

Impact	Mitigation
Emergency Situations	Risks to public safety will be appropriately addressed and prepared for in the operational 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.
	The plant will have a purpose built primed firefighting infrastructure to respond to instances of fire. The wider KHBTDA also has a primed firefighting network installed.
	The plant will have various mitigation controls to protect against spillage of hazardous liquids and materials, including fuels (as detailed elsewhere in this ESIA).
Security	The project will employ its own security provisions to provide 24*7 security control across the plant.

Impact	Mitigation
	The project will be fenced with a high-grade security fence and internal lighting.
	All vehicles entering the site will require pre-approved clearance and will need to registered to enter the site. Project security will record all instances of incoming vehicles.
	CCTV will be installed at key locations around the project, boundaries and gatehouses. Appropriate lighting will be provided at gatehouses for security personnel.
	Project personnel will only be provided access to the plant with valid ID cards and permits to work in line with HSE requirements of the site.

It is recognised that in addition to the above mitigation measures, the project will also implement a grievance mechanism accessible to communities.

15 LABOUR & WORKING CONDITIONS

15.1 Requirements for Assessment

Any construction project will introduce health and safety risks associated with the use of plant, machinery and construction processes. Risks can be severe depending on the type of activities required, materials used and site condition.

For projects in isolated locations or where the local population/skill sets require influx of people from other regions/countries. In such a scenario, a project will need to consider requirements associated with accommodation, welfare, sanitary provision, health care, hygiene, food potable water etc.

15.2 Standards and Guidelines

Jordanian Standards

Labour Law (No. 8, 1996); The labour law defines aspects relating to worker rights and are relevant for those people who will be working at the project during construction and operation. A key component of this law in relation to this project is that the project must comply with article (78) related to occupational health and safety, where the proponent must provide essential precautions and arrangements to protect the workers from the risk of hazards and supply them with Personal Protective Equipment (PPE).

EBRD

The notable PR's that will apply to this project include:

- Performance Requirement 2: Labour and Working Conditions;
- Performance Requirement 10: Information Disclosure and Stakeholder Engagement.

In line with EBRD requirements '*Projects are required to comply, at a minimum, with (i) national labour, social security and occupational health and safety laws, and (ii) the fundamental principles and standards embodied in the ILO conventions* (EBRD, Performance Requirement 2, 2014).'

IFC

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;

IFC's EHS Guidelines for Thermal Power Plants also address industry-specific impacts on the social and economic aspects of the site and surrounding context, specifically:

- Occupational Health and Safety; and
- Community Health and Safety.

In line with IFC requirements, IFC Performance Standard 2 (Labour and Working Conditions) will be complied with, which includes overall alignment to the following conventions:

- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize;
- ILO Convention 98 on the Right to Organize and Collective Bargaining;
- 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 182 on the Worst Forms of Child Labour;
- ILO Convention 100 on Equal Remuneration;
- ILO Convention 111 on Discrimination (Employment and Occupation);
- UN Convention on the Rights of the Child, Article 32.1; and
- UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families.

15.3 Potential Impacts

15.3.1 Construction

Occupational Health and Safety

Common activities undertaken during construction such as the movement of heavy machinery, excavation, handling of chemicals works undertaken at height 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.

The type of hazards attributable to a construction site will vary significantly dependant on the construction methods employed and the degree of control implemented by the EPC and affiliated sub-contractor. It is therefore of the utmost importance that the EPC and affiliated sub-contractors demonstrate consideration of health and safety risks as part of their chosen construction methods and that these risks are appropriately mitigated.

Please Note: Due to occupational health and safety being a risk rather than a potentially defined impact, its significance is not assessed further in this ESIA. Health and safety risks to the site force will be managed through effective risk assessment, development of appropriate methods

statements, emergency and disaster planning and the communication of specific health and safety requirements relevant to specific work/access requirements.

Worker Conditions

Labour exploitation on construction site unfortunately has become a reality in some parts of the world. Inequalities in income, education and opportunities has led to opportunistic immoral practices with labourers and site staff suffering as a consequence.

To ensure the wellbeing of the staff associated with the project, the EPC and associated subcontractors will need to plan for necessary provisions relative to the requirement of the of the required workforce.

Options for worker accommodation are still being explored and discussions ongoing with MDC. Worker accommodation shall be established in accordance with International Labour Organisation (ILO) standards and guidance published by EBRD and IFC.

Please Note: As worker conditions are a defined aspect of site planning rather than a potentially environmental impact, its significance is not assessed further in this ESIA. Risks associated with worker welfare during construction will be managed through effective project planning, and the enforcement of fair and just treatment throughout the construction phase.

15.3.2 Construction phase

HR Policy, Freedom of Association and Collective Bargaining

The overarching ACWA Power HR Policy will provide the basis upon which the projects HR Policy will be developed (to be adopted by the EPC Contractor in their construction HR policy). The HR Policy will ensure alignment with Jordanian labour law and will ensure consistency with international ILO and UN conventions required by the lenders.

Note: In line with the above, the ACWA Power HR Policy the minimum age of working is 18 years. Freedom of Association (Foal)and collective bargaining is included to the ACWA Power annual sustainability reports and our "Our Commitments" policy under "making certain of human rights, the safety and welfare of workers, fair employment and equal opportunity practices across our operations", where Human Rights is intended to cover FoA and Collective Bargaining.

Occupational Health and Safety

Common activities undertaken during construction such as the movement of heavy machinery, excavation, handling of chemicals, works undertaken at height 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.

The type of hazards attributable to a construction site will vary significantly dependant on the construction methods employed and the degree of control implemented by the EPC and

affiliated sub-contractor. It is therefore of the utmost importance that the EPC and affiliated sub-contractors demonstrate consideration of health and safety risks as part of their chosen construction methods and that these risks are appropriately mitigated.

The proximity of the gas fired plant to the north of the site introduces risks to site personnel associated with any emergency or improper operation of this plant. Facility Managerial staff associated with the gas fired plant will be consulted during preparation of the projects Emergency Response Plan.

Health effects from emissions from the plant are not anticipated for site staff given that the plant is gas fired, associated stack heights and that the site needs to comply to national regulatory requirements.

The EPC Contractor will manage Occupational Health and Safety on site via a dedicated Health, Safety and Environment (HSE) Team. Sub-contractor companies will have dedicated HSE Managers who will be responsible for implementing the sites HSE plan in their working areas. The EPC's HSE Plan will be subject to approval by ACWA Power and the Project Company. ACWA Power and the Project Company will periodically audit the project in line with the necessary HSE requirements.

Working Conditions

Labour exploitation on construction sites unfortunately has become a reality in some parts of the world. Inequalities in income, education and opportunities has led to opportunistic immoral practices with labourers and site staff suffering as a consequence.

To ensure the wellbeing of the staff associated with the project, it is planned for worker accommodation to be established within the site boundary. Worker accommodation shall be established in accordance with International Labour Organisation (ILO) standards and guidance published by EBRD and IFC.

15.3.3 Operational Phase

Occupational Health and Safety

The risks associated with the operational phase of the project are anticipated to be significantly less than during the construction phase due to reduced site activity and requirements for heavy plant and machinery.

There will however be incoming electrical connections on-site and the movement of large volumes of water by high powered pumps, all of which pose a significant risk to worker health and safety. Maintenance and inspection will also require the use of site vehicles and activities that pose risks to human health and safety.

In addition, shading provided by the PV Array could provide refuge for dangerous/poisonous flora such as scorpions and reptiles.

The Severity and likelihood of risks during the operational phase will be dependent on the frequency and requirements for planned and unplanned maintenance. The operation and maintenance team will need to ensure that a robust plan is in place to appropriately manage these risks.

15.4 Mitigation Measures

15.4.1 Construction

Impact	Mitigation
Human Resources Policies and Procedures	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 EBRD Performance Requirement 2.
Child Labour	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 shall be subject to an appropriate risk assessment.
Forced Labour	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.
Non-discrimination and equal opportunity	The EPC contractor will comply with EU requirements on non-discrimination related to employment. In particular, 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; - base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate with respect to all 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. Please note that special measures of protection or assistance to remedy past discrimination or 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.
Working Relationships	The EPC contractor 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).
Working Conditions and terms of employment	The EPC contractor will provide a plan detailing how working conditions and terms of employment are compliant with national labour, social security and occupational health and safety laws. Employment relationship shall 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

Impact	Mitigation
	discipline. Special measures of protection or assistance to remedy past discrimination or 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.
Workers organisations	The EPC contractor will enable means for workers to express their grievances and protect their rights regarding working conditions and terms of employment. The EPC contractor will not discourage workers from forming or joining workers' organisations of their choosing or from bargaining collectively, and will not discriminate or retaliate against workers who participate, or seek to participate, in such organisations or bargain collectively.
Wages, benefits and conditions of work	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.
Occupational Health and Safety (OHS)	The EPC contractor will provide the workers with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project. The EPC contractor shall 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 shall be responsible for ensuring that all affiliated sub-contractors comply with the OHS management system. The OHS management system shall be in-line with recognised international best practice and 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.
Worker Accommodation	Where/if accommodation is provided for workers, the accommodation shall be appropriate for its location and be clean, safe and, at a minimum, meet the basic needs of workers. In particular, the provision of accommodation shall meet national legislation and international good practice in relation, but not restricted, to the following: - the practice for charging for accommodation. - the provision of minimum amounts of space for each worker. - provision of sanitary, laundry and cooking facilities and potable water. - the location of accommodation in relation to the workplace. - any health, fire safety or other hazards or disturbances and local facilities. - the provision of first aid and medical facilities. - heating and ventilation. Workers freedom of movement to and from the employer-provided accommodation shall not be unduly restricted.

Impact	Mitigation
Retrenchment	If the EPC contractor anticipates collective dismissals associated with the proposed project, the EPC contractor shall 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.
Grievance Mechanism	The EPC contractor will provide a grievance mechanism for workers to raise reasonable workplace concerns. The client will inform the workers of the grievance mechanism at the time of hiring, and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides feedback to those concerned, without any retribution. The mechanism should not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.
Supply chain	The EPC contractor shall devise a supply management system to ensure the mitigation measures identified above can be demonstrated by associated sub-contractors. Potential adverse impacts associated with supply chains will be considered where low labour cost is a material factor in the competitiveness of the item supplied. In such circumstances, the EPC contractor will take reasonable steps to inquire about the use of child labour and forced labour in its supply chain in relation to goods and materials which are central to the core functions of the project.

15.4.2 Operation

Impact	Mitigation
Human Resources Policies and Procedures	Human resource policies and procedures will be adapted appropriate to the size of the workforce required for operation and maintenance requirements. Policies and procedures must be prepared to demonstrate consistency with the requirements of national legislation and EBRD Performance Requirement 2.
Child Labour	The O&M Company 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 shall be subject to an appropriate risk assessment.
Forced Labour	The O&M Company 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.
Non-discrimination and equal opportunity	The O&M Company will comply with EU requirements on non-discrimination related to employment. In particular, 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; - base the employment relationship on the principle of equal opportunity

Impact	Mitigation
	and fair treatment, and will not discriminate with respect to all 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. Please note that special measures of protection or assistance to remedy past discrimination or 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.
Working Relationships	The O&M Company 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).
Working Conditions and terms of employment	The O&M Company will provide a plan detailing how working conditions and terms of employment are compliant with national labour, social security and occupational health and safety laws. Employment relationship shall 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. Special measures of protection or assistance to remedy past discrimination or 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.
Workers organisations	The O&M Company will enable means for workers to express their grievances and protect their rights regarding working conditions and terms of employment. The O&M Company will not discourage workers from forming or joining workers' organisations of their choosing or from bargaining collectively, and will not discriminate or retaliate against workers who participate, or seek to participate, in such organisations or bargain collectively.
Wages, benefits and conditions of work	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.
Occupational Health and Safety (OHS)	The O&M Company will provide the workers with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project. The O&M Company shall 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 shall be responsible for ensuring that all affiliated sub-contractors comply with the OHS management system. The OHS management system shall be in-line with recognised international best practice and 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.

Impact	Mitigation
Worker Accommodation	Where/if accommodation is provided for workers, the accommodation shall be appropriate for its location and be clean, safe and, at a minimum, meet the basic needs of workers. In particular, the provision of accommodation shall meet national legislation and international good practice in relation, but not restricted, to the following: - The practice for charging for accommodation. - The provision of minimum amounts of space for each worker. - Provision of sanitary, laundry and cooking facilities and potable water. - The location of accommodation in relation to the workplace. - Any health, fire safety or other hazards or disturbances and local facilities. - The provision of first aid and medical facilities. - Heating and ventilation. Workers freedom of movement to and from the employer-provided accommodation shall not be unduly restricted.
Retrenchment	If the O&M Company contractor anticipates collective dismissals associated with the proposed project, the O&M Company contractor shall 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.
Grievance Mechanism	The O&M Company will provide a grievance mechanism for workers to raise reasonable workplace concerns. The client will inform the workers of the grievance mechanism at the time of hiring, and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides feedback to those concerned, without any retribution. The mechanism should not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.
Supply chain	The O&M Company shall devise a supply management system to ensure the mitigation measures identified above can be demonstrated by associated sub-contractors. Potential adverse impacts associated with supply chains will be considered where low labour cost is a material factor in the competitiveness of the item supplied. In such circumstances, the O&M Company will take reasonable steps to inquire about the use of child labour and forced labour in its supply chain in relation to goods and materials which are central to the core functions of the project.