Preliminary Environmental and Social Impact Assessment (ESIA) for developing a 50 MWac PV Power Plant Project in KHBTDA / Mafraq

Environmental & Social Management Plan (ESMP)

February 2017

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Define . Design . Deliver

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1 PROJECT SUMMARY

1.1 Introduction

Al Ambaratouria Li Taka Al Shamsia (referred to as Al Ambaratouria in this report) has been granted an approval from the Government of Jordan, represented by the Ministry of Energy and Mineral Resources (MEMR), to develop a 50 MW_{ac} grid connected Photovoltaic project in Mafraq.

The project will help to decrease the country's dependency on traditional forms of energy by increasing the availability and use of solar energy. The generated electricity will be injected into the national grid, to support the country in meeting its renewable energy target of 10% by 2020.

Arabtech Jardaneh (AJ) was appointed by Al Ambaratouria to prepare this Preliminary Environment Impact Assessment (EIA) Study for the project activities during the three phases of the project namely: construction, operation and decommissioning. Which was prepared in accordance with the requirements of the Jordanian Environmental Impact Assessment (EIA) Regulation no. 37 of 2005, and the International Finance Corporation (IFC) Performance Standards as well as the European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy (ESP) which consists of the EBRD Performance Requirements (PRs) in order to support the application for an environmental permit from the Ministry of Environment (MoEnv).

1.2 Project Description

The project area is located within King Hussein Bin Talal Development Area (KHBTDA) – Mafraq and spans over a total of 1,330 dunums (plot S3-A is 1030 dunums and plot S3-B is 300 dunums) within the solar power field as illustrated in **Figure 1** below. The nominal capacity of the plant is 50MW AC and will have peak capacity of approximately 65MW DC.

The PV plant will be constructed with Polycrystalline PV modules and single axis trackers system to maximize the annual energy yield. The plant will be connected to NEPCO existing 33/132kV Substation which falls within the KHBTDA. The Plant will be connected via 33kV underground cables for evacuation to the grid.

The construction phase will employ approximately 500 people (at peak) where 90% are unskilled, priority will be given to hire local workers from Mafraq. The remaining 10% are skilled workers with equal number of locals and foreigners– mainly engineers and technicians from the main contractor and Supervision Company.

The operational period will be for 20 years and will employ approximately 10 people who will be working full time to operate and maintain the solar PV plant – mainly control, monitoring and maintenance engineers.

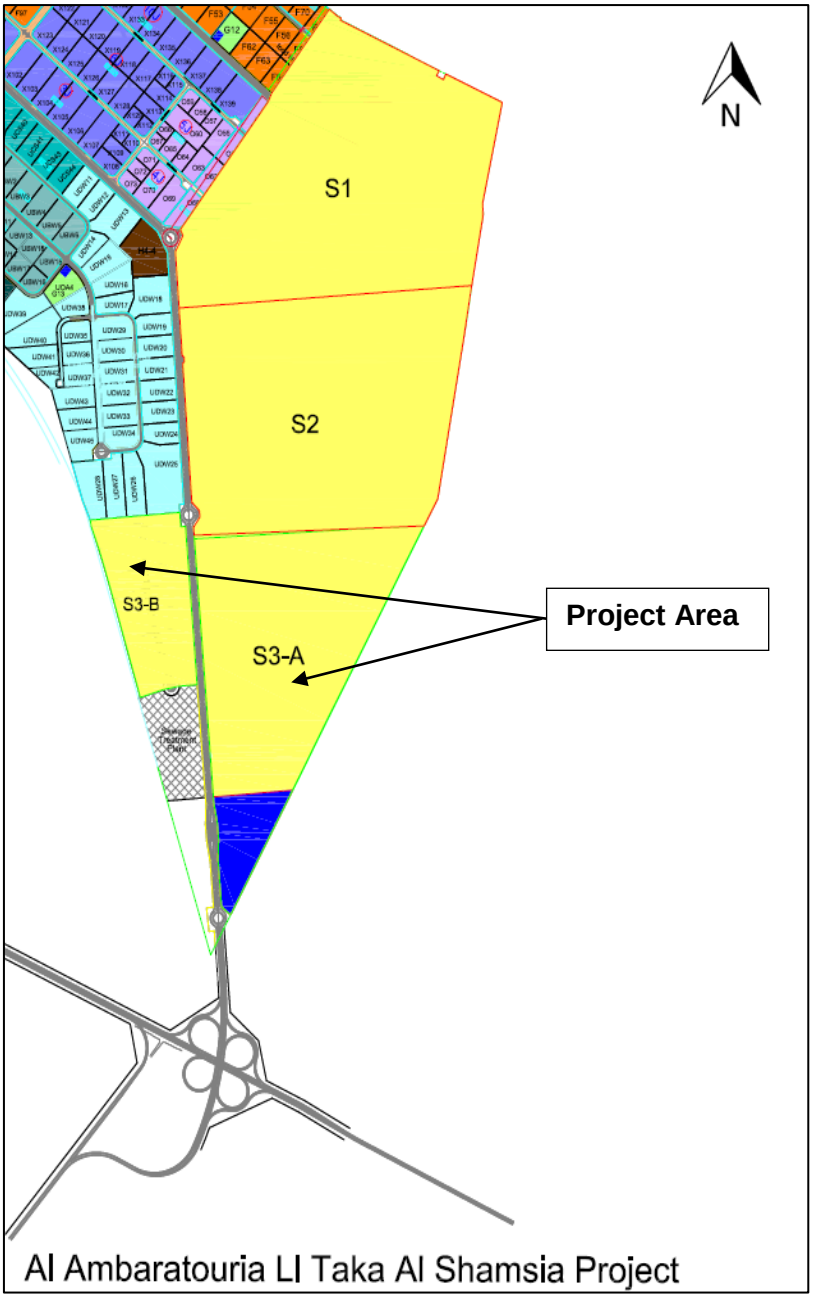

Figure 1: Project area

1.2.1 Project Components

PV Modules

The PV module is the main element that composes the generator or solar field. It transforms the received solar radiation into usable electricity (DC, direct current) by means of the photovoltaic effect through its several silicon cells that form the module.

Inverters

The project shall consist of 42 inverters (65.52 MW), the power plant controller shall be installed in order to manage all the inverters and Grid Requirements.

Trackers

The proposed tracking system is the Axone horizontal single-axis tracker, manufactured by PV Hardware, which aims at minimizing the angle of incidence between the incoming irradiance and the panel, rotating on its axis back and forth in a single direction, with an inclination range of +45 to -45 degrees.

Connection Box

The solar field presents two association levels:

- Parallel association of strings (modules connected in series);
- Parallel association of buses.

The parallel association of strings will be made directly throughout the tracker by means of technology specialized for this purpose; both string poles shall be connected to their corresponding bus.

Wiring

The cable for communication shall be mainly a fiber optic cable (RS232 shall be also employed). The power cable for the tracker's motor shall be a three-phase 400 V. The MV and LV power cables shall be manufactured of high conductivity Aluminum.

Grounding and Lightning Protection

All materials will be of high conductivity copper with the sufficient section to assure the required safety principles, in compliance with local standards.

Control Station

The required infrastructure for the security system (UPS, recorders, etc.), communications and PV plant monitoring shall be located in this station.

In addition, the control station shall be equipped with the necessary equipment according to Occupational Risks Prevention national normative and to Fire Protection Standards.

Monitoring and Control System

The Monitoring and Control System shall be composed of a SCADA application (Supervisory Control and Data Acquisition), hosted in a local server installed in the Control Station of the plant and several Remote Terminal Units (RTU), installed in each inverter area, that acquire data generated by inverters, field metering, solar tracker and protection devices.

Security System

System designed to prevent the intrusion of outsiders and provide protection against theft and vandalism. This system is structured in different areas; the anti-intrusion system and camera system, which are continuously in operation and under surveillance.

The system shall cover the strategic locations and sensitive areas of the project, for comprehensive surveillance and monitoring from central control room.

A fence shall be installed in the perimeter of the site according to local standards. It shall be covered with the necessary number of cameras, maintaining the capability of anti-intrusion detection.

Communications

The installation shall be provided with the necessary infrastructure in order to accomplish the needed requirements with a sufficient bandwidth.

Uninterruptible Power Supply

There will be a back-up emergency system designed to supply energy during black out conditions to power auxiliary loads.

Civil Works

All construction activities shall occur within the site boundary limits with the exception of those activities related to the interconnections between the site and the common infrastructures.

Foundations and site conditioning shall be made according to the requirements, National Building Code, Topographical and Geotechnical study of the site. All the foundations shall endure any load or combination of loads due to wind, snow and earthquake.

Spare Parts

A dedicated warehouse for storing equipment and replacements shall be provided on site. The warehouse will be built according to the National Building Code in order to shelter and protect the spare parts.

1.2.2 Implementation Schedule

The Construction Phase is set to commence in November 2016 with a duration of 12-months - until November 2017; which when the PV plant will be ready for interconnection; and will be followed by performance testing by mid-December 2017, and finally the issuance of the Provisional Acceptance Certificate is planned by January 2018.

2 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The project developer i.e. Al Ambaratouria is committed to achieving and maintaining environmental standards, such that Jordanian environmental regulations, EBRD ESP and IFC performance standards are met, and potential adverse environmental impacts resulting from the project activities are minimized as practicably as possible. This will be achieved through appropriate project planning and methods of Project operation.

Implementation of on-going environmental monitoring programs will enable the assessment and modification, if required, of the Environmental Management program.

2.1 Objectives

This Environmental and Social Management Plan (ESMP) aims at ensuring the application of the mitigation and monitoring measures needed to reduce and control the various environmental and social impacts associated with the implementation of the proposed project.

The key objectives of the ESMP are summarized below:

- Minimizing any adverse environmental, social and health impacts resulting from the project activities;
- Conducting all project activities in accordance with relevant Jordanian Legislation and applicable EBRD and IFC guidelines.
- Implementation of on-going environmental monitoring programs;
- Periodic review of the Environmental Management programs to allow for iterative improvement;
- Ensure that all stakeholder concerns are addressed.

Overall, this ESMP aims at ensuring the application of the mitigation and monitoring measures needed to reduce and control the various environmental and social impacts associated with the implementation of the proposed project as presented in **Table 1** and **Table 2** below.

2.2 Mitigation and Monitoring

Further to the impacts assessed in the previous chapter, this section presents more detailed mitigation measures and monitoring requirements (included in the following tables) that correspond to the impacts examined in the previous section, thus exploring them in more detail.

Mitigation measures aim to offset any negative impacts that may result from the project, and monitoring is the process of measuring the success of mitigation measures in order to assess their effectiveness. Reporting is the process of measuring actual performance or how well the mitigation measures have been implemented, including the format, timing and responsibility for reporting of the monitoring results.

Although the Preliminary EIA process did not reveal any high significant impacts (highest was found to be medium), this section provides measures that further reduce those impacts considered to be medium as well as those considered to be low.

Table 1: Environmental and Social Management Plan during Construction Phase

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
Implementation of KHBTDA Solar Projects							
Coordination Measures between the three developers		As general mitigation measures to be implemented throughout the project, it is recommended that the three solar developers within KHBTDA area seek coordination where possible particularly in relation to the following: • Stakeholder Engagement activities. Adopt collaborative role to stakeholder engagement and consultation with MDC and ACWA Power in an overarching SEP for the solar developments within the KHBTDA. • Define roles and responsibilities for stakeholder engagement with respect to Al Ambaratouria, MDC and ACWA Power. • Establish Croporate Social Responsibility CSR budget and programme prior to construction of implementation, in coordination with other solar developer(s). • CSR budget and commitment to the BDA's CSR programme shall be undertaken prior to financial close. • Social Investment Opporutinities; • Security Issues Management; • Traffic coordination; • Coordination during construction activities; • Emergency Response procedures through coordination in medical support provision on site.	N/A	Throughout the project	N/A	N/A Planting / screening plan provided prior to construction.	N/A

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		• Identify opportunities for collaboration with ACWA to optimise recruitment of local workers. • Identify and implement appropriate measures to mitigate visual impact of the project on receptors, such as planting, earthworks, and appropriate fencing to provide additional screening of the project, in collaboration with other solar developers. • Al Ambaratouria shall also be committed to develop Drainage Strategy in co-ordination with adjacent PV plants, to include reference to supporting studies, in order to Minimise impact on local drainage systems and flood risk.				Drainage Plan provided in collaboration with the developers.	
E&S Requirements/Committements		• Undertake a full assessment of the E&S, H&S and labour policies, systems and performance of EPC contractor, prior to appointment to ensure organisational capability. • Provision should be included in EPC contract (and subcontractor contracts) to ensure compliance with the requirements of all relevant E&S, H&S and labour plans contained within the project ESMS as well as national and lender requirements in order to assure that E&S requirements are fully accomplished. • Undertake monthly E&S audits of the EPC contractor during the construction phase. • Al Ambaratouria to be committed (provide in writing) to recycle the panels at end of life, for example through	N/A	Prior to and during construction Prior to modules installation	N/A	Written commitment to recycling panels to be	Project Developer i.e. Al Ambaratouria

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		projects such as PV Cycle. To ensure recycling of resources and reducing strain on hazardous landfill. • Provide written confirmation from RJA / Jordanian military and/or MDC that unexploded ordinance (UXO) does not pose a risk to the project construction. • Develop chance find procedure of UXO during construction and associated protocol to limit risk of UXO related incidents (initial inspection, specific digging protocol…)				provided to lenders. Confirmation from Royal Engineering Forces of the Jordanian Armed Forces provided. UXO Chance Find Procedure and associated protocol provided.	
Physical Environment							
Air Quality	Dust generation due to construction activities	• Contractor to implement dust control procedures on site such as: • Setting an appropriate site speed limit to reduce dust generation from vehicles travelling over unmade surfaces. • During construction dust generated on unpaved roadways and work areas should be controlled by the application of water on an “as needs” basis. • Unnecessary handling of dusty materials will be	Visual monitoring of dust emissions during earthworks and construction activities	Daily	Corrective actions for all significant dust generation issues Contractor shall prepare and submit a report to Al	No visible dust plumes originating from construction sites. Compliance with Construction Environmenta	EPC Contractor

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		avoided such as minimising drop heights when loaders dump soils into trucks. • Train workers to handle construction materials and debris during construction to reduce fugitive emissions. • Cover trucks when transferring fine and dusty materials outside the project location.			Ambaratouria in case of compliants	l Management Plan (CEMP)	
	Exhaust emissions due to operation of construction plant and machinery	• Ensure adequate maintenance and inspection of vehicles to minimize exhaust emissions. • Not running engines for longer than is necessary.	Visual monitoring of exhaust emissions during earthworks and construction activities	Daily	N/A	Regular vehicle maintenance records	EPC Contractor
Noise	Increased noise levels due to constrcution & machinery	• The contractor shall use heavy equipment, machinery, and fuels in compliance with national regulations. The contractor shall perform regular maintenance on all equipment, vehicle and machinery to prevent noise emissions. • The contractor shall limit idling of engines when not in use to reduce its contribution to noise emissions.	Noise measurements to be undertaken during construction activities, at the site in order to demonstrate compliance with the National environ-mental noise guidelines using a portable noise meter.	One month after start up and every quarter after that., and after receiving any complaints from workers or third parties.	Corrective actions reporting to Al Ambaratouria in case of any exceedance	Compliance with MoEnv and National guideline limits for environmental noise at sensitive receptors:	EPC Contractor
Soil	Soil contamination	• A spill prevention and response plan shall be prepared by the contractor in order to control any inadvertent leakage or spillage.	Visual Inspection of storage area,	Weekly	All unplanned incidents/acc	Number of spills or incidents to	EPC Contractor

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		• Spill response measures shall be implemented (as necessary) to contain and clean up any contaminated soil. • Construction of bunds around relevant work and storage areas. Bunds in areas of hazardous chemical storage (including temporary storage) should be lined to contain accidental spillage and minimize the potential for migration to the underlying soil. • Any spilled chemical shall be immediately collected and disposed of in accordance with Spill Prevention and Response Plan and MSDS. • Contractor shall ensure that a spill kit and adequate PPE is available at the site for emergency cleanup activities in case of chemical/oil spillage.	and machinery through conducting regular audits of on-site activities and incident reporting forms. All site workers to be trained on spill response procedures.		idents and Corrective actions.	be recorded during on-site audits. Training records of personnel trained in spill response procedures must be filed	
	Soil disrtubance	• To control soil erosion, surface run-off should be collected from all paved working areas into retention ditches to restrict concentration of flows	Visual Inspection of any temporary soil storage and run-off controls	Weekly	Corrective actions reporting	Regular inspection reports	EPC Contractor
Visual Amenity	Visual impacts from construction activities such as materials lay down, excavation, backfilling	• Al Ambaratouria shall identify and implement appropriate measures to mitigate visual impact of the project on receptors, such as planting, earthworks, and appropriate fencing to provide additional screening of the project, in collaboration with other solar developers. • The contractor shall ensure general cleanliness and good housekeeping practice at the project site at all times.	N/A Visual inspection of general housekeeping and cleanliness at site in addition to waste	Prior to Construction Daily	N/A Inspection reports	Planting / screening plan provided. Good housekeep-ing and tidiness of work areas	EPC Contractor

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
			management on site.			within the project site.	
Waste Generation	Hazards presented by improper management and handling of hazardous and non-hazardous waste during construction.	• Provide a project Waste Management Plan / Procedure within the CEMP, making provision for separation and recycling of waste, including facilities and training requirements. The procedure should specifically include provision for the disposal of broken or unusable panels and the management of wastewater and hazardous wastes [the procedure shall be prepared to be in-line with the waste management practices that the EPC Contractor plans to implement on site taking into account EBRD/IFC requirements in PR/S3]. • The contractor shall segregate storage for different types of wastes, such as hazardous, non-hazardous recyclable construction material, plastic, paper, etc. to facilitate proper disposal. • The contractor shall provide a separate storage area for hazardous materials. The hazardous materials/products must be labeled with proper identification of its hazardous properties. • Chemical waste shall be stored in accordance with the provisions of Material Safety Data Sheets (MSDS). The contractor shall keep MSDS onsite. • Contractor shall provide trash bins within each construction site so as to prevent littering in the project area and surrounding areas. • The contractor shall establish regular intervals for waste collection and disposal as per contractor's waste	Visual monitoring of site cleanliness and proper storage and handling of hazardous waste and sewage. Inspect that segregated waste disposal or storage areas are clearly marked.	Daily	Contractor shall prepare and submit monthly waste report to Project Developer.	Compliance with waste management procedures. Current and complete records of regular waste pickup and disposal.	EPC Contractor

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		management procedures. • The sanitary and organic wastes shall be collected in a septic tank to be installed on site and disposed off regularly.					
Water Resources	Potential surface water runoff / potential flood risks.	To minimize risks from heavy rainfall and potential flooding the following measures might be necessary as recommended in the project's hydrological study: • As preliminary vision some of the streams need channelization and grouted riprap lining. • For maintenance proposes and to serve the site in all weather conditions, it is recommended to define the wadi banks by means of creating depression within the flooding plain in order to guide the flood to run in a well-defined path. • Earth cut ditch shall be constructed adjacent the roads since the level of the roads are higher than the levels of the land inside the plot, especially at the western site of the catchment 1 in Plot S3-A as shown in **Figure 18** in the Preliminary ESIA report, drainage channels can be adjusted to suit the land use planning of the site. • Catchment 3 runoff enters the plot S3-B at the northwestern corner and can be discharged directly towards the railway. • Runoff of Catchments 4 and 5 can be discharged by a ditch at both eastern and western sides of the plot S3-B • If any internal road to cross the channel at any	Visual inspection of drainage features during the rainy season	Daily during rainy seasons	Inspection reports and Incident reports to Al Ambaratouria in case of flood from high precipitation events.	No flooding caused by the construction and operations	EPC Contractor in collaboration with Al Ambaratouria

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		location, it should cross over Box/ Pipe culvert having cross sectional area equal the cross sectional area of the drainage channel. • The design and layout of photovoltaic arrays of the project should be protected by providing PVC sleeves at each channel crossing with photovoltaic arrays. • Follow-up with the Ministry of Water and Irrigation and MDC (if needed). Based on the above recommendations, Al Ambaratouria shall also be committed to develop Drainage Strategy in co-ordination with adjacent PV plants, to include reference to supporting studies, in order to Minimise impact on local drainage systems and flood risk.					
Biological Environment							
Ecology	Potential disturbance to fauna	• Al Ambaratouria to develop an Ecological Management Plan for the project through an external consultant to include establishment of appropriate native plant species within area and any other appropriate ecological enhancements, along with annual ecological monitoring, • Minimize open spaces on site that migratory birds may	Visual inspection	Prior to Construction During mi-	Periodic report to Al Ambaratouri	Ecological Management Plan in place N/A	Al Ambaratouria EPC

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		land in. • Minimize human and vehicular contact with fauna, including their burrows / nests and feeding grounds. • Waste shall be stored on site within closed container, especially food remnants to avoid attracting birds and vermin onto site.	within project site.	gration season (in spring and autumn)	a on EHS performance		Contractor
Health and Safety							
Health and Safety risks	Potential of exposure to safety events such as tripping, working at height activities, fire from hot works, smoking, failure in electrical installations, mobile plant and vehicles, and electrical shocks	• Presence and compliance with EHS related policies and procedures on site. As part of the project's ESMS documentation an Occupational, Health, Safety & Environment (OHSE) Plan has been prepared for this project in addition to relevant procedures such as: first aid, excavation, PPE, audit, inspection & reporting, accident, incident and near miss, fire prevention, risk assessment, work permit, lock-out and tag-out, and lifeting operations. • Al Ambaratouria to ensure that the contractor includes provision for working in heat as per the procedures planned to be implemented by the contractor on site. Such procedures shall be integrated within OHSE Plan, such as the installation of shelters to be available to construction workers, and relevant guidance and information provided within toolbox talks. Where heat levels necessitate night working OHS and labour policies should incorporate appropriate safeguards to reflect the implications of this.	Visual inspection by user before each activity Maintain proper housekeeping for the project site Routine Facilities' and site Inspection	Prior to activity Continuously Monthly	Contrctors shall prepare and submit monthly H&S report to Al Ambaratouria	Appoint project H&S manager for construction phase. Total Recordable Incidence Rate (TRIR) Lost Time Incidence Frequency Fatal Accident Rate Number of	EPC Contractor and Al Ambaratouria

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		• Compliance with Labor and Working Conditions Plan as well as the Human Resources (HR) Policy prepared for this project as part of the ESMS Also the Contractor's existing labour and staff requirements must be tailored to take into account the requirements of the Labour and Working Conditions Plan and the HR Policy. • EPC Contractor to provide a description of project organisational structure for the implementation of all E&S and labour requirements, with evidence of organisational capacity and commitment. As part of this description an organizational chart shall be included with specific names of individuals who will be filling each role. • HSE manager to be appointed for the project priorto construction commences. • Allocate specific personnel responsible for H&S management on site. • Adequate and appropriate training of all workers of the contractor's EHS policies and procedures before they are permitted to undertake a task. • All construction equipment used for the execution of the project works shall be fit for purpose and carry valid inspection certificates and insurance requirements. • Risk assessment shall be prepared and communicated prior to commencement of work for all types of work activities on site. • Provide walkways that are clearly designated as a	Inspection of Equipment and tools used during working at height activities Fire Emergency Response Drills Inspection for fire extinguishers, testing for fire detection system, and other fire fighting equipment. Maintenance for fire extinguishers, testing for fire detection system, and other fire fighting	Prior to work activity Semi-annually Monthly Continuously Based on Fire risk assessment		safety training performed Number of non-conformance events. Reports. Training records Adhere to relevant ESMS odcumentation prepared for this project: • Construcution Environmental Management Plan (CEMP). • Occupational Health, Safety & Environmental	

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		walkway; all walkways shall be provided with good conditions underfoot; signposted and with adequate lighting. • Signpost any slippery areas, ensure proper footwear with a good grip is worn for personnel working within slippery areas. • As far as reasonably practical, use cordless tools that may not need to use cables. Where cables for temporary lighting or mains-powered tools will be used, all cables shall be run through designated corridors. • Avoid work at height where it reasonably practicable to do so, e.g. by assembly at ground level. • Prevent any person falling a distance liable to cause personal injury e.g. by using a scaffold platform with double guard-rail and toe boards; • Arrest a fall with equipment to minimise the distance and consequences of a fall, e.g. safety nets, where work at height cannot be avoided or the fall prevented. • Carry out fire risk assessment for the construction areas, identify sources of fuel and ignition and establish general fire precautions including, means of escape, warning and fighting fire. • Set up a system to alert workers on site. This may be temporary or permanent mains operated fire alarm. • Fire extinguishers should be located at identified fire points around the site. The extinguishers shall be appropriate to the nature of the potential fire. • Establish and communicate emergency response plan	equipment. Monitor work areas and activities to identify fire and explosions hazards. Preventive maintenance and patrol inspections for all vehicles and mobile plant Vehicles and mobile plants inspection	Monthly Pre-use		(OHSE) Plan with the related procedures.	

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		(ERP) with all parties, the ERP to consider such things as specific foreseeable emergency situations, organizational roles and authorities, responsibilities and expertise, emergency response and evacuation procedure, in addition to training for personnel and drills to test the plan. An ERP has been developed for this project as part of the ESMS documentation that can be used as a farmework. • Ensure all plant machines and vehicles are regularly inspected, serviced and maintained; ensure all staff assigned is trained and competent to operate plant machines and vehicles. • Ensure all routes are suitable and wide enough for the vehicles, routes should be planned by minimising bends/junctions, steep gradients and the need for reversing, clearly designate areas for pedestrian walkways and crossing points. • Ensure clear signages are in place, such as Warning of speed limits, obstructions, allowable widths/heights...etc. • Electrical equipment must be safe and properly maintained; works shall not be carried out on live systems. • Only competent authorised persons shall carry out maintenance on electrical equipment, adequate Personal Protective Equipment (PPE) for electrical works must be provided to all personnel involved in the tasks as per the PPE procedure prepared for this					

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		project. • Lock-Out / Tag-Out (LOTO) system shall be implemented during any electrical works as per the LOTO procedure prepared for this project. • Adequate number of staff and first aiders shall be on site in accordance with Jordanian Labour Law requirements. • First aid kit with adhesive bandages, antibiotic ointment, antiseptic wipes, aspirin, non-latex gloves, scissors, thermometer, etc. shall be made available by the contractor on site. • Emergency evacuation response shall be prepared by the contractor and relevant staff shall be trained through mock-up drills.					
	Exposure to health events during construction activities such as manual handling, electrical shocks and burns, hand-arm vibration, temporary or permanent hearing loss, heat stress,	• Ensure that operations, which involve manual handling, are eliminated so far as reasonably practicable, provide mechanical aids such as forklifts, trolleys, cranes, hoists etc. • Ensure all equipment are suitable for jobs (safety, size, power, efficiency, ergonomics, cost, user acceptability etc), provide the lowest vibration tools that are suitable and can do the works. • Ensure all tools and other work equipment are serviced and maintained in accordance with maintenance schedules and manufacturer's instructions. • Regular noise exposure assessments and noise level surveys of noisy areas, processes and equipment shall be carried out in order to form basis for remedial	Monitor the health of workers Monitor work areas and operations to identify noise	Continuously Monthly	Contrctors shall prepare and submit monthly H&S report to the developer	Total Recordable Incidence Rate (TRIR) Lost Time Incidence Frequency Fatal Accident Rate Medical Treatment Case(MTC) No.	EPC Contractor and Al Amabartouria

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
	and dermatitis	actions when necessary. • As far as reasonably practical, all steps to reduce noise exposure levels of employees by means other than that of personal protective equipment shall be taken, such as reducing exposure times, enclosures, silencers, machine covers…etc. • Provide suitable and effective hearing protection to employees working in high noise levels. • Designate and clearly mark hearing protection zones, which may include particular areas, operations or pieces of equipment. All personnel entering these zones shall be required to wear hearing protection inside these areas. • Awareness training sessions should be established and provided to all personnel involved during the construction phase in order to highlight the heat related illnesses of working in hot conditions such as heat cramps, heat exhaustion, heat stroke, dehydration. • Ensure adequate quantities of drinking water are available at different locations within the site, • Ensure proper planning of works to consider the time of peak temperatures during the day, provide rest brakes during the peak times. • Provision of sun shades at different locations within the site. • Eliminate the risk of exposure whenever possible, provide proper PPE wherever necessary and to ensure that there are satisfactory washing and changing	hazards. Inspection for use hear protection equipment Fit Testing Maintenance & Care for Hear protection equipment.	Prior Use Prior to employment Monthly		Restricted Work Day Cases (RWDC) HSE Training Hours Number of non-conformance events. Adherance to OHSE Plan prepared as part of the project's ESMS documentation in addition to the relevant procedures prepared for this project.	

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		facilities. • Ensure that all workers exposed to a risk are aware of the possible dangers. They should be given thorough training in how to protect themselves and there should be effective supervision to ensure that the correct methods are being used.					
Socio-economics							
Traffic	Additional traffic load due to transport of equipment and materials to and from the site through the surrounding road network	• As part of the projects ESMS documentation, a traffic management plan was developed as a framework to provide certain precautions and mitigation measures relevant to the project, however it is the responsibility of the EPC Contractor to provide project Construction Traffic Management Plan (CTMP), aligned with Al Ambaratouria's Traffic Management Plan, to include proposed delivery routes and number of vehicle movements across the construction phase, given that the contractor is aware of the number of vehicles, their route, axial loads, entry points of materials, and will be responsible to obtain relevant permits from authorities. • contractor to ensure that all trucks and vehicles accessing the facility are operated by licensed operators. • Pedestrians Safety: All project vehicles and trucks shall comply with the proposed speed limits • Ensure adequate maintenance and inspection of vehicles • Presence of flagman at the entrance and exit of the project site in order to control vehciles and truck	Maintain an open dialogue with the MDC. Monitor vehicle movement to and from the Project area.	Continuously	All incidents to be investigated and reported to Al Ambaratouria	No complains or concerns from traditional users of the area's roads routes are received during the construction activities. No incidents or accidents (collisions) are recorded Adhere to Traffic Management Plan	EPC Contractor

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		movement. • Every employee working on the project site shall make sure that all needed signs and preventive measures are implemented when starting any activity. • Number of traffic signs, their characteristics and distance among them will be placed according to local legal requirements and an on-site HSE assessment that will conducted prior to any construction activity starts. Signs shall always be in good conditions and be visible to every road user. • Unjustified use of horn will be avoided • Vehicle transit across any restricted area and/or limited to working activities is prohibited • Vehicle repairmen and/or maintenance activities are not allowed within the project area. They shall only be carried out within the especially dedicated areas.					
Local communities	Implications on Local Community Groups	• Follow the community grievance mechanism developed as part of the project's Stakeholder Engagement Plan (SEP) prior to construction in complicance with EBRD and IFC guidelines, which links into MDC's community liaison. • Compliance with the Community Health & Safety Plan prepared for this project as part of the ESMS documentation. • Appoint a Community Liaison Officer CLO, whose remit should include management of all community related matters for the project; this extended role should be reflected in the SEP.	Ensure to establish specific monitoring procedure for stakeholder consultation and records of grievances where needed.	Throughout the project phases	To Al Ambaratouria Management	Compliance with IFC and EBRD guidelines and implementati of SEP as well as the public grievance mechanism outlined in the SEP (please	Al Ambaratouria

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		• In addition to commitment made in SEP to disclose E&S annual reports on Al Ambaratouria or EBRD website, –ensure general public access to information on the Project and E&S performance and include a project website. This needs to be accessible to all and provided in a meaningful way to local people (including translation into Arabic) and aligned with relevant requirements of the MDC disclosure plans. The following documentation should be provided in paper copy and on the internet: o ESMP o Non-Technical Summary (NTS) o MoE Environmental Authorisation (including conditions) o Stakeholder Engagement Strategy / Plan and outcomes of stakeholder consultation and grievance mechanism. • Undertake appropriate assessment to confirm whether the project will cause any economic displacement and if so, identify areas of replacement grazing land or other measures to be employed to ensure appropriate compensation where relevant. • This should include consideration of seasonal land use and be developed in consultation with stakeholder who may have used the land for grazing and seeding.		Prior to Construction		refer to APPENDIX D of the Prelminary EIA Report) Number of grievances and time taken to resolve them. Provide assessment, including consultation outcomes, and a report / plan that describes how Al Ambaratouria is going to identify / assess / compensate / monitor compensation of all users of	

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
						the land.	
Worker Community	Labour and Working Conditions	• Compliance with project Labour and Working Conditions Plan preapred for this project for effective worker management. • Develop and implement a training programme prior to construction to ensure appropriate and timely project specific training is provided to build employment opportunities for the local workforce. This should be developed and implemented in consultation with MDC and include opportunities for women's employment where appropriate. • Appoint project HR manager for construction phase. • EPC Contractor to ensure that conditions of work, including those relating to working hours, are compliant with ILO standards.	N/A	Prior to Construction		Project Training Programme formulated and approved by lenders. Satisfy requirements in Labour & Working Conditions Plan Provision of EPC's Labour and Employment procedures, including provision for working hours.	EPC Contractor under supervision of Al Ambaratouria

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
Community Health, Safety and Security	Security risks Minimisation of impacts of influx of workers during construction, and other impacts of the project on the community. Minimise potential community H&S risks.	• Implementation of Security Management Plan conducted for the project. • Compliance with Community Health & Safety Plan prepared for this project as part of the ESMS documentation. In addition to the Security Management Plan prepared for this project by an external consultant. • It is recommeded that developers to coordinate with eachother where possible of issues relating to community health, safety and security. • Al Amabaratouria to provide project worker code of conduct and measures to ensure appropriate management of worker interaction with the local communities. This should include measures to avoid / reduce the risk of exposure to communicable disease.	Ensure that security management plan is applied during all project phases.	Throughout the project phases	To Al Ambaratouria Management	Compliance with Security Management Plan Worker code of conduct provided	Al Amaratouria

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
Emergency Preparedness							
External Risks	-Natural disasters such as: earthquakes and flash floods; -Medical Emergency such as disease outbreaks causing an immediate risk to a persons' life; -Public Riots; -Terrorism;	• To reduce risks of flooding its recommended to implement the mitigation meausres proposed as part of the hydrological study for the project area discussed in this table. As for earthquakes it is recommended to conduct an awareness program for workers, coordinate with police & civil defence department to reduce risks, implement first aid, and Evacuation and ensure power shutdown and securing area. • To reduce the risks from medical emergencies it is recommended to: o Notify Security Supervisor and Al Ambaratouria site management (including security); o Provide first aid to the person by the certified First Aider. o Do not move an injured person. o Call Ambulance for further check up and treatment / transport to the nearest hospital; o Coordination with health department in Mafraq • For riots it is recommended that the site manager or other designated person to maintain regular social contact with the local head of the police, the General Intellingence Department (GID), mayor and head of municipality.primary importance shall be placed on the local police designated as first responders at MDC site. • For terrorist attacks security personnel must be trained and provided with relevant information sheets as mentioned in the security management plan. It is	Regular reporting of incidents and communication with relevant authorities to detect certain acts/trends. Constant oversight by security personnel. Liaison with local authorities and police unit at MDC site. Audit the security on the site and the understanding of the expected behavior in response to an incident from both a security and community	Regularly	Follow the incident /accident reporting discussed in the Security Management Plan on page. 19. Key audits will be reported to Al Ambaratouria Management.	Training records of security personnel Compliance with Emergency Preparedness and Response Plan prepared for this project as part of the ESMS documentation. Adherance to Security Management Plan prepared for this project.	EPC Contractor / Al Ambaratouria / security services provider

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		essential to follow evacuation procedures and inform relevant authorities/police/GID and following their instructions. • Please refer to the security management plan for detailed procedures and mitigation measures in dealing with external risks.	relations perspective; and Monitor risk triggers relative to the area and setup an incident identification process to alert Al Ambaratouria of any situation that should occur on or near the site.				
Internal Risks	Man made risks such as: - Sabotage/work disruption by workers, -Vandalism, -Attacks and theft/robbery from workers or external	• During construction it is recommended to monitor of risk triggers in the area and communicate these triggers to on site management within the EPC so they are aware of what to look for • Liaise with the local police unit on the MDC site, in order to gather and to share feedback about any incidents or security related developments on the MDC or in the related area; • Establish effective training, management and reporting lines for local security guards on site to increase security awareness. • Adherence to the measures discussed in the security management plan.	Same as above	Regularly	Follow the incident /accident reporting discussed in the Security Management Plan on page. 19.	Same as above.	EPC Contractor / Al Ambaratouria / security services provider

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
	parties; -Crime.						
Archaeological Resources & Cultural Heritage							
Archaeology & Cultural Resources	Only potential concern can be impacts on possible unseen archaeological sites/remains (chance finds)	• All construction works shall be ceased if any potential historical or archaeological sites are chance found during construction. • In the event potential archarological and/or cultural resources are discovered during construction activities, the Ministry of Tourism and Antiquities – Mafraq Directorate shall be invited for consultations and assessment of the finding. • Work shall be resumed only after archaeological experts from Ministry of Tourism and Antiquities and official authorities such as the Department of Antiquities (DoA) are consulted and appropriate mitigation measures are implemented.	• Minimum of one site inspection immediately after chance find. • Informing personnel present on site of chance find procedures in case any archaeological or cultural resources were encountered	One site inspection after chance find	To Department of Antiquities (DoA) in case of chance finds.	Compliance with Jordanian Antiquities Law.	Contractor

Table 2: Environmental and Social Management Plan during Operation Phase

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
Physical Environment							
Soil	Potential spillage of stored oil and chemicals	• Specific procedures shall be developed for the removal of waste or spilled fuel, oil and contaminated soil at approved disposal facilities. • Proper storage for chemicals and fuel within confined areas on site and adopting proper safety measures when handling those chemicals to prevent their leakage and infiltration into the soil.	Inspect the presence of any disturbed areas in and around the project site for erosion Visual inspection of oil storage tanks, waste storage area and fuel storage area for spills and leaks	Post rainfall event Weekly	To developer's top management	Maintain readily available records of all workers training on spill response procedures.	Contractor during warranty preiod ; and Al Ambaratouria for the rest of the operational period
Visual Amenity	Potential glare from PV panels	The used technology has Anti- Reflective coating that significantly reduce the refelectivity of the PV Panels	N/A	N/A	N/A	N/A	Contractor during warranty preiod ; and Al Ambaratouria for the rest of the operational period
Terrestrial Ecology							
Terrestrial Ecology	Potential disturbance and harm to birds	• Minimize human and vehicular contact with resident birds including their burrows / nests and feeding grounds. • Ground nests found on site shall be translocated outside the industrial park's boundary.	Visual inspection within project site.	Weekly	To developer's top management	No reported harm to birds.	Contractor during warranty preiod ; and Al Ambaratouria for the rest of the operational

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		• Waste shall be stored on site within closed container, especially food remnants to avoid attracting birds on site. • Apply manual plant removal if needed.					period
Health and Safety							
Safety risks	Potential of exposure to safety events during operation activities such as slipping and tripping, working at height activities, and fire	• Provide walkways that are clearly designated as a walkway; all walkways shall be provided with good conditions underfoot; signposted and with adequate lighting. • Ensure all works and storage areas are tidy, all material deliveries shall be planned to minimize accumulated materials at project site. • Signpost any slippery areas, provide proper footwear during working within slippery areas. • Avoid work at height where it reasonably practicable to do so, e.g. by assembly at ground level. • Prevent any person falling a distance liable to cause personal injury e.g. by using a scaffold platform with double guard-rail and toe boards. • Carry out fire risk assessment during operation to identify sources of fuel and ignition and establish general fire precautions including, means of escape, warning and fighting fire.	Inspection of equipment and tools used during working at height activities Maintain proper housekeeping for the project site Facilities and site inspection. Monitor work areas and activities to identify fire hazards.	Prior to work commencement Continuously Monthly Based on fire Assessmnet	Prepare regular report to developer's top management	Total Recordable Incidence Rate (TRIR) Lost Time Incidence Frequency Number of safety training performed Number of non-conformance events. Compliance with Operation Environmental Management Plan (OEMP) prepared as part of the ESMS documentation for this project Compliance	Contractor during warranty preiod ; and Al Ambaratouria for the rest of the operational period

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		• Set up a system to alert workers on site. This may be temporary or permanent mains operated fire alarm. • Fire extinguishers should be located at identified fire points around the site. The extinguishers shall be appropriate to the nature of the potential fire. • Establish and communicate emergency preparedness and response plan with all parties which shallto consider such things as specific foreseeable emergency situations, organizational roles and authorities, responsibilities and expertise, emergency response and evacuation procedure, in addition to training for personnel and drills to test the plan. • Adequate first aiders shall be on site in accordance with Jordanian Labour Law requirements. • First aid kit with adhesive bandages, antibiotic ointment, antiseptic wipes, aspirin, non-latex gloves, scissors, thermometer, etc. shall be made available by the contractor on site. • Emergency evacuation response shall be prepared by the contractor and relevant staff shall be trained through mock-up drills.	Fire emergency response drills Maintenance check for fire extinguishers, testing for fire detection system, and other fire fighting equipment.	Semi-annually Monthly		with Labor and Working Conditions Plan as well as the HR Policy prepared for this project.	
Socio-economics							
Traffic	Potential	Implementation of a regulated entrance and	Monitoring of	Daily	All incidents	Number of	Contractor

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
	minimal increase of traffic load	exit into the facility.	access roads around site Record complaints received from locals or authorities.		reported to the proper authority and to MDC.	complaints from road users. Number of traffic incidents due to vehicle movement.	during warranty preiod; and Al Ambaratouria for the rest of the operational period
Emergency Preparedness							
External Risks	-Natural disasters such as: earthquakes and flash floods; -Medical Emergency such as disease outbreaks causing an immediate risk to a persons' life; -Public Riots; -Terrorism;	• To reduce risks of flooding its recommended to implement the mitigation meausres proposed as part of the hydrological study for the project area. As for earthquakes it is recommended to conduct an awareness program for workers, coordinate with police & civil defence department to reduce risks, implement first aid, and Evacuation and ensure power shutdown and securing area. • To reduce the risks from medical emergencies it is recommended to: o Notify Security Supervisor and Al Ambaratouria site management (including security); o Provide first aid to the person by the certified First Aider. o Do not move an injured person.	Regular reporting of incidents and communication with relevant authorities to detect certain acts/trends. Constant oversight by security personnel. Liaison with local authorities and police unit at MDC site. Audit the security on the	Regularly	Follow the incident /accident reporting discussed in the Security Management Plan on page. 19.	Training records of security personnel Compliance with Emergency Preparedness and Response Plan (EPRP) prepared for this project as part of the ESMS documentation. Adherance to Security Management	Al Ambaratouria / security services provider

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
		o Call Ambulance for further check up and treatment / transport to the nearest hospital; o Coordination with health department in Mafraq • In case of riots it is recommended that the site manager or other designated person to maintain regular social contact with the local head of the police, the General Intellingence Department (GID), mayor and head of municipality.primary importance shall be placed on the local police designated as first responders at MDC site. • For terrorist attacks security personnel must be trained and provided with relevant information sheets as mentioned in the security management plan. It is essential to follow evacuation procedures and inform relevant authorities/police/GID and following their instructions. • Please refer to the security management plan for detailed procedures and mitigation measures in dealing with external risks.	site and the understanding of the expected behavior in response to an incident from both a security and community relations perspective; and Monitor risk triggers relative to the area and setup an incident identification process to alert Al Ambaratouria of any situation that should occur on or near the site.			Plan prepared for this project.	
Internal Risks	Man made risks such as: Sabotage/work disruption by	• Liaise with the local police unit on the MDC site, in order to gather and to share feedback about any incidents or security related developments on the MDC or in the related area;	Same as above	Regularly	Follow the incident /accident reporting discussed in	Same as above.	Al Ambaratouria / security services provider

Aspect	Key Potential Impact	Mitigation Measures	Monitoring Requirements	Frequency	Reporting	Performance Indicator	Responsibility
	workers, -Vandalism, -Attacks and theft/robbery from workers or external parties; -Crime.	• Establish effective training, management and reporting lines for local security guards on site to increase security awareness. • Adherence to the measures discussed in the security management plan.			the Security Management Plan on page. 19.		

2.3 Decommissioning

The solar power plant facility is considered a large scale long-term investment that will contribute to economic benefits to the country through provision of power supply, designed in accordance with best practice, taking into account all relevant national and internal codes and legislation.

The design life of the facility will cover the period of 20 years, and will be renewed upon mutual consent between NEPCO and Al Ambaratouria. Therefore, the post-design life is expected to involve rehabilitation, upgrading and modernization of the facility, with a possible expansion (retrofitting and addition of new technology).

As a result, impacts from decommissioning are not expected to arise in the near future unless retrofitting and upgrade of the facility was not feasible. However, this, Preliminary EIA Study has considered potential decommissioning impacts in case there was a need for the facility to be dismantled and end operations.

As can be noted from the impact assessment **section 9** of the Preliminary ESIA Report, no impacts with high significance are anticipated to take place during decommissioning of the project since all facilities will be removed, solar power plant decommissioned, and PV panels will be dismantled and sent for recycling. According to the Preliminary Environmental Assessment study conducted for KHBTDA in 2014 by Al Shamil Engineering Company, recycling is recommended during the decommissioning phase. Furthermore, as part of the ESMS documentation, a Decommissioning Environmental Management Plan (DEMP) has been prepared for the project which shall be updated in due course by the Contractor that will be responsible for the decommissioning of the project. Furthermore, Al Ambaratouria will be committed to conduct periodic reviews and updates of the plan over the operational life of the project (recommended every 7 years or in the case of issuance of new relevant laws and regulations) to accommodate any changes during the course of the project and the surrounding environment, as several assumptions may change as a result of project activities.

The main mitigation and monitoring measures to minimize or reduce the environmental and social impacts during decommissioning are anticipated to be similar to those identified for the construction phase.

Therefore, to avoid repetition, please refer to **Table 1** above for detailed mitigation measures that overlap with decommissioning as well.