



## **Environment Management and Monitoring Plan (EMMP) For PV System Installation at Seven Heritage Sites**

**September, 2022**



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## List of Abbreviations

<b>Acronym</b>	<b>Definition</b>
BOQs	Bill of Quantities
CBO	Community Based Organization
DGA	Director General Archeology
EP	Environmental Protection
EPA	Environmental Protection Agency
EPC	Engineering, Procurement and Construction Contract
ESMF	Environment and Social Management Framework
EMMP	Environmental Management and Monitoring Plan
ESMP	Environment and Social Management Plan
E&S	Environmental and Social
E&SS	Environmental and Social Screening
EA	Environmental Assessment
GHG	Greenhouse Gases
GOP	Government of Pakistan
GOPb	Government of Punjab
GRM	Grievance Redress Mechanism
kW	Kilo Watt
NA	Not Applicable
NOC	No objection certificate
OP	Operational Policy
PCR	Physical Cultural Resource
PDO	Project Development Objective
P&DD	Planning & Development Department
PMU	Project Management Unit
PPE	Personal Protective Equipment
PTEGP	Punjab Tourism for Economic Growth Project
PV	Photovoltaic
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SAA	Same as Above
SOP	Standard Operating Procedure
UNESCO	United Nation, Education, Scientific and Cultural Organization
USD	United States of America, Dollar
WB	World Bank

## EXECUTIVE SUMMARY

Tourism is highlighted as one of the sectors of Pakistan economy that could help stimulate economic growth. Government of Punjab, Pakistan has launched Punjab Tourism for Economic Growth Project (PTEGP) with the financial assistance of the World Bank (WB). The total funding of the Project is 55 Million USD with a World Bank contribution of USD 50 million over the five-year time frame. The project objectives are to strengthen institutional capacity, increase private sector participation and improve infrastructure services for the tourism sector growth in the Province of Punjab. The project is being implemented by a dedicated Project Management Unit (PMU) PTEGP.

The detail of sub-projects to be executed under the PTEGP was not available during the project initiation, so an Environmental and Social Management Framework (ESMF) was prepared according to WB Operational Policies. This Environmental Management and Monitoring Plan (EMMP) is prepared for the sub-project "PV System Installation at seven Heritage Sites". The selected seven heritage sites include:

Taxila Museum, Taxila Rawalpindi;  
Wah Gardens, Wah Rawalpindi;  
Rohtas Fort, Jahelum;  
Hiran Minar, Sheikhupura;  
Jahangir's Tomb, Lahore;  
Shalamar Gardens, Lahore; and  
Harappa Museum, Harappa Sahiwal.

The main objective of proposed sub-project is to offsetting the burden of energy on national grid and reducing emission of GHGs by using green source of energy. Specialised consultant Pak Indenting and Trading Company Pvt. Ltd (PITCO) was hired for the core focus on developing feasibility studies (load assessment, proposing energy conservation measures (ECM's) and PV system design) in order to lower energy consumption, operating costs and promote efficient energy usage in Punjab. Suitable locations for installation of solar panels within the premises of heritage sites were finalized through stakeholder consultation and evaluation of environmental and social aspect of the area.

Environmental and Social (E&S) Screening reports for all seven sites were prepared and issued to WB separately during June 2022 to September 2022. Key findings of E&S screening studies are:

- Anticipated adverse E&S impacts of the proposed sub-project are mainly related with construction activities which are localized, temporary and mitigable. Identified impacts are less significant and not diverse, sensitive and numerous.
- No land acquisition or resettlement require for the proposed sub-project as all the identified sites for PV System installation are located within the premises of heritage sites, owned by Archaeological Department, GOPb.
- A consolidated EMMP should be prepared to manage the risk of environmental and social hazards pertain to the project activities.
- Standard Operating Procedures (SOPs) should be a part of the EMMP for execution of work activities within the premises of heritage site. Taxila Museum Management have

their own management plan which will be applied during execution of work at Taxila Museum site.

Under Pakistan Antiquity Act 1975, NOC is required from Archaeological Department Punjab Government for execution of proposed sub-project. Director General Archaeology (DGA) issued NOC for this sub-project and is attached as an Annexure A of EMMP.

World Bank Operational Policies 4.01 (Environment Assessment) and 4.11 (Physical Cultural Resources) triggered in this sub-project. Proposed work schemes are categorized as category B project. However, there is no land acquisition or resettlement require and therefore EMMP is prepared to address associated environmental and social issues of the sub-project. SOPs are prepared for executing work within premises of heritage sites and included in the EMMP.

PITCO prepared the feasibility studies for PV System installation at above seven heritage sites with the collaboration of stakeholder (mainly Archaeological Department). Solar panels usually installed either on rooftop or as ground mounting structure. Ground mounting structures are proposed at five heritage sites including at Taxila Museum, Rohtas Fort, Hiran Minar, Jahangir's Tomb and Shalamar Gardens. Rooftops structures are proposed on relatively newly constructed structures at Wah gardens and Harappa Museum. The contractor will assess the structural stability of proposed rooftops before install the PV System.

The environmental assessment revealed that the project activities will not cause any significant disturbance and inconvenience to local community and natural environment of the area. Construction related impacts such as air pollution, noise etc. will be mitigated by the implementation of the EMMP. All the solid waste and wastewater generated from the project activities would be disposed of according to the waste disposal plan, which is a component of the EMMP. The chances of land contamination from effluents, accidental spills and leaks should be avoided and Material Safety Data Sheets (MSDS) will be placed at fuel storage area.

The proposed sub-project will have significant positive environmental impact by reducing GHGs emission due to switching to green source of energy i.e. from fossil based fuel energy to solar energy. This will also help to maintain continuous supply of energy to heritage tourist sites and subsequently improve micro economy of the area by attracting more tourist.

## 1. Introduction

The Government of Pakistan (GOP) development agenda (Vision 2025) stresses the objectives of boosting economic growth, job creation and regional cooperation in addition to bolstering the country's image abroad. Tourism is highlighted as one of the sectors of the economy that could help stimulate economic growth.

The Planning & Development Department, Government of Punjab (GOPb) with the financial assistance of the World Bank (WB) has launched the Punjab Tourism for Economic Growth Project (PTEGP) to increase the contribution of the tourism and related sectors to the local economic development of the province. The total funding of the Project is 55 Million USD with a World Bank contribution of USD 50 million over the five-year time frame.

### 1.1 Project Details

The project objectives are to strengthen institutional capacity, increase private sector participation and improve infrastructure services for the tourism sector growth in the Province of Punjab. The Project consists of four major components:

- Component 1: Policy, Institutions and Governance for Tourism Development
- Component 2: Private Investment and Entrepreneurship Promotion
- Component 3: Public Investment Facility
- Component 4: Project Management, Monitoring and Evaluation

The project is being implemented by a dedicated Project Management Unit (PMU) PTEGP since October 2017. The project is financing some low-scale physical interventions to provide improved access, better road conditions and public convenience facilities in selected tourists destinations located throughout the Punjab Province.

### 1.2 Project Environmental & Social Management Framework

The detail of sub-projects to be executed under the PTEGP was not available during the project initiation, so an Environmental and Social Management Framework (ESMF) was prepared for PTEGP in December 2016 according to WB Operational Policy (OP) 4.01.

The project ESMF has been approved by the WB and is available on the WB and PTEGP website for public disclosure. The overall project has been assigned Category B, due to the limited environmental and social impacts mainly during the construction phase.

The ESMF concluded that:

- Environmental and Social Screening (E&SS) shall be carried for each sub-project intervention/s in order out to determine the appropriate Environmental and Social category as per WB Operational Policies.
- Category-A sub-project will not be financed under this project. If Category-A sub-project is identified, sub-project will be either dropped or replaced with a Category B or C sub-project.
- Environmental and Social Management Plans (ESMPs) will be prepared for category 'B' sub- projects and clearance from WB will be a prerequisite before initiating the sub-project. The guidelines for the preparation of ESMPs are attached as Annex-8 of project ESMF.
- Sub-projects categorized as Category C, no further activity beyond screening would be required.
- The ESMF also assesses the Physical Cultural Resources (PCR) requirements and guides the preparation of PCR Management Plans, where required.
- PMU PTEGP will obtain necessary NOCs from the relevant departments before

commencing works of any sub-project.

### 1.3 Introduction of the Sub-Project

It is proposed to install solar panels within the premises of seven heritage sites under PTEG Project including:

- Jahangir's Tomb, Lahore
- Shalamar Gardens, Lahore
- Hiran Minar, Sheikhupura
- Rohtas Fort, Jhelum
- Taxila Museum, Taxila Rawalpindi
- Harrapa Museum and site, Harappa
- Wah Garden, Wah Rawalpindi

The main objective of this proposal is to offsetting the burden of energy on national grid and reducing emission of GHGs by using green source of energy. Figure 1 shows the location of above seven Heritage sites.



Figure 1: Approximate Locations of Selected Heritage Sites for PV System Installation Work

Through a competitive selection process, Pak Indenting and Trading Company Pvt. Ltd (PITCO) was selected as the consultancy firm for the project with core focus on developing PMU-PTEG's feasibility study (load assessment, proposing energy conservation measures (ECM's) and PV system design) in order to lower energy consumption, operating costs and promote efficient energy usage in Punjab.



## 1.4 Environmental & Social Screening

Environmental & Social Screening (E&SS) for PV Installation works at seven selected heritage sites were completed between June 2022 and September 2022. All sites are in the possession of Archeological Department Govt. of Punjab and therefore no land acquisition or resettlement impact envisaged for this sub-project. Environmental and social checklists completed for each site during screening process are attached as an Annexure B.

As per findings of the site visit, discussion held with stakeholder and public (tourists, sub-contractor etc.) following World Bank operational policies are triggered:

OP 4.01 Environmental Assessment and

OP 4.11 Physical Cultural Resources

No permanent or significant adverse environmental or social impact anticipated pertain to this sub-project. Envisaged adverse environmental impacts are related to the construction activities and they are localize and temporary nature. No land acquisition or resettlement require for this sub-project.

## 1.5 Purpose of this Document

The proposed sub-project “PV System Installation at Seven Heritage Sites” triggered two World Bank Policies i.e. OP4.01 and OP4.11. The sub-project categorized as category B project according to World Bank Safeguard Policies and therefore, further evaluation of E&S impact assessment are required after completion of E&SS.

This consolidated Environmental Management and Monitoring Plan (EMMP) prepared for above sub-project in order to comply with World Bank’s operational policies.

The EMMP provides a mechanism to address the anticipated adverse environmental impacts of the sub-project during construction and operational phase of the project. Objectives of the EMMP are:

- Define responsibilities of different parties of the project (proponent, contractor and supervision consultant);
- Identify project’s adverse impacts, derive their control measures and facilitate the implementation of control measures;
- Provide a procedure for timely actions in case of the emergency situation; and
- Identify training requirements for project execution team.

## 1.6 Study Methodology

A baseline study involves data collection and analysis in order to identify basic conditions before or at the beginning of proposed PV System installation work. Information for the baseline assessment is obtained from a wide variety of sources and should roughly focus on the following categories:

1. Use of structure questionnaires/checklists
2. Focus Group Discussion with local community and visitors
3. Meetings with concerned officials
4. Personal observation and technical assessment of the site
5. Secondary Data Collections

The baseline data was analyzed to identify potential environmental impacts of the project. A risk based methodology was adopted to identify high risk activities and suggest their mitigation

measures. Where possible, eliminating the risk by changing site location within the available space, altering the scope or method of solar panels installation were preferred rather than minimizing the risk with control measures.

## **2. Applicable Regulatory and Legal Framework**

Based on findings of the sub-project screening, following national/ provincial legislation, regulations, EPA guidelines, World Bank Operational Policies and guidelines which are relevant and applicable to the sub-project.

### **2.1 National and Provincial Legislative Framework**

#### **National Environmental Policy 2005**

It aims to protect, conserve, and restore the environment in order to improve quality of the life of citizens through sustainable development and resource conservation.

#### **Punjab Environmental Protection Act, 1997 (Amended 2012)**

The Punjab Environmental Protection Act, 1997 (Amended, 2012) is comprehensive legislation and provides the legislative framework for protection, conservation, rehabilitation and improvement of the environment.

#### **Punjab Environmental Quality Standards (PEQS), 2016**

The PEQS, 2016 specify the

- Maximum allowable concentration of pollutants in municipal and liquid industrial effluents discharged into inland waters, sewage treatment facilities, and the sea.
- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources.
- Maximum allowable concentration of pollutants (two parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles.
- In addition, PEQS has also been issued for drinking water, ambient air, motor vehicle exhaust and noise, municipal and liquid industrial effluents, noise and treatment of liquid and disposal of biomedical waste.

#### **Pakistan Penal Code, 1860**

This Act defines the penalties for violations concerning pollution of air, water bodies and land.

#### **Motor Vehicle Rules 1969**

It defines powers and responsibilities of Motor Vehicle Examiners (MVEs). The establishment of MVE inspection system is one of the regulatory measures that can be taken to tackle the ambient air quality problems associated with the vehicular emissions during operation phase.

#### **Pakistan Labour Policy, 2010**

Pakistan's Labour Policy aims at attaining its objectives in a manner best suited to the resources of the country and the present state of economy. Equitable adjustment of rights between workers and employers should be ensured in an atmosphere of harmony, mutually beneficial to workers and the management. It prohibits the use of Child Labour.

**The Bonded Labour System (Abolition) ACT 1992**

According to this act, forced labour is any type of work or kind of service in which someone engages involuntarily and under implied coercion a manifest threat of a party or oppression measures. The bonded labor can exist in following forms under different situations:

- Bonded labor in exchange of advance/an amount of money given before services are rendered, received by a person or his family.
- Bonded labor as a consequence of some social or customary obligations.
- Bonded labor in exchange of an economic benefit/consideration received by a person or his family,
- Bonded labor of a guarantor in exchange for debtor who was unable to pay off his debt.
- Bonded labor is prevalent in agriculture sector, brick kilns, domestic work and begging.

**The Land Acquisition Act, 1894**

It is the key legislation that has direct relevance to resettlement and compensation in Pakistan.

**Provincial Wildlife Act, 1974**

This law helps in eliminating any trespassing into wildlife habitat area. Under this law, all site workers will be prohibited to disturb any wildlife habitat area.

**Pakistan Antiquities Act 1975 and Punjab Antiquities Amendment Act 2012**

The act relates to the protection, preservation and conservation of archaeological/historical sites and monuments. It requires that all accidental discoveries need to be reported to the federal Department of Archaeology.

**The Forest Act, 1927 (and Provincial Acts and Rules)**

The Act, inter alia, deals with the matters related with protection and conservation of natural vegetation/habitats. Trees located within the heritage sites belongs to the Archeological Department. NOC will be required from the Archeological Department if any tree need to be uprooted.

**Employment of Child Act, 1991 and Punjab Restriction of Employment of Children Ordinance, 2016**

Article 11(3) of the constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mine, or any other hazardous employment. In accordance with this article, the ECA 1991 disallows such child labor in the country.

**2.2 International Laws/Treaties****UNESCO World Heritage Convention**

Pakistan is a State Party to the World Heritage Convention. State Parties agree to identify and nominate properties on their national territory to be considered for inscription on the World Heritage List. When a State Party nominates a property, it gives details of how a property is protected and provides a management plan for its upkeep. They are also expected to protect the World Heritage values of the properties inscribed and are encouraged to report periodically on their condition.

**World Bank Operational Policy 4.01 (Environment Assessment)**

The major objective of this policy is to address all activities which may potentially cause negative environmental and social impacts and to suggest safeguard instruments accordingly. Under this policy, projects are categorized as "A, B, C" depending upon their impacts, severity, nature and frequency.

**Category “A”:** Significant or irreversible impacts

**Category “B”:** Reversible or moderate impacts that can be mitigated

**Category “C”:** Minimal impacts

Under PTEG Project, World Bank will not finance any Category A sub-project. If the sub-project classified as category A project than the project will be either dropped or replaced with a Category B or C sub-project.

Environmental and Social Management Plan (ESMP) will be prepared for Category B project and for Category C sub-project no further study E&S study require beyond E&S Screening process.

Identified adverse environmental impacts pertain to the proposed PV System Installation works are mild to moderate because the nature of envisaged impacts are temporary, localized, reversible and mitigable. The sub-project is classified as No land acquisition or resettlement require for the sub-project. Therefore an Environmental Management and Monitoring Plan (EMMP) will fulfill the World Bank’s requirement of E&S studies.

### **World Bank Operational Policy 4.11 (Physical Cultural Resources)**

World Bank assist countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it financed.

### **World Bank Environmental and Social Framework Environmental and Social Standard 8: Cultural Heritage**

The World Bank Environmental and Social Framework sets out the World Bank’s commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards. The standards with their annexes, sets out the mandatory requirements that apply to the World Bank’s borrower and projects.

Environmental and Social Standard 8 sets out measures designed to protect cultural heritage throughout the project life cycle. Objectives of this standard are:

- To protect cultural heritage from the adverse impacts of project activities and support its preservation
- To address cultural heritage as an integral aspect of sustainable development.
- To promote meaning full consultation with stakeholder regarding cultural heritage.
- To promote the equitable sharing of benefits from the use of cultural heritage.

## **3. Sub-project Description**

### **3.1 Project Background**

Punjab Tourism for Economic Growth Project (PTEGP) is launched by Govt. of Punjab, Pakistan in 2017. The tentative duration of the project is five years. The main objective of the project is to increase the contribution of the tourism and related sectors to the local economic development of the province. Details of sub-projects to be executed under the PTEGP was not available during the project initiation. Number of sub-projects are being developed to achieve the objective of PTEG project as the progress made in PTEGP.

This sub-project “PV System Installation at Seven Heritage Sites” is proposed mainly to offsetting the burden of energy on national grid and reducing emission of GHGs by using green source of energy. It will also help to avoid break in energy supply due to load shearing at heritage sites.

### **3.2 Scope of Work**

Through a competitive selection process, Pak Indenting and Trading Company (PITCO) was selected as the consultancy firm for the project with core focus on developing feasibilities

studies for all seven heritage sites. The feasibility studies include energy load assessment, proposing energy conservation measures (ECMs) and PV system design in order to lower energy consumption, operating cost and promote efficient energy usage in Punjab.

Following aspects were considered in finalizing the site for solar panels installation within the premises of heritage sites:

- Accessibility to the selected location
- Minimum intrusion by the visitors/general public
- Security Arrangements
- Energy Load Assessment
- Cost Effective Analysis
- Flood Prone Area
- Compatibility with the protected
- Visibility and aesthetic value
- Distance from residential area
- Minimum site clearance (vegetation, tree cutting)
- Water Leakage issues if rooftop are used for installation
- Tree falling during strong wind storm
- Competitive analysis for wind speed and its direction for all proposed locations
- Temperature and rainfall pattern for the proposed location

Solar panels usually installed either on rooftop or ground mounting, typical examples of rooftop and ground mounting structures are shown in below pictorial views.



Figure 2. Typical Rooftop Solar Panels Structures



Figure 3. Typical Ground Mounting Solar Panels Structures

Table 1 presents type of structure proposed at each heritage site by PITCO:

Table 1: Proposed Type of Structure for Solar Panels Installation Work

Heritage Site	Type of Solar Panels Structure
Taxila Museum	Ground Mounting
Wah Gardens	Rooftop Structure
Rohtas Fort	Ground Mounting
Hiran Minar	Ground Mounting
Jahanger's Tomb	Ground Mounting
Shalamar Gardens	Ground Mounting
Harappa Museum	Rooftop Structure

Location maps for solar panels installation within the premises of Heritage sites are attached as an Annexure C.

#### 4. Stakeholder and Public Consultation

Timely and broad based stakeholder involvement is an essential element for an effective environmental assessment, as it linked with project planning, appraisal and development in general. Public involvement during environmental and social assessment has a tendency to improve project design environmental soundness and social acceptability.

In this project, the work area is located within the premises of heritage sites controlled by Archeological Department, Govt. of Punjab. PTEGP has conducted multiple consultations with Archeology Directorate and site staff of Archeological Department. Recommended sites for solar panels installation were selected with the consensus of Archeological Department.

Community stakeholder including canteen owners, parking contractor, tourist were also consulted and their opinions are counted in designing this sub-project. The project activities were briefed to them. All consulted people appreciate the proposed Solar System Installation work and showed their willingness to co-operate in the project execution. Few concerns were raised by them which were eliminated by ensuring them that:

- Work activities including material storage, plant & equipment area etc. will be kept within the allocated area only, away from their premises (canteen area, parking area, houses etc.);
- Access to their shop, restaurant, parking area etc. will be maintained as usual.
- Dust and noise pollution will be controlled through implementation of EMMP during construction phase of the project.

**Pictorial Views of Stakeholder & Public Consultations**



Consultation with Staff of Archeology Directorate, Harappa Museum



Consultation with Staff of Archeology Directorate, Hiran Minar



Consultation with Canteen Owner Hiran Minar



Public Consultation at hiran Minar



Consultation with Staff of Archeology Directorate, Jahangir's Tomb



Consultation with Local Office of Archeological Department at Rohtas Fort

Consultation at Wah Gardens



Consultation with Archeology Directorate, Regarding Taxila Museum and Wah Gardens

## 5. Mitigation Measures and Implementation Plan

This section outlines the potential environmental impacts and their associated mitigation measures of the proposed sub-project. It also assigns the responsibilities for implementation, supervision and frequency of suggested mitigation measures.



**Table 2: Environmental Management and Monitoring Plan**

Sr. No.	Impacts	Mitigation Measures	Responsibility		Parameters for Monitoring	Frequency
			Executor	Monitor		
1	Soil erosion; Loss of fertile soil and obstruction in natural drainage	1.1 Avoid unnecessary land clearance/excavation. Contractor will get approval of land clearance and excavation (area and depth) from the supervision consultant before commence work on site.	Contractor	Supervision Consultant PTEGP	Clear marking of land on site which need to be cleared or excavated. Documentation record of approval from supervision consultant.	Once before start of clearing land or excavation
		1.2 Maintain photographic record of the area being used by the contractor before and after the work completion.	Contractor	Supervision Consultant PTEGP	Photographs records	At the start of the work then after restoration.
		1.3 Contractor will ensure that the surface drainage is provided to control the surface run off	Contractor	Supervision Consultant PTEGP	Compliances with Specification	Check once a week on typical working day
		1.4 Ensure that the movement of earth moving machinery is limited to the work area	Contractor	Supervision Consultant PTEGP	Compliance Site inspections	Daily
		1.5 Contractor will ensure that erosion protection measures are taken, such as retaining wall (if required), avoidance of steep cut etc.	Contractor	Supervision Consultant PTEGP	Visible signs of any soil erosion	Weekly and Once after rain
		1.6 Contractor will maintain the complete documentation for the excavated areas i.e. volume excavated, date of excavation, leveling date after completion of excavation	Contractor	Supervision Consultant PTEGP	Records	At the start of the excavation; During excavation.
2	Soil and water contamination; obstruction in natural drainage; obstruction of community paths; and aesthetic problem	2.1 Hazardous material e.g. fuel, chemicals etc. should be avoided to keep on site by arranging periodic deliveries. If the hazardous material need to be kept on site than it should be stored in the bunded area with additional suitable catchment container in case of leakage or accidental spill of the	Contractor	Supervision Consultant PTEGP	Record	At the start of work

Sr. No.	Impacts	Mitigation Measures	Responsibility		Parameters for Monitoring	Frequency
			Executor	Monitor		
		material.				
		2.2 Waste produces from the project activities should be collected in the suitable waste bins and arrange collection of waste from the site with local authority on regular basis.	Contractor	Supervision Consultant PTEGP	Photographs record	Once before start When required
		2.3 Contractor will ensure that all trucks used for the transportation of waste or construction material are covered and waste/material should not escape to the environment during transportation.	Contractor	Supervision Consultant  PTEGP	System in Place	Once at the start of work When required
		2.4 Supervision Consultant will ensure that the Contractor's fulfill contractor's obligations regarding disposal of construction waste material including broken panels, fitting or packing material etc.	Supervision Consultant	PTEGP	Compliance	Daily
		2.5 Hazardous material (fuel, cement, cleaning chemicals etc.) should be kept away from the water body (water pond, drain, groundwater source etc.)	Contractor	Supervision Consultant PTEGP	Site Set up Plan	Daily When required
		2.6 Contractor will ensure that surface drainage is not blocked due to the piling of the raw material	Contractor	Supervision Consultant PTEGP	Site Inspection Record	Daily Once a month after each rain
		2.7 Contractor will maintain leak / spill record for each incident of spill or damaged vehicles. Damaged / defective vehicles will not be operated unless repaired	Contractor	Supervision Consultant PTEGP	Maintain Site Incident Record	Daily When required
		2.8 Contractor will ensure that the material is stock piled at the designated area only.	Contractor	Supervision Consultant PTEGP	Compliance with agreed site setup plan; photographs	At the time of establishment of batching plant. Randomly

Sr. No.	Impacts	Mitigation Measures	Responsibility		Parameters for Monitoring	Frequency
			Executor	Monitor		
		2.9 Ensure work activities do not block public path or access to the local facilities e.g. shop, washroom, entrance/exit etc.	Contractor	Supervision Consultant PTEGP	Site Inspection, Compliance with Site set up plan agreed with client and consultant	Daily
3	loss of natural vegetation; safety hazard for communities; damage to public infrastructure; Dust Emission	3.1. The Contractor will prepare and implement Traffic Management Plan and gets its approval from The Engineer for implementation at site	Contractor	Supervision Consultant PTEGP	Compliance with agreed site setup plan, Site inspections	Daily Once a month
		3.2 All the local roads under the use of the contractor will be restored immediately in case of any damage occur due to the project traffic.	Contractor	Supervision Consultant PTEGP	Site inspection; Public Consultation; photographs	At completion of works and after demobilised of the contractor.
		3.3 All sections of the road/paths including access tracks that are prone to dust emission should be damped with water sprinkling during construction phase of the project.	Contractor	Supervision Consultant PTEGP	Public Consultation; visual inspection;	Once at the start of work On monthly basis
		3.3 Ensure adherence to the speed limit of 20 km/hr, otherwise specified by the project management, inside the heritage site.	Contractor	Supervision Consultant PTEGP	Compliance evidence of training provided to drivers.	When required
		3.4 Ensure that vegetation clearing will be minimized and no tree will be uprooted without prior consent of the Supervision Consultant.	Contractor	Supervision Consultant PTEGP	Site record; Site Inspection	Once a week or When required basis
		3.5 Contractor will ensure that the disposal of cleared vegetation is not in a manner that may affect the blockage of natural drainage or public paths	Contractor	Supervision Consultant PTEGP	Site Inspections Implementation of Waste Disposal Plan	Daily Once a month
4	air contamination; noise emissions; damage to natural vegetation, habitat	4.1 Vehicle and plant maintenance work should not be conducted inside the heritage sites except light maintenance i.e. changing wheel etc. can be carried out at work site with the permission of	Contractor	Supervision Consultant PTEGP	Compliance System in place	Daily As and When required

Sr. No.	Impacts	Mitigation Measures	Responsibility		Parameters for Monitoring	Frequency
			Executor	Monitor		
	and wildlife	the supervision consultant. Vehicle washing should be avoided at site.				
		4.2 Material Safety Data Sheets (MSDS) or Control of Substances Hazardous to Health (COSHH) sheets should be available at site.	Contractor	Supervision Consultant PTEGP	System in place	Once every 15-days Once a month
		4.3 Ensure that all equipment, generators and vehicles used during the construction are properly tuned and maintained in good working condition in order to minimize the emissions.	Contractor	Supervision Consultant PTEGP	Compliance	Daily When required
		4.4 Ear plugs and other protective devices will be provided to the workers working at noise prone area by the Contractor.	Contractor	Supervision Consultant PTEGP	PPE Issue record Site Inspections	Daily When required
		4.5 Carry out noise monitoring at 5m distance from machine or work activities which is producing noise pollution.	Contractor	Supervision Consultant PTEGP	Environmental monitoring record	Once a day for every noise producing activity
		4.6 Use appropriate machinery in good working condition in order to keeping noise levels within NEQS.	Contractor	Supervision Consultant PTEGP	Compliance	When required
		4.7 Contractor will ensure that safe driving practices are adopted on site so that the accidental killing of reptiles or small animals crossing the roads could be avoided.	Contractor	Supervision Consultant PTEGP	Compliance with site rules	When required Once a month
5	Tree cutting and wildlife habitat disturbance. The natural habitat is vulnerable to noise and dust generated	5.1 When aligning the access tracks ensure that the chosen route requires minimum vegetation loss and no tree cutting. If tree cutting require, than every tree cut on site for the execution of work will be replaced with the plantation of a	Contractor	Supervision Consultant PTEGP	Compliance	BC Once at the time of aligning of access road

Sr. No.	Impacts	Mitigation Measures	Responsibility		Parameters for Monitoring	Frequency
			Executor	Monitor		
	from the movement of site traffic and work activities	minimum of ten new trees in the project vicinity.				
		5.2 Ensure that no fire arms are carried out by any of the employees or labour, except designated security staff if required	Contractor	Supervision Consultant PTEGP	Compliance Site inspection	DC Daily When required
		5.3 Ensure that no-hunting, trapping and/ or harassing wildlife takes place at site. The wildlife protection laws should be strictly implemented	Contractor	Supervision Consultant PTEGP	Compliance with wildlife protection rules & regulation	BC/DC Daily  When required
		5.4 Ensure that the general awareness of the crew is enhanced regarding the wildlife, through environmental training and notice boards	Contractor	Supervision Consultant PTEGP	Compliance with Environmental and Wildlife Protection laws	DC Daily  When required
		5.5 Ensure wood and shrubs are not used as fuel during construction phase	Contractor	Supervision Consultant PTEGP	Compliance with site rules	DC Daily Once a month
<b>6</b>	Public grievances related to environmental and social aspects e.g. unavailability of drinking water, loss of public property, loss of agricultural land or of livelihood.	Maintain a complaint register on site.  Conduct meaningful public consultation during all stages of the project execution.  Identify and appropriately respond to impacts on directly affected persons to ensure legal compliance and meet moral/ethical obligation.	Contractor	Supervision Consultant  PTEGP	Inspect Register Compliant  Public Consultation Record	Weekly during construction

Sr. No.	Impacts	Mitigation Measures	Responsibility		Parameters for Monitoring	Frequency
			Executor	Monitor		
7	Archeological or religious remains (such as graves etc.) may find during the construction activities of the project, particularly during preparation of ground and earthwork activities	All earthwork activities must be supervised by a competent person on site.  In case of findings of archeological or religious site during execution of work on site, the work should be stop and immediately inform archeological department and PMU.	Contractor	Supervision Consultant  PTEGP	Site Inspection record	When required basis during construction phase
		Prepare Chance Find Procedure and explain to the site workers by delivering toolbox talk on this topic	Contractor	Supervision Consultant  PTEGP	Site training record	Before start work on site

## 6. Standard Operating Procedure

PV System will be installed at seven heritage sites located in Punjab Province of Pakistan. A Standard Operating Procedures are developed for executing the proposed solar panels installation work within the premises of heritage sites. All parties of the project i.e. Contractor, Consultant, Client or any other sub-contractor (delivery contractor, individual service provider etc.) must adhere these standards.

- The Contractor shall be bound to:-
  - a) Ensure that no damage or adverse effect is caused to archaeological sites, graveyards and burial places. No work activities shall be conducted within 20m of the historical structures (monuments) without prior approval of supervision consultant and additional control measures (fencing the area, limiting work which could producing vibration etc.).
  - b) Historical buildings must not be used for any project activities e.g. using as rest area, keeping material inside the structure etc.
  - c) All work activities must be performed during day light including material delivery etc. in order to avoid any accidental damage of the historical sites.
  - d) Ensure that no damage or disruption is caused to the social infrastructure or public services e.g. restaurants, offices of Archeological Department, education, health, electricity supply, drinking water supply, and facilities for public gathering or religious congregations.
  - e) Ensure that existing ownership of land around the Project site is respected.
- The consultant's environmental team will maintain a social complaint register at site office to document all complaints received from the local communities. The register will also record the measures taken to mitigate these concerns.
- The Contractor shall be contractually bound to not to allow or cause discharge spill or dumping on any building, house, graveyard, archaeological site (established or newly found), unstable slopes, un-compacted embankment or leakage of material/waste into the construction area. Any such failure shall be duly noted by Supervision Consultant during site inspections and contractor shall immediately remedy the situation.
- The Contractor shall ensure that his construction machinery is always in first class working order and no spilling of Diesel or any other fluids into the surrounding environment, is caused by the defective machinery of the Contractor.
- The Contractor shall not cause deterioration of air quality by using old or ill maintained machinery which raise excessive dust, produce excessive smoke or cause excessive noise pollution. The Contractor shall follow strict standards of maintenance of machinery, provide qualified and trained drivers and operations for the vehicles. The Contractor shall also sprinkle water on earthen (kacha) roads to be used as link roads, and sites where the earth is to be dumped. The Contractor shall provide protective masks to his work force.
- The Contract shall ensure that:-
  - a) Unnecessary and out of bound activities/movements are not done outside the area allotted to the contractor for setting-up his facilities, material depots and machinery yard etc.

- b) No fire arms are carried by any of the employees or labour, except security staff.
  - c) All Environment, Labour, Forest, Wildlife and Fisheries Laws are fully respected and abided by the Contractor and his work force.
  - d) The Biodiversity is respected and saved on its terrestrial, aquatic and aerial habitats.
  - e) Necessary sign boards indicating boundaries of the work area are displayed to make labour, visitors and members of public to remind them of their obligations towards Biota.
  - f) Inspections by Labour, Wildlife, Forest and Fisheries Officers are facilitated in camps to facilitate a proper implementation of relevant Laws.
  - g) Specified speed limits must be followed by project traffic.
  - h) The Contractor shall carry out a walk over survey before clearing the land from natural vegetation and relocate any bird nest or wildlife habitat e.g. rabbit hole find in the area etc.
  - i) The Contractor shall get prior approval from supervision consultant for any tree cutting or uprooting require for the project.
- The Contractor shall:-
    - a) Put up temporary but prominent sign boards in all of the project activity area warning people against likely hazards which can be caused due to certain activities.
    - b) Ensure proper housekeeping and cleanliness conditions are maintained at work area by ensuring proper drainage and suitable disposal of solid waste.
    - c) Provide PPE specified in the risk assessment or health and safety plan e.g. helmet, field boots, earplugs and others gears at work site as a precaution against any mishap, and interlink various parts of the construction complex with local wireless telephones, which may also be fitted in the vehicles.

## 7. Waste Management

### 7.1 Solid Waste Management

This component describes the waste disposal plan that will be employed during the construction phase of this sub-project. The main types of waste to be disposed of include:

- Domestic Waste;
- Waste generated during construction;
- Fuel, oils, and chemicals;
- Packing waste;
- Excess construction material; and
- Special Waste (damaged/broken panels, damaged batteries etc.);

Domestic waste and construction waste will be the main type of waste generated from work area and construction activities. Domestic waste contains high percentage of readily degradable hydrocarbon which gives bad smell on decomposition, especially in hot and humid environment. Construction waste classified as inert waste which could be problematic to dispose of. It is recommended to collect the domestic waste and construction waste separately. The Contractor will adopt 3 Rs (reduce, reuse and recycle) approach for proper disposal of solid waste.



### **Domestic Waste**

- All the waste generated at contractor's site office should be collected and bagged. Domestic waste collection should be arranged with the local authority for disposal.
- Burning of waste at site is strictly prohibited.
- Biodegradable bags should be provided at site for waste collection and disposal.
- Separate bins should be provided at site for collection recyclable waste (paper, glass, cans, plastic bottles etc.) and green waste (compostable, kitchen or garden waste).

### **Construction Waste**

- Excavated spoil can be used as fill material provided it meets require engineering criteria. But if it needs to be disposed at site then ensure it does not affect natural drainage of the area and cause water ponding, flooding etc.
- Extra material (aggregate, brick, cement etc.) should be sent back to the supplier at the completion of the work.
- No waste should be buried at site.
- Recycle packing waste, if it comprises on cardboard or other recyclable material.

### **Special Waste**

- Broken/Damaged solar panels, damaged batteries pieces of steel or wires can be classified as special waste.
- Special waste should be handled as hazardous waste and collect in suitable container/bags and send of site to authorized disposal site.
- All site workers handling special waste should use appropriate PPE according to the risk assessment or health & safety plan of the project.
- Special waste should be carried in the approved carrier of particular waste by local authority.

## **7.2 Liquid Waste Management**

Wastewater generate from the project sites during construction and operation phase of the project can be disposed of by connecting the wastewater pipe line to the existing sewerage system with the approval of concern authority. Wastewater testing should be conducted as per the requirement of the local authorities.

Liquid material, fuel etc. should be kept in the designated bunded (impermeable with raised boundaries) area only. The bunded area should be designed, construct and maintain by the competent person.

Spill Kit (sand bags, absorbing pads, shovels and plastic bags/container for carrying contaminated soil or liquid) should be provided at the storage area, in case of accidental spills or leakage.

Loading and unloading of the material at site should be managed by a trained banksman.

## 8. Training Plan

The environmental and social training will help to ensure that the requirement of the EMMP are clearly understood and followed by all project personnel. The primary responsibility of providing these training to all project personnel will be that of the contractor and Supervision Consultants. The training will be given to the site workers, working at different level (manager, supervisor, labour etc.) and stages of the project i.e. construction and operation stage. Tentative training plan of 3 sessions which will be finalized before the commencement of the project by the supervision consultant is given below:

**Table 3. Proposed Training Plan**

Trainee	Trainer	Contents	Schedule
All Site Workers	Contractor's Site/Project Manager	Site Inductions – All site workers should be inducted for the site. The sensitive area i.e. historical buildings, gardens etc. should be explained to the trainee and inform them that no entry to the sensitive area is allowed without permission from client or PTEGP. Site rules e.g. speed limit, break timing and area, waste handling practice etc. should be explained to the site workers. Records should be kept for all the site workers inducted for the project and issue them a verification card/certificate. Only inducted person(s) should allow to work on site.	Before construction activities
<ul style="list-style-type: none"> <li>• Contractor's: Managerial or supervising staff</li> <li>• Consultants: Managerial staff and Engineers</li> </ul>	Environment Specialist PTEGP	Environmental and social aspects of the area, key finding of the EA; Mitigation measures; key elements of EMMP and its implementation on site. Using Fire Extinguisher correctly (type of fire extinguisher for different types of fire, how to inspect and use it).	Before construction Phase
Specialised Contractor of PV System	Contractor's staff implementing O&M Plan	Implementing O&M plan, managing environmental aspect of the work e.g. handling wastewater	During construction stage

Trainee	Trainer	Contents	Schedule
		generated from cleaning, waste collection and disposal, access to the solar panels location etc.	

## 9. Emergency Plan

The probabilities of accident such as oil spills, accidental habitat destruction, water or air pollution or finding unexpected ground is low because of nature and extend of work. However, such accidents may occur and overall environmental emergency response method may be used:

- Obtain an early warning of the emergency conditions so as to avoid adverse impacts on the environment
- Safeguard personnel to prevent injuries or loss of life. First aider should be provided full time at site during construction phase of the project. First Aider should maintain First Aid Box on site.
- Minimize the impact of such event on the environment by mitigating the potential for escalation and containing of the hazards
- Site manager should have permanent mode of contact (e.g. mobile phone or walkie talkie) with project team member.
- Chance Find Procedure should be prepared and briefed to the site workers, In case of findings of archeological or religious site during execution of work. Chance Find Procedure is provided as Annexure D.

## 10. Conclusion

As there are no significant adverse environmental or social issues involved during construction and operational phase of the sub-project. Anticipated adverse environmental impacts are construction work related e.g. noise, dust vibration etc. and they are localized, temporary and mitigable.

On the other hand, the project will help offloading burden on national grid and reduce emission of GHGs due to switching from fossil based source energy to solar source of energy. Continuous energy supply to the heritage sites will be achieved with proposed PV System. This will attract more tourist and subsequently improve the local economy and help poverty alleviation.

## ANNEXURE A: NOC from Archeological Department



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Secretary Tourism  
Dy. No. 1526  
Dated: 24/9/21  
• ADDL. SECRETARY  
• DY. SECRETARY (ADMIN)  
• DY. SECRETARY (PI)

No. DGA- I (225)/Arch/2021/1369  
DIRECTORATE GENERAL OF ARCHAEOLOGY  
GOVERNMENT OF THE PUNJAB  
TOURISM DEPARTMENT  
OLD FORT LAHORE

AS/DS(P)

Dated the 13th September, 2021

To,

The Secretary,  
Tourism Department,  
Government of the Punjab,  
Lahore.

Dr. No. 202  
Date: 14/09/2021  
R&I Tourism Department

**Subject: - PROVISION AND IMPROVEMENT OF TOILETS, CAFÉ, SOLAR PANELS, TOURIST INFORMATION CENTERS AND ROHTAS MUSEUM GALLERY**

Kindly refer to meeting held under the Chairmanship of Secretary Tourism Department in the Committee Room of Tourism Department dated 10.03.2021 on the subject cited above.

It is submitted that during the meeting the Chair directed as follows:

- i. PTEGP will provide new toilets (international standard) and make improvement in the existing ones. The design of toilets will be in harmony with specific heritage site.
- ii. The Director General of Archaeology will provide locations for new toilets (international standards) at Shalamar Garden, Jahangir's Tomb, Harappa Museum, Hiran Minar, Rohtas Fort, Taxila Museum and Wah Garden.
- iii. The PTEGP will also make a plan for the improvement of Rohtas Fort museum gallery in consultation with Archaeology department which includes improvement of the museum gallery building, display of objects and lighting system etc.
- iv. The PTEGP will also design and provide tourist information centers (TICs) at key heritage sites for which Directorate General of Archaeology will specify location and provide requisite area for the purpose.

- v. The Directorate General of Archaeology will also nominate focal person for identifying locations for Washrooms, Cafe, Solar Panel and TIC to facilitate the PTEGP for an early execution.

In pursuance of the directions of the Chair, the Directorate General of Archaeology has no objection for provision of above tourist facilities at above mentioned sites and the detail of various activities alongwith location coordinates are submitted herewith for kind perusal, please.

*AMR 13/10/21*  
DIRECTOR GENERAL ARCHAEOLOGY

The detail of various activities alongwith location with coordinates are as under:

Name of the Activity	Shalamar Gardens	Jahangir's Tomb	Hiran Minar	Rohtas Fort	Harappa Museum	Taxila Museum	Wah Garden
	1	2	3	4	5	6	7
Provision for New Toilet Blocks	31.58524 74.38472	31.62138 74.30119	31.44103 73.95742	32.96403 73.57461	30.628894 72.86908	--	33.80072 72.83182
Improvement of Existing Washroom	31.58524 74.38472	--	--	32.96403 73.57461	30.628894 72.86908	33.74595 72.81838	--
Solar Panels	31.58410 74.38072	31.62181 74.29823	31.73994 73.95665 & 31.741065 73.95369	32.9636 73.5744	30.62529 72.86117	33.74801 72.81821	33.800561 72.69856
Cafeteria	31.58623 74.38362	31.62100 74.30103	Improvement of existing	32.96378 73.57321	30.62579 72.86610	30.627003 72.86797	33.80701 72.83092
Tourist Information Centre	--	--	--	32.9625 73.5736	30.62511 72.86687	33.74595 72.81844	33.80102 72.69872
Focal Person	Mr. Attiq-ur-Rehman Deputy Director E&M /Mr. Mukhtar Ahmad SDO	Mr. Attiq-ur-Rehman Deputy Director E&M/ Mr. Qazi Ashraf Archaeological Conservator	Mr. Attiq-ur-Rehman Deputy Director E&M/ Mr. Waqas Sub-Engineer	Mr. Imran Zahid, SDO	Muhammad Hassan Deputy Director/ Mr. Ahmad Nawaz, Assistant Curator	Mr. Iqbal Khan, Deputy Director/ Mr. Ali Gohar, Archaeological Conservator	Mr. Iqbal Khan Deputy Director/ Mr. Ali Gohar Archaeological Conservator



## ANNEXURE B: Environment & Social Screening Checklist

### E&S Screening Checklist Completed for Wah Gardens

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
<b>A. Environmental Aspects</b>					
1.	Will the sub-project involve significant land disturbance or site clearance?		✓	Solar panels will be installed on roof of two buildings i.e. 1) Office Block and 2) Garage.  No major area preparation require for PV system installation on roof of selected buildings.	Load bearing capacity of both roofs of selected buildings should be checked by the competent person.  Ensure PV installation works do not adversely affect the buildings capacity or damage any structural component of the building.
2.	Is the subproject located in an area with designated natural reserves?		✓		
3.	Will the subproject cause noise and vibration during construction activities?	✓		Drilling and noise producing activities are anticipated. However, the impacts will be localized and likely to be absorbed in the immediate surrounding environment.	The anticipated impact is not significant and localized.  All plant & equipment should be regularly inspected and maintained.  Ensure enforcement of noise control measures as specified in ECoPs <sup>1</sup> .
4.	Will Firefighting equipment provided at site?	✓		Hot work activity will be performed which may lead to fire hazard.	Firefighting equipment should be provided at the site during installation and operation of solar Panels system.

<sup>1</sup> Environment code of practices

Sr. No.	Issues	Ye s	No	Impacts Description	Mitigation Measures
					<p>Flammable material will be kept well away from the hot work area.</p> <p>Fire drills should be arranged and conducted before commence work on site by the contractor. The drill/workshop should be designed to learn the procedure every site workers need to follow in case of fire.</p> <p>Site works must be trained for type and use of correct fire extinguisher.</p> <p>All workers involve in hot work activities should use specified PPEs according to the health &amp; safety plan.</p>
5.	Which types of electrical wires will be used in Solar Panel installation to avoid any electrical shocks and measures regarding safety purposes?			Details are provided in the feasibility and detail design study reports	<p>XLPO/XLPO DC cables will be used and XLPE AC cables will be used. These are thicker insulation cables rated at higher voltage than PVC cables.</p> <p>All site workers should use the specified PPE according to risk assessment and health &amp; safety plan for the project.</p>
6.	Are there anticipated impacts on building roofs such as structural damage and water leakage into the building?	✓		In case of direct penetration into the	Ballasted system is proposed which is non penetrative type. It is



Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
7.	Is the roof safe, protected and can bear the load of the panels?	✓		<p>roof, water ingress becomes crucial.</p> <p>Structural damage is possible in case the roof is not able to bear the load of solar panels.</p>	<p>recommended that structure stability analysis be included in the scope of the EPC vendor before commencement of construction activities.</p> <p>The decision on load bearing capacity of the roofs can only be taken after the requisite study, however given the year of construction of the buildings, visual analysis and nominal size of the PV system. It is perceived that there will be no such problem.</p>
8.	Is there a risk of soil pollution and soil erosion during construction phase?		✓	<p>No Soil Pollution and Soil erosion are anticipated from the work activities.</p>	<p>Unnecessary vegetation removal or excavating ground will be prohibited.</p> <p>Fuel or chemical storage on site will be avoided through better management and arranging periodic delivery of fuel on site.</p> <p>If fuel storage is required on site then ensure that the fuel or chemical are stored in the designated bunded area only.</p>
9.	Are there arrangements in place for proper handling, storage and transport of hazardous waste?	✓		<p>Improper storage and handling of substances leading to contamination of soil and water</p>	<p>Ensure provision of Material Safety Data Sheet (MSDS) or Control of Substances</p>

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				resources of the area and cause health hazards.	<p>Hazardous to Health (COSHH) sheets at site.</p> <p>Construct concrete or other impermeable flooring of the material storage area to prevent seepage in case of spills of hazardous material.</p> <p>The contractor will be required to follow the ECoP and dispose of the solid waste in a manner not to contaminate soil or water, not to generate foul odor, and not to spread any vector-borne diseases.</p> <p>The contractor will provide require Personal Protected Equipment (PPE) and ensure all the site workers use them accurately during execution of work activities.</p>
10.	Is the existing capacity of staff sufficient to properly handle, store, transport and dispose of hazardous waste associated with solar panels?	✓		Improper and untrained staff involve in handling of hazardous materials can cause any catastrophic incidents.	<p>Staff should be trained and competent to execute the work activities e.g. material handling, storing, transporting and disposal of hazardous waste produced from work activities.</p> <p>Correct use of appropriate Personal Protective Equipment (PPEs)</p> <p>The project will be on a turnkey basis with the EPC contractor responsible for initial</p>

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					O&M period of 2 years. The client can hire a trainee during this period to learn and then supervise O&M activities after 2 years.
11.	Is the activity result in improper disposal of broken/damaged solar panels, batteries, and supporting structure are planned to address?	✓		There is possibility that activity may result in improper disposal as well as damaging solar panels.	Damaged solar panels and batteries should be collected in the suitable container and send it of site with other hazardous waste for disposal according to the waste management plan which will be provided in the EMMP.  SOP will be submitted by the contractor for collection and disposal of the waste before commence work on site.
12.	Are there risks to workers health and safety during maintenance?	✓		Risk of electric shock hazard is identified during maintenance work.	Maintenance work should be conducted by the trained staff  Specified PPE will be worn by site workers.
13.	Will the activity result in clearance of natural vegetation from a large tract of land which can potentially disturb the natural habitat and the associated wildlife species?		✓		

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
14.	Will the work activity involve emissions resulting in air Pollution including dust emissions?	✓		Dust, noise and air pollution from plant and equipment emission are anticipated during construction phase of the project. However, there is likely to be a net decrease in GHG emissions because of power generation from a non-fossil fuel source during operational phase of the project.	Use appropriate machine or equipment to execute the work activities.  Inspect and maintain plant and equipment on regular basis.  Carry out regular sprinkling of water on dust prone areas.  Use appropriate PPEs by all site workers.
15.	Is the sub-project located close to Groundwater sources, surface water bodies, water courses or wetlands?		✓	Percolation of contaminated surface runoff can deteriorate the water quality of groundwater resources of the area.  The proposed site for PV system installation is more than 50m away from the Wah Garden Water Pond.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies and seeping into freshwater bodies.  Monitor groundwater quality of the nearest existing groundwater source (hand pump, tube well etc.) during execution and early stage of operational phase of the project.
16.	Is the sub-project located in an area with endangered or conservation-worthy ecosystems, fauna or flora?		✓		
17.	Does the roof need any repair to ensure its safety and ensure its capacity to hold the additional load of the proposed solar PV system?		✓	Reviewing available data of buildings and visual inspection of both roofs indicates that no repair work require for installing	Detailed structural analysis should be conducted by the contractor to confirm the suitability of roofs for PV System Installation.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				solar panels on roofs.  However, there is no document available on structure stability of selected building. Proper structure stability analysis is required to assess the capacity of both rooftops.	
18.	Is rooftop access available at all times? Are there any permanent or temporary encumbrances/obstructions on the rooftop?		✓	There is only a temporary access available to both rooftops in form of movable ladder. Permanent access or its construction is not recommended due to the nominal size of the PV system.	Temporary safe climbing system should be provided by the contractor to accommodate construction activities.  Supervision consultant will confirm the suitability/safety of ladder provided by the contractor.
19.	Does the rooftop has access to water which is required for washing of panels?		✓	The office building has an overhead water tank which is a permanent obstruction and has been modelled in shading analysis during design phase	Water supply can be arranged with water hoses from ground level for solar panels washing requirement.
20.	Is there any plan of waste disposal/recycling system in place if any panel (s) needs to be changed or due to battery damage etc.?	✓		There will be a risk of damaging battery or panels to be broken during installation.	When installation of solar panels and technology is finalized, vendor will be asked to submit plan for its disposal and/or recycling of damaged panels etc. Waste Management Plan including (hazardous

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					waste management) will be included in the Environmental Management & Monitoring Plan (EMMP).  This will also be covered in the SOP sourced from the contractor.
21.	Are there any possible damages envisaged caused by falling of broken solar panels and supporting structure?	✓		There is a possibility that falling of solar panels and their support structure can cause substantial damage in the buildings and also broken by the windstorm.	The consultant will ensure that all safety factors are accounted for in the design phase, for instance standards assessment procedure (SAP) report of structure will be submitted by the contractor and the consultant will ensure that the structure is rated for the highest wind gust expected at site.
<b>B. Social Aspects</b>					
22.	Does the subproject require land acquisition?		✓		The proposed site for the PV System will be installed within the premises of Wah Gardens and the require area is owned by the Archaeology Department.
23.	Will the sub project cause any livelihood or economic loss?		✓		
24.	Is the subproject located on land with contested ownership?		✓		
25.	Is the subproject located in a densely populated area?		✓		

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
26.	Is the sub-project located in prime agricultural land?		✓		
27.	Is the subproject located in an area with security problems?  If Yes  What are the security arrangements?		✓	Currently staff from Archeological department is carrying out security task at site.  Additional security arrangement is recommended.	Security arrangements such as fencing & hiring of licensed security staff are proposed for protecting the installed solar energy system.
<b>C. Physical Cultural Resources</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
28.	Is the subproject located in an area with designated cultural properties such as archaeological historical and/or religious sites?  If Yes  What is name and distance from subproject site Possible impacts and their mitigation measures during installation as well as during operational phase	✓		PV System will be installed within the premises of Wah Garden Heritage site.	All work activities should be conducted under the supervision of competent person and ensure the protection of historical site from work activities.  All work activities should be conducted in the day light, including material or plant delivery etc. in order to avoid any accidental damage of the heritage site.  Maintain specified speed limit within the premises of Wah Garden.  All site workers should be restricted to the work area and do not move outside work area without permission of the project manager.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					All waste generated at work site should be collected in the bags and dispose of according to the waste management plan, presented in the EMMP.
29.	Will the sub-project have an impact on archaeological or historical sites?	✓		<p>Unplanned and uncontrolled work activities may have adverse impact on the historical site Wah Garden.</p> <p>Minimizing emission of GHG gases due to switching to clean source of energy will have positive impact on the local environment of the heritage site (Wah Garden)</p>	PMU will prepare Physical Cultural Resource Management Plan (PCRMP) before commence work on site. During construction, the contractor will be responsible to implement PCRMP on site and supervised by PMU.
30.	Will the sub-project have an impact on religious monuments, structures and/or cemeteries?		✓		
31.	Have Chance Finds procedures been prepared for use in the sub- project?	✓		Archeological or religious remains (such as graves etc) may find during the construction activities of the project.	<p>In case of findings of archeological or religious site during execution of work on site, the work should be stop and immediately inform archeological department and PMU.</p> <p>Have Chance Finds procedure is included as an Annexure B.</p>



Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
32.	Will the sub project have negative impact on the visibility and the aesthetic value of any historical or archaeological site?		✓	Installation of PV System may adversely impact on aesthetic value of the historical site.	The PV System installation site was carefully selected and it was ensured that the proposed work scheme does not cause any obstruction in view or deteriorate aesthetic value of the historical site.
<b>D. Operational &amp; Maintenance</b>					
33.	Is there any plan of O&M for solar panels after installation?	✓			In scope of contractor as initial O&M for two years will be their responsibility.  Suitable training courses should be arranged for the staff involving in managing the operation of the solar system for capacity building.
34.	What will be the mechanism for record keeping regarding panels to be replaced?				An inventory system will be developed for keeping record of any damage or replaced panels.
35.	What will be the procedure for handling hazardous waste if generated?			The only identified hazardous waste which can be generated on site during operation phase of the solar system is the run-off from panel cleaning activity which will include traces of detergent.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
36.	What will be the process of cleaning the solar panels?				Auto cleaning system with water pumps and nozzles will be installed by the vendors for the maintenance and cleaning. 1 to 2 persons will be required for maintaining this cleaning system.
<b>E. General Issues</b>					
37.	Is the project in a politically sensitive area?		✓		
38.	Will the sub-project make significant demands on utilities and services?		✓	It is envisaged that existing utilities services are sufficient to complete the installation work of solar system including existing road network, power supply, water supply etc.	
39.	Is the subproject located in an area susceptible to landslides or erosion?		✓		
40.	Is the subproject located near a waste dump?		✓		
41.	Is there health safety plan during construction phase and operational phase?	✓		Health & Safety Plan will be required to undertake the work activities.	Contractor will submit his Health & Safety (H&S) Plan to PMU and get its approval before commence work on site.  The contractor's H&S plan should collate in light of WB Health Safety Guidelines.  H&S Plan should be enforced on site and

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					supervised by the competent person from the contractor.

## **E&S Screening Checklist Completed for Taxila Museum**

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
<b>A. Environmental Aspects</b>					
1.	Will the sub-project involve significant land disturbance or site clearance?	Yes		On ground location, site levelling and land clearance will be required. The allocated area is filled with wild vegetation, however, no mature tree likely to be uprooted for project activities.	New plantation will be carried out within the project vicinity.  If any tree uprooting require for the execution of work than prior permission will be required from supervision consultant and PMU. Minimum 10 more trees will be planted for every one tree uprooted on site.
2.	Is the subproject located in an area with designated natural reserves?	No			
3.	Will the subproject cause noise and vibration during construction activities	Yes		During structure installation and earth pit construction some drill work will be involved which may cause noise and vibration in the immediate surrounding area.	All plant & equipment should be regularly inspected and maintained.  Ensure enforcement of noise control measures as specified in ECoPs <sup>2</sup> .  Carried out regular noise monitoring as per

<sup>2</sup> Environment code of practices

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				The anticipated impact is not significant and localized.	requirement of the EMMP.
4.	Will Firefighting equipment provided at site?	Yes		Hot work activity will be performed which may lead to fire hazard.	<p>Firefighting equipment should be provided at the site during installation and operation of solar Panels system.</p> <p>Flammable material will be kept well away from the hot work area.</p> <p>Fire drills should be arranged and conducted before commence work on site by the contractor. The drill/workshop should be designed to learn the procedure every site workers need to follow in case of fire.</p> <p>Site works must be trained for type and use of correct fire extinguisher.</p> <p>All workers involve in hot work activities should use specified PPEs according to the health &amp; safety plan.</p>

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
5.	Which types of electrical wires will be used in Solar Panel installation to avoid any electrical shocks and measures regarding safety purposes?				<p>XLPO/XLPO DC cables will be used and XLPE AC cables will be used. These are thicker insulation cables rated at higher voltage than PVC cables.</p> <p>Ensure all site workers worn specified PPE, according to the health &amp; safety plan and risk assessment documents.</p>
6.	Are there anticipated impacts on building roofs such as structural damage and water leakage into the building?		No	Not relevant as ground mount system is purposed in this sub-project.	
7.	Is the roof safe, protected and can bear the load of the panels?				
8.	Is there a risk of soil pollution and soil erosion during construction phase?		No	No soil pollution and erosion anticipated from the purposed sub-project activities.	<p>Unnecessary vegetation removal or excavating ground will be prohibited.</p> <p>Fuel or chemical storage on site will be avoided through better management and arranging periodic delivery of fuel on site.</p> <p>If fuel storage is require on site than ensure that the fuel or chemical are stored in the designated banded area only.</p>
9.	Are there arrangements in place for proper handling, storage and transport of hazardous waste?		No	No Soil Pollution and Soil erosion are anticipated from the work activities.	Unnecessary vegetation removal or excavating ground will be prohibited.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				Leakage from the fuel storage at site, broken solar panels and damaged batteries classified as hazardous waste.	<p>Fuel or chemical storage on site will be avoided through better management and arranging periodic delivery of fuel on site.</p> <p>If fuel storage is require on site than ensure that the fuel or chemical are stored in the designated bunded area only.</p>
10	Is the existing capacity of staff sufficient to properly handle, store, transport and dispose of hazardous waste associated with solar panels?			Untrained staff involve in handling of hazardous materials can cause any catastrophic incidents.	<p>Staff should be trained and competent to execute the work activities e.g. material handling, storing, transporting and disposal of hazardous waste produced from work activities.</p> <p>Correct use of specified Personal Protective Equipments (PPEs)</p> <p>The project will be on a turnkey basis with the EPC contractor responsible for initial O&amp;M period of 2 years. The client can hire a trainee during this period to learn and then supervise O&amp;M activities after 2 years.</p>

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
11	Will the activity result in improper disposal of broken/damaged solar panels, batteries, and supporting structure?	Yes		Damage solar panels, batteries and structural pieces cause health hazards and their handling need to be addressed.	<p>Damaged solar panels and batteries should be collected in the suitable container and send it of site with other hazardous waste for disposal according to the waste management plan which will be provided in the EMMP.</p> <p>SOP will be submitted by the contractor for collection and disposal of the waste before commence work on site.</p>
12	Are there risks to workers health and safety during maintenance?	Yes		Risk of electric shock hazard is identified during maintenance work.	<p>Maintenance work should be conducted by the trained staff</p> <p>Ensure all site workers use the specified PPE.</p> <p>EMMP will be prepared and provide detail mitigation measures to control electric shock risk.</p>
13	Will this activity involve emissions resulting in air Pollution including dust emissions?	Yes		Dust, noise and air pollution from plant and equipment emission are anticipated during construction phase of the project. However, there is likely to be a net decrease in GHG emissions because of power generation from a non-fossil fuel source during operational phase of the project.	<p>Use appropriate machine or equipment to execute the work activities.</p> <p>Inspect and maintain plant and equipment on regular basis.</p> <p>Carry out regular sprinkling of water on dust prone areas.</p> <p>Use appropriate PPEs by all site workers.</p>
14	Is the sub-project located close to Groundwater sources, surface water bodies, water courses or wetlands?	Yes		Infiltration of contaminated surface run-off which may generated during washing/cleaning of solar panels will cause hazard of contaminating	<p>Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies.</p> <p>Any waste water produced will be disposed into the</p>

				groundwater resource of the area.	existing sewerage lines already being used for the residential area & offices inside the Museum premises with the approval of local wastewater management authority.
15	Is the sub-project located in an area with endangered or conservation- worthy ecosystems, fauna or flora?		No		
16	Does the roof need any repair to ensure its safety and ensure its capacity to hold the additional load of the proposed solar PV system?	N/A		The sub project is ground mounted.	
17	Is rooftop access available at all times? Are there any permanent or temporary encumbrances/obstructions on the rooftop?	N/A			
18	Does the rooftop has access to water which is required for washing of panels?	N/A			



Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
19	Is there any plan of waste disposal/recycling system in place if any panel (s) needs to be changed or due to battery damage etc.?	Yes			Will be covered in the SOP sourced from the contractor.
20	Are there any possible damages envisaged caused by falling of broken solar panels and supporting structure?	Yes		High winds can impact structure and modules. PV Panels can also be damaged during installation.	The design consultant will ensure that all safety factors are accounted for in the design phase including highest wind gust expected at site etc.
<b>B. Social Aspects</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
21	Does the subproject require land acquisition?		No		The land is property of Archaeology Department.
22	Will the sub project cause any livelihood or economic loss?		No		
23	Is the subproject located on land with contested ownership?		No		
24	Is the subproject located in a densely populated area?		No		The area chosen for construction is out of the public eye. There is a residential colony for Museum employees near the construction site, however they are only 12 houses and there is a road between the colony and proposed site for PV System.
25	Is the sub-project located on prime agricultural land?		No		
26	Is the subproject located in an area with security problems?  If No  What are the security arrangements?		No		For preventing damage or theft of solar panels, fencing is recommended. It will be included in the BOQ. Also, existing security staff will be utilized.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
<b>C. Physical Cultural Resource</b>					
27	<p>Is the subproject located in an area with designated cultural properties such as archaeological historical and/or religious sites?</p> <p>If Yes</p> <p>What is name and distance from subproject site Possible impacts and their mitigation measures during installation as well as during operational phase</p>	Yes		Project is within the premises of Taxila Museum.	<p>All work activities should be conducted under the supervision of competent person and ensure the protection of historical site from work activities.</p> <p>All work activities should be conducted in the day light, including material or plant delivery etc. in order to avoid any accidental damage of the heritage site.</p> <p>All site workers should be restricted to the work area and do not move outside work area without permission of the project manager.</p> <p>All waste generated at work site should be collected in the bags and dispose of according to the waste management plan, presented in the EMMP.</p>
28	Will the sub-project have an impact on archaeological or historical sites?	Yes			<p>The sub-project will help in full filling electricity needs of this site by reducing its cost and using environment friendly technology.</p> <p>The PV System installation location has been selected carefully so that the work has no or little impact on archeological site.</p>
29	Will the sub-project have an impact on religious monuments, structures and/or cemeteries?		No		

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
30	Have Chance Finds procedures been prepared for use in the sub-project?	Yes			The require digging for the work will not be of significant depth, however, considering the close proximity of the museum to the excavated ruins of Taxila, a chance find procedures included as Annex B .
31	Will the sub project have negative impact on the visibility and the aesthetic value of any historical or archaeological site?		No		The selected site for solar panels installation are away from the public eye, near the residential colony.
<b>D. Operational &amp; Maintenance</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
32	Is there any plan of O&M for solar panels after installation?	Yes			The contractor will provide O&M for the PV System. First two years of implementing of O&M manual will be the contractor's responsibility.
33	What will be the mechanism for record keeping regarding panels to be replaced?				An inventory system will be developed for keeping record of any damage or replaced panels.
34	What will be the procedure for handling hazardous waste if generated?			The only hazardous waste which can be generated on site is the run-off from panel cleaning activity which will include traces of detergent.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies.  Any waste water produced will be disposed of into the existing sewerage system for the offices and residential colony with the permission of the concerned authority.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
35	What will be the process of cleaning the solar panels?				Auto cleaning system with water pumps and nozzles will be installed by the vendors for the maintenance and cleaning. 1 to 2 persons will be required for maintaining this cleaning system.
<b>E. General Issues</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
36	Is the project in a politically sensitive area?		No		
37	Will the sub-project make significant demands on utilities and services?		No		
38	Is the subproject located in an area susceptible to landslides or erosion?		No		
39	Is the subproject located near a waste dump?		No		
40	Is there health safety plan during construction phase and operational phase?	Yes			<p>Contractor will submit his Health &amp; Safety (H&amp;S) Plan to supervision consultant and PMU and get its approval before commence work on site.</p> <p>The contractor's H&amp;S plan should collate in light of WB Health Safety Guidelines.</p> <p>H&amp;S Plan should be enforced on site and supervised by the competent person from the contractor.</p>

**E&S Screening Checklist Completed for Rohtas Fort**

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
<b>A. Environmental Aspects</b>					
1.	Will the sub-project involve significant land disturbance or site clearance?	✓		The available free land next to the administration/office block is filled with natural vegetation. Vegetation clearance or tree uprooting may require for preparation of the area for installation of the solar panels system.	New tree plantation will be carried out in the vicinity of the project area as a compensation plantation.  It is proposed to plant minimum 10 more tree for every one tree uprooted on site for the project activities.
2.	Is the subproject located in an area with designated natural reserves?		✓		
3.	Will the subproject cause noise and vibration during construction activities?	✓		During structure installation and earth pit construction some drill work will be involved which may cause noise and vibration in the immediate surrounding area.	The anticipated impact is not significant and localized.  All plant & equipment should be regularly inspected and maintained.  Ensure enforcement of noise control measures as specified in ECoPs <sup>3</sup> .
4.	Will Firefighting equipment provided at site?	✓		Hot work activity will be performed which may lead to fire hazard.	Firefighting equipment should be provided at the site during installation and operation of solar Panels system.  Flammable material will be kept well away

<sup>3</sup> Environment code of practices

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					<p>from the hot work area.</p> <p>Fire drills should be arranged and conducted before commence work on site by the contractor. The drill/workshop should be designed to learn the procedure every site workers need to follow in case of fire.</p> <p>Site works must be trained for type and use of correct fire extinguisher.</p> <p>All workers involve in hot work activities should use specified PPEs according to the health &amp; safety plan.</p>
5.	Which types of electrical wires will be used in Solar Panel installation to avoid any electrical shocks and measures regarding safety purposes?			Details are provided in the feasibility and detail design study reports	<p>XLPO/XLPO DC cables will be used and XLPE AC cables will be used. These are thicker insulation cables rated at higher voltage than PVC cables.</p> <p>Proper PPE in form of gloves and insulated boots will be worn by installers</p>
6.	Are there anticipated impacts on building roofs such as structural damage and water leakage into the building?		✓	No impact on building or rooftops is anticipated.	Proposed location is ground mounted rather than roof top.
7.	Is the roof safe, protected and can bear the load of the panels?				

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
8.	Is there a risk of soil pollution and soil erosion during construction phase?		✓	No Soil Pollution and Soil erosion are anticipated from the work activities.	<p>Unnecessary vegetation removal or excavating ground will be prohibited. Fuel or chemical storage on site will be avoided through better management and arranging periodic delivery of fuel on site.</p> <p>If fuel storage is required on site then ensure that the fuel or chemical are stored in the designated bunded area only.</p>
9.	Are there arrangements in place for proper handling, storage and transport of hazardous waste?	✓		Improper storage and handling of substances leading to contamination of soil and water resources of the area and cause health hazards.	<p>Ensure provision of Material Safety Data Sheet (MSDS) or Control of Substances Hazardous to Health (COSHH) sheets at site.</p> <p>Construct concrete or other impermeable flooring of the material storage area to prevent seepage in case of spills of hazardous material.</p> <p>The contractor will be required to follow the ECoP and dispose of the solid waste in a manner not to contaminate soil or water, not to generate foul odor, and not to spread any vector-borne diseases.</p> <p>The contractor will provide require Personal Protected</p>

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					Equipment (PPE) and ensure all the site workers use them accurately during execution of work activities.
10.	Is the existing capacity of staff sufficient to properly handle, store, transport and dispose of hazardous waste associated with solar panels?	✓		Improper and untrained staff involve in handling of hazardous materials can cause any catastrophic incidents.	<p>Staff should be trained and competent to execute the work activities e.g. material handling, storing, transporting and disposal of hazardous waste produced from work activities.</p> <p>Correct use of appropriate Personal Protective Equipment (PPEs)</p> <p>The project will be on a turnkey basis with the EPC contractor responsible for initial O&amp;M period of 2 years. The client can hire a trainee during this period to learn and then supervise O&amp;M activities after 2 years.</p>
11.	Is the activity result in improper disposal of broken/damaged solar panels, batteries, and supporting structure are planned to address?	✓		There is possibility that activity may result in improper disposal as well as damaging solar panels.	<p>Damaged solar panels and batteries should be collected in the suitable container and send it of site with other hazardous waste for disposal according to the waste management plan which will be provided in the EMMP.</p> <p>SOP will be submitted by the contractor for collection and</p>



Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					disposal of the waste before commence work on site.
12.	Are there risks to workers health and safety during maintenance?	✓		Risk of electric shock hazard is identified during maintenance work.	Maintenance work should be conducted by the trained staff  Specified PPE will be worn by site workers.
13.	Will the activity result in clearance of natural vegetation from a large tract of land which can potentially disturb the natural habitat and the associated wildlife species?	✓		The selected site for PV system installation within the premises of the heritage site (Rohtas Fort) will require vegetation clearance. However, the selected site is next to the office blocks and therefore, no noticeable adverse impact on biological environment of the area is anticipated.	A walk over survey will be conducted before preparation of the ground and if any bird nest or other wildlife habitat (rabbit hole etc.) finds in the area than relocate them to suitable adjacent place.
14.	Will the work activity involve emissions resulting in air Pollution including dust emissions?	✓		Dust, noise and air pollution from plant and equipment emission are anticipated during construction phase of the project. However, there is likely to be a net decrease in GHG emissions because of power generation from a non-fossil fuel source during operational phase of the project.	Use appropriate machine or equipment to execute the work activities.  Inspect and maintain plant and equipment on regular basis.  Carry out regular sprinkling of water on dust prone areas.  Use appropriate PPEs by all site workers.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
15.	Is the sub-project located close to Groundwater sources, surface water bodies, water courses or wetlands?		✓	Nearest surface water body is River Jhelum located about 5 km east of the fort.  Percolation of contaminated surface runoff can deteriorate the water quality of groundwater resources of the area.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies and seeping into freshwater bodies.
16.	Is the sub-project located in an area with endangered or conservation-worthy ecosystems, fauna or flora?		✓		
17.	Does the roof need any repair to ensure its safety and ensure its capacity to hold the additional load of the proposed solar PV system?			Not applicable	
18.	Is rooftop access available at all times? Are there any permanent or temporary encumbrances/obstructions on the rooftop?			Not applicable (proposed system is ground mounted)	
19.	Does the rooftop has access to water which is required for washing of panels?			Not applicable	
20.	Is there any plan of waste disposal/recycling system in place if any panel (s) needs to be changed or due to battery damage etc.?	✓		There will be a risk of damaging battery or panels to be broken during installation.	When installation of solar panels and technology is finalized, vendor will be asked to submit plan for its disposal and/or recycling of damaged panels etc. Waste Management Plan including (hazardous waste management) will be included in the Environmental Management &

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					Monitoring Plan (EMMP).  This will also be covered in the SOP sourced from the contractor.
21.	Are there any possible damages envisaged caused by falling of broken solar panels and supporting structure?	✓		There is a possibility that falling of solar panels and their support structure can cause substantial damage in the buildings and also broken by the windstorm.	The consultant will ensure that all safety factors are accounted for in the design phase, for instance SAP report of structure will be submitted by the contractor and the consultant will ensure that the structure is rated for the highest wind gust expected at site.
<b>B. Social Aspects</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
22.	Does the subproject require land acquisition?		✓		The proposed site for the PV System will be installed within the premises of Rohtas Fort and the require land is owned by the Archaeology Department.
23.	Will the sub project cause any livelihood or economic loss?		✓		
24.	Is the subproject located on land with contested ownership?		✓		
25.	Is the subproject located in a densely populated area?		✓		The area chosen for construction is out of the public eye, however, there are few houses (about 12 houses) for Museum

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					employees next to the construction site.
26.	Is the sub-project located on prime agricultural land?		✓		
27.	Is the subproject located in an area with security problems?  If Yes  What are the security arrangements?	✓		Trespassing is a common occurrence. Only 2 watchmen are deployed for security. They are not licensed security staff.	Security arrangements such as fencing & hiring of licensed security staff are proposed for protecting the installed solar energy system.
<b>C. Physical Cultural Resources</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
28.	Is the subproject located in an area with designated cultural properties such as archaeological historical and/or religious sites?  If Yes  What is name and distance from subproject site Possible impacts and their mitigation measures during installation as well as during operational phase	✓		PV System will be installed within the premises of Rohtas Fort.	All work activities should be conducted under the supervision of competent person and ensure the protection of historical site from work activities.  All work activities should be conducted in the day light, including material or plant delivery etc. in order to avoid any accidental damage of the heritage site.  Maintain specified speed limit within the premises of Rohtas Fort.  All site workers should be restricted to the work area and do not move outside work area without permission of the project manager.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					All waste generated at work site should be collected in the bags and dispose of according to the waste management plan, presented in the EMMP.
29.	Will the sub-project have an impact on archaeological or historical sites?	✓		Unplanned and uncontrolled work activities may have adverse impact on the historical site Rohtas Fort.  Minimizing emission of GHG gases due to switching to clean source of energy will have positive impact on the local environment of the heritage site (Rohtas Fort)	PMU will prepare Physical Cultural Resource Management Plan (PCRMP) before commence work on site. During construction, the contractor will be responsible to implement PCRMP on site and supervised by PMU.
30.	Will the sub-project have an impact on religious monuments, structures and/or cemeteries?		✓		
31.	Have Chance Finds procedures been prepared for use in the sub-project?	✓		Archeological or religious remains (such as graves etc) may find during the construction activities of the project, particularly during preparation of ground and earthwork activities	In case of findings of archeological or religious site during execution of work on site, the work should be stop and immediately inform archeological department and PMU.  Have Chance Finds procedure is included as an Annexure B.
32.	Will the sub project have negative impact on the visibility and the aesthetic value of any historical or archaeological site?		✓	Installation of PV System may adversely impact on aesthetic value	The PV System installation site was carefully selected and it was ensured that

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				of the historical site.	the proposed work scheme does not cause any obstruction in view or deteriorate aesthetic value of the historical site.
<b>D. Operational &amp; Maintenance</b>					
33.	Is there any plan of O & M for solar panels after installation?	✓			In scope of contractor as initial O&M for two years will be their responsibility.  Suitable training courses should be arranged for the staff involving in managing the operation of the solar system for capacity building.
34.	What will be the mechanism for record keeping regarding panels to be replaced?				An inventory system will be developed for keeping record of any damage or replaced panels.
35.	What will be the procedure for handling hazardous waste if generated?			The only identified hazardous waste which can be generated on site during operation phase of the solar system is the run-off from panel cleaning activity which will include traces of detergent.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies.
36.	What will be the process of cleaning the solar panels?				Auto cleaning system with water pumps and nozzles will be installed by the vendors for the maintenance and cleaning. 1 to 2 persons will be required for

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					maintaining this cleaning system.
<b>E. General Issues</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
37.	Is the project in a politically sensitive area?		✓		
38.	Will the sub-project make significant demands on utilities and services?		✓	It is envisaged that existing utilities services are sufficient to complete the installation work of solar system.	
39.	Is the subproject located in an area susceptible to landslides or erosion?		✓		
40.	Is the subproject located near a waste dump?		✓		
41.	Is there health safety plan during construction phase and operational phase?	✓		Health & Safety Plan will be required to undertake the work activities.	<p>Contractor will submit his Health &amp; Safety (H&amp;S) Plan to PMU and get its approval before commence work on site.</p> <p>The contractor's H&amp;S plan should collate in light of WB Health Safety Guidelines.</p> <p>H&amp;S Plan should be enforced on site and supervised by the competent person from the contractor.</p>

**E&S Screening Checklist for Hiran Minar**

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
<b>A. Environmental Aspects</b>					
1.	Will the sub-project involve significant land disturbance or site clearance?	✓		On ground location, site levelling and land clearance will be required. The allocated area is filled with wild vegetation. However, it is envisaged that no tree uprooting will be required for solar panels installation work.  For Carport structure at Parking area, few trees may need to be uprooted.	New plantation will be carried out within the project vicinity.  If any tree uprooting require for the execution of work than prior permission will be required from supervision consultant and PMU.  New tree plantation will be undertaken in the project vicinity to replace the loss of trees in the parking area.
2.	Is the subproject located in an area with designated natural reserves?		✓		
3.	Will the subproject cause noise and vibration during construction activities?	✓		Drilling and land excavation will be required for solar panels installation work. However, the magnitude of drilling or excavation is limited and only cause localized vibration and noise impact on the	All plant & equipment should be regularly inspected and maintained.  Ensure enforcement of noise control measures as specified in ECoPs <sup>4</sup> .  Carried out regular noise monitoring as

<sup>4</sup> Environment code of practices



				<p>surrounding environment.</p> <p>The anticipated impact can be classified as low to moderate and mitigable impact.</p>	<p>per requirement of the EMMP.</p>
4.	Will Firefighting equipment provided at site?	✓		<p>Hot work activity will be performed which may lead to fire hazard.</p>	<p>Firefighting equipment should be provided at the site during installation and operation of solar Panels system.</p> <p>Flammable material will be kept well away from the hot work area.</p> <p>Fire drills should be arranged and conducted before commence work on site by the contractor. The drill/workshop should be designed to learn the procedure every site workers need to follow in case of fire.</p> <p>Site works must be trained for type and use of correct fire extinguisher.</p> <p>All workers involve in hot work activities should use specified PPEs according to the health &amp; safety plan.</p>
5.	Which types of electrical wires will be used in Solar Panel installation to avoid any electrical shocks and measures regarding safety purposes?			<p>Details are provided in the feasibility and detail design study reports</p>	<p>XLPO/XLPO DC cables will be used and XLPE AC cables will be used. These are thicker insulation cables rated at higher voltage than PVC cables.</p>

					Ensure all site workers use specified PPE on site (according to risk assessment or health & safety plan prepared for the sub-project)
6.	Are there anticipated impacts on building roofs such as structural damage and water leakage into the building?		✓	Building roofs will not utilize for solar panels installation.  Carport structure will be designed and constructed considering the roof of the carport being utilize for solar panels installation. The carport structure is not connected or close to other structures/buildings.	
7.	Is the roof safe, protected and can bear the load of the panels?				
8.	Is there a risk of soil pollution and soil erosion during construction phase?		✓	No Soil Pollution and Soil erosion are anticipated from the work activities.	Unnecessary vegetation removal or excavating ground will be prohibited.  Fuel or chemical storage on site will be avoided through better management and arranging periodic delivery of fuel on site.  If fuel storage is require on site than ensure that the fuel or chemical are stored in the designated banded area only.
9.	Are there arrangements in place for proper handling, storage and transport of hazardous waste?	✓		Improper storage and handling of substances may lead to contaminate soil	Ensure provision of Martial Safety Data Sheet (MSDS) or Control of Substances

				<p>and water resources of the area and cause health hazards.</p>	<p>Hazardous to Health (COSHH) sheets at site.</p> <p>Provide concrete or other impermeable flooring of the material storage area to prevent seepage in case of spills of hazardous material.</p> <p>The contractor will be required to follow the ECoP and dispose of the solid waste in a manner not to contaminate soil or water, not to generate foul odor, and not to spread any vector-borne diseases.</p> <p>The contractor will provide required Personal Protected Equipment (PPE) and ensure all the site workers use them accurately during execution of work activities.</p>
10.	<p>Is the existing capacity of staff sufficient to properly handle, store, transport and dispose of hazardous waste associated with solar panels?</p>	✓		<p>Untrained staff involve in handling of hazardous materials can cause any catastrophic incidents.</p>	<p>Staff should be trained and competent to execute the work activities e.g. material handling, storing, transporting and disposal of hazardous waste produced from work activities.</p> <p>Correct use of specified Personal Protective Equipments (PPEs)</p> <p>The project will be on a turnkey basis with the EPC contractor responsible for initial O&amp;M period of 2 years. The client can hire a trainee during</p>

					this period to learn and then supervise O&M activities after 2 years.
11.	Will the activity result in improper disposal of broken/damaged solar panels, batteries, and supporting structure are planned to address?	✓		Damage solar panels, batteries and structural pieces cause health hazards and their handling need to be addressed.	<p>Damaged solar panels and batteries should be collected in the suitable container and send it of site with other hazardous waste for disposal according to the waste management plan which will be provided in the EMMP.</p> <p>SOP will be submitted by the contractor for collection and disposal of the waste before commence work on site.</p>
12.	Are there risks to workers health and safety during maintenance?	✓		Risk of electric shock hazard is identified during maintenance work.	<p>Maintenance work should be conducted by the trained staff</p> <p>Ensure all site workers use the specified PPE.</p> <p>EMMP will be prepared and provide detail mitigation measures to control electric shock risk.</p>
13.	Will the activity result in clearance of natural vegetation from a large tract of land which can potentially disturb the natural habitat and the associated wildlife species?	✓		The selected site for ground mounted PV system installation within the premises of the heritage site (Hiran Minar) will require vegetation clearance. However, no noticeable adverse impact on biological	A walk over survey will be conducted before preparation of the ground and if any bird nest or other wildlife habitat (rabbit hole etc.) finds in the area than relocate them to suitable adjacent place.

				environment of the area is anticipated.	
14.	Will the work activity involve emissions resulting in air Pollution including dust emissions?	✓		Dust, noise and air pollution from plant and equipment emission are anticipated during construction phase of the project. However, there is likely to be a net decrease in GHG emissions because of power generation from a non-fossil fuel source during operational phase of the project.	Use appropriate machine or equipment to execute the work activities.  Inspect and maintain plant and equipment on regular basis.  Carry out regular sprinkling of water on dust prone areas.  Use appropriate PPEs by all site workers.
15.	Is the sub-project located close to Groundwater sources, surface water bodies, water courses or wetlands?		✓	Percolation of contaminated surface runoff can deteriorate the water quality of groundwater resources of the area.  The proposed site for PV system installation is more than 50m away from the Hiran Minar Water Pond.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies and seeping into freshwater bodies.  The Hiran Minar has a system of water hydrants to utilize the ground water. Monitor groundwater quality of the turbine on regular basis during execution and early stage of operational phase of the project.
16.	Is the sub-project located in an area with endangered or conservation-worthy ecosystems, fauna or flora?		✓		
17.	Does the roof need any repair to ensure its safety and ensure its capacity to hold the additional load of the proposed solar PV system?				
18.	Is rooftop access available at all times? Are there any permanent or			Not applicable	

	temporary encumbrances/obstructions on the rooftop?			
19.	Does the rooftop has access to water which is required for washing of panels?			
20.	Is there any plan of waste disposal/recycling system in place if any panel (s) needs to be changed or due to battery damage etc.?	✓		<p>Waste comprising on damaged batteries and solar panels likely to be generated during installation work. Damaged batteries or panels are hazardous waste.</p> <p>When installation of solar panels and technology is finalized, vendor will be asked to submit plan for its disposal and/or recycling of damaged panels etc. Waste Management Plan including (hazardous waste management) will be included in the Environmental Management &amp; Monitoring Plan (EMMP).</p> <p>This will also be covered in the SOP sourced from the contractor.</p>
21.	Are there any possible damages envisaged caused by falling of broken solar panels and supporting structure?	✓		<p>There is a possibility that falling of solar panels and their support structure can cause substantial damage in the buildings and also broken by the windstorm.</p> <p>The consultant will ensure that all safety factors are accounted for in the design phase, for instance SAP report of structure will be submitted by the contractor and the consultant will ensure that the structure is rated for the highest wind gust expected at site.</p>
<b>B. Social Aspects</b>				
22.	Does the subproject require land acquisition?		✓	<p>The proposed site for the PV System will be installed within the premises of Hiran Minar and the land is owned by the</p>

					Archaeology Department.
23.	Will the sub project cause any livelihood or economic loss?		✓		
24.	Is the subproject located on land with contested ownership?		✓		
25.	Is the subproject located in a densely populated area?		✓		
26.	Is the sub-project located on prime agricultural land?		✓		
27.	Is the subproject located in an area with security problems?  If Yes  What are the security arrangements?	✓		Trespassing is a common occurrence. The security is managed by the staff of Archaeology Dept at Hiran Minar. Currently there is no licensed security staff.	Security arrangements such as fencing is proposed.
<b>C. Physical Cultural Resources</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
28.	Is the subproject located in an area with designated cultural properties such as archaeological historical and/or religious sites?  If Yes  What is name and distance from subproject site Possible impacts and their mitigation measures during installation as well as during operational phase	✓		PV System will be installed within the premises of Hiran Minar.	All work activities should be conducted under the supervision of competent person and ensure the protection of historical site from work activities.  All work activities should be conducted in the day light, including material or plant delivery etc. in order to avoid any accidental damage of the heritage site.  All site workers should be restricted to the work area and do

					<p>not move outside work area without permission of the project manager.</p> <p>All waste generated at work site should be collected in the bags and dispose of according to the waste management plan, presented in the EMMP.</p>
29.	Will the sub-project have an impact on archaeological or historical sites?	✓		<p>Unplanned and uncontrolled work activities may have adverse impact on the historical site.</p> <p>Minimizing emission of GHG gases due to switching to clean source of energy will have positive impact on the local environment of the heritage site</p>	<p>PMU will prepare and implement Physical Cultural Resource Management Plan (PCRMP) before commence work on site. PMU will supervise implementation of PCRMP on site during construction phase of the project.</p>
30.	Will the sub-project have an impact on religious monuments, structures and/or cemeteries?		✓		
31.	Have Chance Finds procedures been prepared for use in the sub-project?	✓		<p>Archeological or religious remains (such as graves etc) may find during the construction activities of the project, particularly during preparation of ground earthwork activities and trenching for cables.</p>	<p>In case of findings of archeological or religious site during execution of work on site, the work should be stop and immediately inform archeological department and PMU.</p> <p>Chance Finds procedure is included as an Annexure B.</p>
32.	Will the sub project have negative impact on the visibility and the		✓	<p>Installation of PV System may adversely impact on aesthetic value</p>	<p>A secluded space has been allocated for ground mount PV system by the site</p>



	aesthetic value of any historical or archaeological site?			of the historical site.	staff of Archaeology Department.  Carport structure will add to the aesthetics of the parking area and provide shade for vehicles..
<b>D. Operational &amp; Maintenance</b>					
<b>Sr. No.</b>	<b>Issues</b>	<b>Yes</b>	<b>No</b>	<b>Impacts Description</b>	<b>Mitigation Measures</b>
33.	Is there any plan of O & M for solar panels after installation?	✓			In scope of contractor as initial O&M for two years will be their responsibility.  Suitable training courses should be arranged for the staff involving in managing the operation of the solar system for capacity building.
34.	What will be the mechanism for record keeping regarding panels to be replaced?				An inventory system will be developed for keeping record of any damage or replaced panels.
35.	What will be the procedure for handling hazardous waste if generated?			The only identified hazardous waste which can be generated on site during operation phase of the solar system is the run-off from panel cleaning activity which will include traces of detergent.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies.
36.	What will be the process of cleaning the solar panels?				Auto cleaning system with water pumps and nozzles will be installed by the vendors for the maintenance and

					cleaning. 1 to 2 persons will be required for maintaining this cleaning system.
<b>E. General Issues</b>					
<b>Sr. No.</b>	<b>Issues</b>	<b>Yes</b>	<b>No</b>	<b>Impacts Description</b>	<b>Mitigation Measures</b>
37.	Is the project in a politically sensitive area?		✓		
38.	Will the sub-project make significant demands on utilities and services?		✓	It is envisaged that existing utilities services are sufficient to complete the installation work of solar system.	
39.	Is the subproject located in an area susceptible to landslides or erosion?		✓		
40.	Is the subproject located near a waste dump?		✓		
41.	Is there health safety plan during construction phase and operational phase?	✓		Health & Safety Plan will be required to undertake the work activities.	<p>Contractor will submit his Health &amp; Safety (H&amp;S) Plan to supervision consultant and PMU and get its approval before commence work on site.</p> <p>The contractor's H&amp;S plan should collate in light of WB Health Safety Guidelines.</p> <p>H&amp;S Plan should be enforced on site and supervised by the competent person from the contractor.</p>

**E&S Screening Checklist for Jahangir's Tomb**

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
<b>A. Environmental Aspects</b>					
1.	Will the sub-project involve significant land disturbance or site clearance?	✓		On ground location, site levelling and land clearance will be required. The allocated area is filled with wild vegetation. However, it is envisaged that no tree uprooting require for execution of the proposed work. Therefore it can be stated that moderate level of land disturbance and site clearance require for the sub-project.	New plantation will be carried out within the project vicinity.  If any tree uprooting require for the execution of work than prior permission will be required from supervision consultant and PMU.
2.	Is the subproject located in an area with designated natural reserves?		✓		
3.	Will the subproject cause noise and vibration during construction activities?	✓		During structure installation and earth pit construction some drill work will be involved which may cause noise and vibration in the immediate surrounding area.	All plant & equipment should be regularly inspected and maintained.  Ensure enforcement of noise control

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				<p>The anticipated impact is not significant.</p> <p>The impact is localized.</p>	<p>measures as specified in ECoPs<sup>5</sup>.</p> <p>Carried out regular noise monitoring as per requirement of the EMMP.</p>
4.	Will Firefighting equipment provided at site?	✓		Hot work activity will be performed which may lead to fire hazard.	<p>Firefighting equipment should be provided at the site during installation and operation of solar Panels system.</p> <p>Flammable material will be kept well away from the hot work area.</p> <p>Fire drills should be arranged and conducted before commence work on site by the contractor. The drill/workshop should be designed to learn the procedure every site workers need to follow in case of fire.</p> <p>Site works must be trained for type and use of correct fire extinguisher.</p> <p>All workers involve in hot work activities should use specified PPEs according to the health &amp; safety plan.</p>
5.	Which types of electrical wires will be used in Solar Panel installation to avoid any electrical shocks and			Details are provided in the feasibility and	XLPO/XLPO DC cables will be used and XLPE AC cables

<sup>5</sup> Environment code of practices

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
	measures regarding safety purposes?			detail design study reports	will be used. These are thicker insulation cables rated at higher voltage than PVC cables.  Ensure all site workers use specified PPE on site (according to risk assessment or health & safety plan prepared for the sub-project)
6.	Are there anticipated impacts on building roofs such as structural damage and water leakage into the building?		✓	No impact on building or rooftops is anticipated.	Proposed location is ground mounted rather than roof top.
7.	Is the roof safe, protected and can bear the load of the panels?				
8.	Is there a risk of soil pollution and soil erosion during construction phase?		✓	No Soil Pollution and Soil erosion are anticipated from the work activities.	Unnecessary vegetation removal or excavating ground will be prohibited.  Fuel or chemical storage on site will be avoided through better management and arranging periodic delivery of fuel on site.  If fuel storage is require on site than ensure that the fuel or chemical are stored in the designated banded area only.
9.	Are there arrangements in place for proper handling, storage and transport of hazardous waste?	✓		Improper storage and handling of substances leading to contamination of soil and water	Ensure provision of Martial Safety Data Sheet (MSDS) or Control of Substances

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				resources of the area and cause health hazards in the area.	<p>Hazardous to Health (COSHH) sheets at site.</p> <p>Construct concrete or other impermeable flooring of the material storage area to prevent seepage in case of spills of hazardous material.</p> <p>The contractor will be required to follow the ECoP and dispose of the solid waste in a manner not to contaminate soil or water, not to generate foul odor, and not to spread any vector-borne diseases.</p> <p>The contractor will provide require Personal Protected Equipment (PPE) and ensure all the site workers use them accurately during execution of work activities.</p>
10.	Is the existing capacity of staff sufficient to properly handle, store, transport and dispose of hazardous waste associated with solar panels?	✓		Improper and untrained staff involve in handling of hazardous materials can cause any catastrophic incidents.	<p>Staff should be trained and competent to execute the work activities e.g. material handling, storing, transporting and disposal of hazardous waste produced from work activities.</p> <p>Correct use of specified Personal Protective Equipment (PPEs)</p> <p>The project will be on a turnkey basis with the EPC contractor responsible for initial</p>

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					O&M period of 2 years. The client can hire a trainee during this period to learn and then supervise O&M activities after 2 years.
11.	Will the activity result in improper disposal of broken/damaged solar panels, batteries, and supporting structure are planned to address?	✓		There is possibility that activity may result in improper disposal as well as damaging solar panels.	Damaged solar panels and batteries should be collected in the suitable container and send it of site with other hazardous waste for disposal according to the waste management plan which will be provided in the EMMP.  SOP will be submitted by the contractor for collection and disposal of the waste before commence work on site.
12.	Are there risks to workers health and safety during maintenance?	✓		Risk of electric shock hazard is identified during maintenance work.	Maintenance work should be conducted by the trained staff  Ensure all site workers use the specified PPE.
13.	Will the activity result in clearance of natural vegetation from a large tract of land which can potentially disturb the natural habitat and the associated wildlife species?	✓		The selected site for PV system installation within the premises of the heritage site (Jahangir Tomb) will require vegetation clearance. However, no noticeable adverse impact on biological environment of the area is anticipated.	A walk over survey will be conducted before preparation of the ground and if any bird nest or other wildlife habitat (rabbit hole etc.) finds in the area than relocate them to suitable adjacent place.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
14.	Will the work activity involve emissions resulting in air Pollution including dust emissions?	✓		Dust, noise and air pollution from plant and equipment emission are anticipated during construction phase of the project. However, there is likely to be a net decrease in GHG emissions because of power generation from a non-fossil fuel source during operational phase of the project.	Use appropriate machine or equipment to execute the work activities.  Inspect and maintain plant and equipment on regular basis.  Carry out regular sprinkling of water on dust prone areas.  Use appropriate PPEs by all site workers.
15.	Is the sub-project located close to Groundwater sources, surface water bodies, water courses or wetlands?		✓	Percolation of contaminated surface runoff can deteriorate the water quality of groundwater resources of the area.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies and seeping into freshwater bodies.  The nearest groundwater source is turbine system of Jahangir Tomb. Monitor groundwater quality of the turbine on regular basis during execution and early stage of operational phase of the project.
16.	Is the sub-project located in an area with endangered or conservation-worthy ecosystems, fauna or flora?		✓		
17.	Does the roof need any repair to ensure its safety and ensure its capacity to hold the additional load of the proposed solar PV system?			Not applicable	



Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
18.	Is rooftop access available at all times? Are there any permanent or temporary encumbrances/obstructions on the rooftop?			Not applicable (proposed system is ground mounted)	
19.	Does the rooftop has access to water which is required for washing of panels?			Not applicable	
20.	Is there any plan of waste disposal/recycling system in place if any panel (s) needs to be changed or due to battery damage etc.?	✓		There will be a risk of damaging battery or panels to be broken during installation.	When installation of solar panels and technology is finalized, vendor will be asked to submit plan for its disposal and/or recycling of damaged panels etc. Waste Management Plan including (hazardous waste management) will be included in the Environmental Management & Monitoring Plan (EMMP).  This will also be covered in the SOP sourced from the contractor.
21.	Are there any possible damages envisaged caused by falling of broken solar panels and supporting structure?	✓		There is a possibility that falling of solar panels and their support structure can cause substantial damage in the buildings and also broken by the windstorm.	The consultant will ensure that all safety factors are accounted for in the design phase, for instance SAP report of structure will be submitted by the contractor and the consultant will ensure that the structure is rated for the highest wind gust expected at site.
<b>B. Social Aspects</b>					

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
22.	Does the subproject require land acquisition?		✓		The proposed site for the PV System will be installed within the premises of Jahangir's Tomb and the land is owned by the Archaeology Department.
23.	Will the sub project cause any livelihood or economic loss?		✓		
24.	Is the subproject located on land with contested ownership?		✓		
25.	Is the subproject located in a densely populated area?		✓		
26.	Is the sub-project located on prime agricultural land?		✓		
27.	Is the subproject located in an area with security problems?  If Yes  What are the security arrangements?	✓		Trespassing is a common occurrence. Only 2 watchmen are deployed for security. They are not licensed security staff.	Enhancement of Security arrangements is recommended through fencing and hiring licensed security staff.
<b>C. Physical Cultural Resources</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
28.	Is the subproject located in an area with designated cultural properties such as archaeological historical and/or religious sites?  If Yes  What is name and distance from subproject site Possible impacts and their mitigation measures during installation as well as during operational phase	✓		PV System will be installed within the premises of Jahangir's Tomb.	All work activities should be conducted under the supervision of competent person and ensure the protection of historical site from work activities.  All work activities should be conducted in the day light, including material or plant delivery etc. in order to avoid any

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					<p>accidental damage of the heritage site.</p> <p>All site workers should be restricted to the work area and do not move outside work area without permission of the project manager.</p> <p>All waste generated at work site should be collected in the bags and dispose of according to the waste management plan, presented in the EMMP.</p>
29.	Will the sub-project have an impact on archaeological or historical sites?	✓		<p>Unplanned and uncontrolled work activities may have adverse impact on the historical site.</p> <p>Minimizing emission of GHG gases due to switching to clean source of energy will have positive impact on the local environment of the heritage site (Rohtas Fort)</p>	<p>PMU will prepare and implement Physical Cultural Resource Management Plan (PCRMP) before commence work on site. PMU will supervise implementation of PCRMP on site during construction phase of the project.</p>
30.	Will the sub-project have an impact on religious monuments, structures and/or cemeteries?		✓		
31.	Have Chance Finds procedures been prepared for use in the sub-project?	✓		<p>Archeological or religious remains (such as graves etc) may find during the construction activities of the project, particularly during preparation of ground</p>	<p>In case of findings of archeological or religious site during execution of work on site, the work should be stop and immediately inform archeological department and PMU.</p>

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				and earthwork activities	Have Chance Finds procedure is included as an Annexure A.
32.	Will the sub project have negative impact on the visibility and the aesthetic value of any historical or archaeological site?		✓	Installation of PV System may adversely impact on aesthetic value of the historical site.	The PV System installation site was carefully selected and it was ensured that the proposed work scheme does not cause any obstruction in view or deteriorate aesthetic value of the historical site.
<b>D. Operational &amp; Maintenance</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
33.	Is there any plan of O & M for solar panels after installation?	✓			In scope of contractor as initial O&M for two years will be their responsibility.  Suitable training courses should be arranged for the staff involving in managing the operation of the solar system for capacity building.
34.	What will be the mechanism for record keeping regarding panels to be replaced?				An inventory system will be developed for keeping record of any damage or replaced panels.
35.	What will be the procedure for handling hazardous waste if generated?			The only identified hazardous waste which can be generated on site during operation phase of the solar system is the run-off from panel cleaning activity which will	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				include traces of detergent.	
36.	What will be the process of cleaning the solar panels?				Auto cleaning system with water pumps and nozzles will be installed by the vendors for the maintenance and cleaning. 1 to 2 persons will be required for maintaining this cleaning system.
<b>E. General Issues</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
37.	Is the project in a politically sensitive area?		✓		
38.	Will the sub-project make significant demands on utilities and services?		✓	It is envisaged that existing utilities services are sufficient to complete the installation work of solar system.	
39.	Is the subproject located in an area susceptible to landslides or erosion?		✓		
40.	Is the subproject located near a waste dump?		✓		
41.	Is there health safety plan during construction phase and operational phase?	✓		Health & Safety Plan will be required to undertake the work activities.	Contractor will submit his Health & Safety (H&S) Plan to supervision consultant and PMU and get its approval before commence work on site.  The contractor's H&S plan should collate in light of WB Health Safety Guidelines.

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					H&S Plan should be enforced on site and supervised by the competent person from the contractor.

### **E&S Screening Checklist Completed for Shalamar Gardens**

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
<b>A. Environmental Aspects</b>					
1.	Will the sub-project involve significant land disturbance or site clearance?	✓		The available free land is covered with natural vegetation. Vegetation clearance or tree uprooting will be required for preparation of the area for installation of the solar panels system.	New tree plantation will be carried out in the vicinity of the project area as a compensation plantation.  It is proposed to plant minimum 10 more tree for every one tree

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					uprooted on site for the project activities.
2.	Is the subproject located in an area with designated natural reserves?		✓		
3.	Will the subproject cause noise and vibration during construction activities?	✓		During structure installation and earth pit construction some drill work will be involved which may cause noise and vibration in the immediate surrounding area.	The anticipated impact is not significant and localized.  All plant & equipment should be regularly inspected and maintained.  Ensure enforcement of noise control measures as specified in ECoPs <sup>6</sup> .
4.	Will Firefighting equipment provided at site?	✓		Hot work activity will be performed which may lead to fire hazard.	Firefighting equipment should be provided at the site during installation and operation of solar Panels system.  Flammable material will be kept well away from the hot work area.  Fire drills should be arranged and conducted before commence work on site by the contractor. The drill/workshop should be designed to learn the procedure every site workers need to follow in case of fire.  Site works must be trained for type and

<sup>6</sup> Environment code of practices

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					<p>use of correct fire extinguisher.</p> <p>All workers involve in hot work activities should use specified PPEs according to the health &amp; safety plan.</p>
5.	Which types of electrical wires will be used in Solar Panel installation to avoid any electrical shocks and measures regarding safety purposes?			Details are provided in the feasibility and detail design study reports	<p>XLPO/XLPO DC cables will be used and XLPE AC cables will be used. These are thicker insulation cables rated at higher voltage than PVC cables.</p> <p>Proper PPE in form of gloves and insulated boots will be worn by installers</p>
6.	Are there anticipated impacts on building roofs such as structural damage and water leakage into the building?		✓	No impact on building or rooftops is anticipated.	Proposed location is ground mounted rather than roof top.
7.	Is the roof safe, protected and can bear the load of the panels?				
8.	Is there a risk of soil pollution and soil erosion during construction phase?		✓	No Soil Pollution and Soil erosion are anticipated from the work activities.	<p>Unnecessary vegetation removal or excavating ground will be prohibited. Fuel or chemical storage on site will be avoided through better management and arranging periodic delivery of fuel on site.</p> <p>If fuel storage is required on site than ensure that the fuel or chemical are stored in</p>



Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					the designated banded area only.
9.	Are there arrangements in place for proper handling, storage and transport of hazardous waste?	✓		Improper storage and handling of substances leading to contamination of soil and water resources of the area and cause health hazards.	<p>Ensure provision of Material Safety Data Sheet (MSDS) or Control of Substances Hazardous to Health (COSHH) sheets at site.</p> <p>Construct concrete or other impermeable flooring of the material storage area to prevent seepage in case of spills of hazardous material.</p> <p>The contractor will be required to follow the ECoP and dispose of the solid waste in a manner not to contaminate soil or water, not to generate foul odor, and not to spread any vector-borne diseases.</p> <p>The contractor will provide require Personal Protected Equipment (PPE) and ensure all the site workers use them accurately during execution of work activities.</p>
10.	Is the existing capacity of staff sufficient to properly handle, store, transport and dispose of hazardous waste associated with solar panels?	✓		Improper and untrained staff involve in handling of hazardous materials can cause any catastrophic incidents.	Staff should be trained and competent to execute the work activities e.g. material handling, storing, transporting and disposal of hazardous waste

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					<p>produced from work activities.</p> <p>Correct use of appropriate Personal Protective Equipment (PPEs)</p> <p>The project will be on a turnkey basis with the EPC contractor responsible for initial O&amp;M period of 2 years. The client can hire a trainee during this period to learn and then supervise O&amp;M activities after 2 years.</p>
11.	Is the activity result in improper disposal of broken/damaged solar panels, batteries, and supporting structure are planned to address?	✓		There is possibility that activity may result in improper disposal as well as damaging solar panels.	<p>Damaged solar panels and batteries should be collected in the suitable container and send it of site with other hazardous waste for disposal according to the waste management plan which will be provided in the EMMP.</p> <p>SOP will be submitted by the contractor for collection and disposal of the waste before commence work on site.</p>
12.	Are there risks to workers health and safety during maintenance?	✓		Risk of electric shock hazard is identified during maintenance work.	<p>Maintenance work should be conducted by the trained staff</p> <p>Specified PPE will be worn by site workers.</p>
13.	Will the activity result in clearance of natural vegetation from a large tract of land which can potentially disturb	✓		The selected site for PV system installation within the premises of the heritage site	A walk over survey will be conducted before preparation of the ground and if any

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
	thenatural habitat and the associated wildlife species?			(Shalimar Gardens) will require vegetation clearance. However, the selected site is next to the office blocks and therefore, no noticeable adverse impact on biological environment of the area is anticipated.	bird nest or other wildlife habitat (rabbit hole etc.) finds in the area than relocate them to suitable adjacent place.
14.	Will the work activity involve emissions resulting in air Pollution including dust emissions?	✓		Dust, noise and air pollution from plant and equipment emission are anticipated during construction phase of the project. However, there is likely to be a net decrease in GHG emissions because of power generation from a non-fossil fuel source during operational phase of the project.	Use appropriate machine or equipment to execute the work activities.  Inspect and maintain plant and equipment on regular basis.  Carry out regular sprinkling of water on dust prone areas.  Use appropriate PPEs by all site workers.
15.	Is the sub-project located close to Groundwater sources, surface water bodies, water courses or wetlands?		✓	Nearest surface water body are Shalimar Gardens Water ponds located more than 50m away from the selected site.  Percolation of contaminated surface runoff can deteriorate the water quality of groundwater resources of the area.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies and seeping into freshwater bodies.  Any waste water produced will be disposed into the existing Lahore WASA's sewerage line.
16.	Is the sub-project located in an area with endangered or conservation-worthy ecosystems, fauna or flora?		✓		
17.	Does the roof need any repair to ensure its safety and ensure its			Not applicable	

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
	capacity to hold the additional load of the proposed solar PV system?				
18.	Is rooftop access available at all times? Are there any permanent or temporary encumbrances/obstructions on the rooftop?			Not applicable (proposed system is ground mounted)	
19.	Does the rooftop has access to water which is required for washing of panels?			Not applicable	
20.	Is there any plan of waste disposal/recycling system in place if any panel (s) needs to be changed or due to battery damage etc.?	✓		There will be a risk of damaging battery or panels to be broken during installation.	When installation of solar panels and technology is finalized, vendor will be asked to submit plan for its disposal and/or recycling of damaged panels etc. Waste Management Plan including (hazardous waste management) will be included in the Environmental Management & Monitoring Plan (EMMP).  This will also be covered in the SOP sourced from the contractor.
21.	Are there any possible damages envisaged caused by falling of broken solar panels and supporting structure?	✓		There is a possibility that falling of solar panels and their support structure can cause substantial damage in the buildings and also broken by the windstorm.	The consultant will ensure that all safety factors are accounted for in the design phase, for instance SAP report of structure will be submitted by the contractor and the consultant will ensure that the structure is rated for the highest wind gust expected at site.
<b>B. Social Aspects</b>					

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
22.	Does the subproject require land acquisition?		✓		The proposed site for the PV System will be installed within the premises of Shalimar Garden and the require land is owned by the Archaeology Department.
23.	Will the sub project cause any livelihood or economic loss?		✓		
24.	Is the subproject located on land with contested ownership?		✓		
25.	Is the subproject located in a densely populated area?		✓		The area chosen for PV System installation is out of the public eye in the premises of Shalimar Gardens. However, the Gardens located within a congested part of Lahore city.  Site deliveries and heavy vehicle movement in the area for the project activities should be controlled and ensure the project activities have minimum adverse impact on the local population.
26.	Is the sub-project located on prime agricultural land?		✓		
27.	Is the subproject located in an area with security problems?  If Yes  What are the security arrangements?	✓		Trespassing is a common occurrence in the area.	Security arrangements such as fencing & hiring of licensed security staff are proposed for protecting the

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					installed solar energy system.
<b>C. Physical Cultural Resources</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
28.	<p>Is the subproject located in an area with designated cultural properties such as archaeological historical and/or religious sites?</p> <p>If Yes</p> <p>What is name and distance from subproject site</p> <p>Possible impacts and their mitigation measures during installation as well as during operational phase</p>	✓		PV System will be installed within the premises of Shalimar Garden.	<p>All work activities should be conducted under the supervision of competent person and ensure the protection of historical site from work activities.</p> <p>All work activities should be conducted in the day light, including material or plant delivery etc. in order to avoid any accidental damage of the heritage site.</p> <p>Maintain specified speed limit within the premises of Shalimar Gardens.</p> <p>All site workers should be restricted to the work area and do not move outside work area without permission of the project manager.</p> <p>All waste generated at work site should be collected in the bags and dispose of according to the waste management plan, presented in the EMMP.</p>
29.	Will the sub-project have an impact on archaeological or historical sites?	✓		Unplanned and uncontrolled work activities may have	PMU will prepare Physical Cultural Resource

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
				adverse impact on the historical site.  Minimizing emission of GHG gases due to switching to clean source of energy will have positive impact on the local environment of the heritage site.	Management Plan (PCRMP) before commence work on site. During construction, the contractor will be responsible to implement PCRMP on site and supervised by PMU.
30.	Will the sub-project have an impact on religious monuments, structures and/or cemeteries?		✓		
31.	Have Chance Finds procedures been prepared for use in the sub-project?	✓		Archeological or religious remains (such as graves etc) may find during the construction activities of the project, particularly during preparation of ground and earthwork activities	In case of findings of archeological or religious site during execution of work on site, the work should be stop and immediately inform archeological department and PMU.  Have Chance Finds procedure is included as an Annexure B.
32.	Will the sub project have negative impact on the visibility and the aesthetic value of any historical or archaeological site?		✓	Installation of PV System may adversely impact on aesthetic value of the historical site.	The PV System installation site was carefully selected and it was ensured that the proposed work scheme does not cause any obstruction in view or deteriorate aesthetic value of the historical site.
<b>D. Operational &amp; Maintenance</b>					
33.	Is there any plan of O & M for solar panels after installation?	✓			It will be the contractor's responsibility to implement O&M manual during first two years of the

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					<p>operational phase of the sub-project.</p> <p>Suitable training courses should be arranged for the staff involving in managing the operation of the solar system for capacity building.</p>
34.	What will be the mechanism for record keeping regarding panels to be replaced?				An inventory system will be developed for keeping record of any damage or replaced panels.
35.	What will be the procedure for handling hazardous waste if generated?			<p>The only identified hazardous waste which can be generated on site during operation phase of the solar system is the run-off from panel cleaning activity which will include traces of detergent.</p>	<p>Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies.</p> <p>Wastewater produce from cleaning work may dispose of into the existing WASA's sewerage line with the approval of WASA. Wastewater testing may require before discharge the wastewater into the exiting sewerage, depend on response of WASA.</p>
36.	What will be the process of cleaning the solar panels?				Auto cleaning system with water pumps and nozzles will be installed by the vendors for the maintenance and cleaning. 1 to 2 persons will be required for



Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
					maintaining this cleaning system.
<b>E. General Issues</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
37.	Is the project in a politically sensitive area?		✓		
38.	Will the sub-project make significant demands on utilities and services?		✓	It is envisaged that existing utilities services are sufficient to complete the installation work of solar system.	
39.	Is the subproject located in an area susceptible to landslides or erosion?		✓		
40.	Is the subproject located near a waste dump?		✓		
41.	Is there health safety plan during construction phase and operational phase?	✓		Health & Safety Plan will be required to undertake the work activities.	<p>Contractor will submit his Health &amp; Safety (H&amp;S) Plan to PMU and get its approval before commence work on site.</p> <p>The contractor's H&amp;S plan should collate in light of WB Health Safety Guidelines.</p> <p>H&amp;S Plan should be enforced on site and supervised by the competent person from the contractor.</p>

### **E&S Screening Checklist Completed for Harappa Museum**

Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
<b>A. Environmental Aspects</b>					
1.	Will the sub-project involve significant land disturbance or site clearance?		✓		
2.	Is the subproject located in an area with designated natural reserves?		✓		
3.	Will the subproject cause noise and vibration during construction activities?	✓		During structure installation, some drill work will be involved. The impact is localized.	All plant & equipment should be regularly inspected and maintained.  Ensure enforcement of noise control measures as specified in ECoPs <sup>7</sup> .  Carried out regular noise monitoring as per requirement of the EMMP.
4.	Will Firefighting equipment provided at site?	✓		Hot work activity will be performed which may lead to fire hazard.	Firefighting equipment should be provided at the site during installation and operation of solar Panels system.  Flammable material will be kept well away from the hot work area.  Fire drills should be arranged and conducted before commence work on site by the contractor. The drill/workshop should be designed to learn the procedure every site workers need to follow in case of fire.

<sup>7</sup> Environment code of practices

					<p>Site works must be trained for type and use of correct fire extinguisher.</p> <p>All workers involve in hot work activities should use specified PPEs according to the health &amp; safety plan..</p>
5.	Which types of electrical wires will be used in Solar Panel installation to avoid any electrical shocks and measures regarding safety purposes?			Details are provided in the feasibility and detail design study reports	<p>XLPO/XLPO DC cables will be used and XLPE AC cables will be used. These are thicker insulation cables rated at higher voltage than PVC cables.</p> <p>Ensure all site workers use specified PPE on site (according to risk assessment or health &amp; safety plan prepared for the sub-project)</p>
6.	Are there anticipated impacts on building roofs such as structural damage and water leakage into the building?	✓		In case of direct penetration into the roof, water ingress becomes crucial. Structural damage is possible in case the roof is not able to bear the load.	<p>Ballasted system is proposed which is non penetrative type.</p> <p>The selected roofs of the Museum building and rest house are 50 years old whereas the Auditorium was inaugurated in 2021.</p>
7.	Is the roof safe, protected and can bear the load of the panels?				<p>It is recommended that structure stability analysis be included in the scope of the EPC vendor before commencement of construction activities.</p>
8.	Is there a risk of soil pollution and soil erosion during construction phase?		✓	No Soil Pollution and Soil erosion are anticipated	Unnecessary vegetation removal or

				from the work activities.	excavating ground will be prohibited.  Fuel or chemical storage on site will be avoided through better management and arranging periodic delivery of fuel on site.  If fuel storage is require on site than ensure that the fuel or chemical are stored in the designated banded area only.
9.	Are there arrangements in place for proper handling, storage and transport of hazardous waste?	✓		Improper storage and handling of substances leading to contamination of soil and water resources of the area and cause health hazards.	Ensure provision of Martial Safety Data Sheet (MSDS) or Control of Substances Hazardous to Health (COSHH) sheets at site.  Provide concrete or other impermeable flooring of the material storage area to prevent seepage in case of spills of hazardous material.  The contractor will be required to follow the ECoP and dispose of the solid waste in a manner not to contaminate soil or water, not to generate foul odor, and not to spread any vector-borne diseases.  The contractor will provide required Personal Protected Equipment (PPE) and ensure all the site workers use them accurately during execution of work activities.

10.	Is the existing capacity of staff sufficient to properly handle, store, transport and dispose of hazardous waste associated with solar panels?		✓	Untrained staff involved in handling hazardous materials can cause a catastrophic incidents.	<p>Staff should be trained and competent to execute the work activities e.g. material handling, storing, transporting and disposal of hazardous waste produced from work activities.</p> <p>Correct use of specified Personal Protective Equipment (PPEs)</p> <p>The project will be on a turnkey basis with the EPC contractor responsible for initial O&amp;M period of 2 years. The client can hire a trainee during this period to learn and then supervise O&amp;M activities after 2 years.</p>
11.	Will the activity result in improper disposal of broken/damaged solar panels, batteries, and supporting structure are planned to address?	✓		Damaged Solar Panels cause health hazards and need to be addressed.	<p>Damaged solar panels and batteries should be collected in the suitable container and send it of site with other hazardous waste for disposal according to the waste management plan which will be provided in the EMMP.</p> <p>SOP will be submitted by the contractor for collection and disposal of the waste before commence work on site.</p>
12.	Are there risks to workers health and safety during maintenance?	✓		Risk of electric shock hazard is identified during maintenance work.	Maintenance work should be conducted by the trained staff

					<p>Ensure all site workers use the specified PPE.</p> <p>Detailed EMMP will be prepared and detailed mitigation measures will be provided.</p>
13.	Will the activity result in clearance of natural vegetation from a large tract of land which can potentially disturb the natural habitat and the associated wildlife species?		✓		
14.	Will the work activity involve emissions resulting in air Pollution including dust emissions?	✓		<p>Dust, noise and air pollution from plant and equipment emission are anticipated during construction phase of the project. However, there is likely to be a net decrease in GHG emissions because of power generation from a non-fossil fuel source during operational phase of the project.</p>	<p>Use appropriate machine or equipment to execute the work activities.</p> <p>Inspect and maintain plant and equipment on regular basis.</p> <p>Carry out regular sprinkling of water on dust prone areas.</p> <p>Use appropriate PPEs by all site workers.</p>
15.	Is the sub-project located close to Groundwater sources, surface water bodies, water courses or wetlands?		✓	<p>Percolation of contaminated surface runoff can deteriorate the water quality of groundwater resources of the area.</p>	<p>Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies and seeping into freshwater bodies.</p> <p>Harappa Museum has a system of water bore/water hydrants to utilize the ground water. Monitor groundwater quality of the turbine on regular basis during execution and early</p>

					stage of operational phase of the project.
16.	Is the sub-project located in an area with endangered or conservation-worthy ecosystems, fauna or flora?		✓		
17.	Does the roof need any repair to ensure its safety and ensure its capacity to hold the additional load of the proposed solar PV system?				Any proposed rectifications can only be identified once a proper structure stability analysis for the rooftops has been carried out by the ECP contractor.
18.	Is rooftop access available at all times? Are there any permanent or temporary encumbrances/obstructions on the rooftop?		✓		There is only a temporary access available to all three rooftops in form of movable ladder.
19.	Does the rooftop has access to water which is required for washing of panels?		✓		Providing Permanent access will be included in the EPC contract only for Auditorium due to its height from ground level.  As per site survey activity only the rest house has rooftop water access. Water distribution network has been included in the scope of EPC contractor.
20.	Is there any plan of waste disposal/recycling system in place if any panel (s) needs to be changed or due to battery damage etc.?	✓		There will be a risk of damaging battery or panels to be broken during installation.  Damaged batteries of panels are a hazardous waste.	When installation of solar panels and technology is finalized, vendor will be asked to submit plan for its disposal and/or recycling of damaged panels etc. Waste Management Plan including (hazardous waste management) will be included in the Environmental

					Management & Monitoring Plan (EMMP).  This will also be covered in the SOP sourced from the contractor.
21.	Are there any possible damages envisaged caused by falling of broken solar panels and supporting structure?	✓		There is a possibility that falling of solar panels and their support structure can cause substantial damage to the buildings and also broken by the windstorm.	The consultant will ensure that all safety factors are accounted for in the design phase, for instance SAP report of structure will be submitted by the contractor and the consultant will ensure that the structure is rated for the highest wind gust expected at site.
<b>B. Social Aspects</b>					
22.	Does the subproject require land acquisition?		✓		The proposed site for the PV System will be installed within the premises of Harappa Museum and the land is owned by the Archaeology Department.
23.	Will the sub project cause any livelihood or economic loss?		✓		
24.	Is the subproject located on land with contested ownership?		✓		
25.	Is the subproject located in a densely populated area?		✓		
26.	Is the sub-project located on prime agricultural land?		✓		
27.	Is the subproject located in an area with security problems?  If Yes	✓		Trespassing is a common occurrence. The security is managed by the staff of	Enhancing security arrangements are recommended through hiring



	What are the security arrangements?			Archaeology Dept at Harappa Museum. At present there is no licensed security staff.	specialized security staff.
<b>C. Physical Cultural Resources</b>					
Sr. No.	Issues	Yes	No	Impacts Description	Mitigation Measures
28.	<p>Is the subproject located in an area with designated cultural properties such as archaeological historical and/or religious sites?</p> <p>If Yes</p> <p>What is name and distance from subproject site</p> <p>Possible impacts and their mitigation measures during installation as well as during operational phase</p>	✓		PV System will be installed within the premises of Harappa Museum.	<p>All work activities should be conducted under the supervision of competent person and ensure the protection of historical site from work activities.</p> <p>All work activities should be conducted in the day light, including material or plant delivery etc. in order to avoid any accidental damage of the heritage site.</p> <p>All site workers should be restricted to the work area and do not move outside work area without permission of the project manager.</p> <p>All waste generated at work site should be collected in the bags and dispose of according to the waste management plan, presented in the EMMP.</p>
29.	Will the sub-project have an impact on archaeological or historical sites?	✓		Unplanned and uncontrolled work activities may have adverse impact on the historical site.	PMU will prepare and supervise implementation of Physical Cultural Resource Management Plan (PCRMP). The

				Minimizing emission of GHG gases due to switching to clean source of energy will have positive impact on the local environment of the heritage site	contractor will implement PCRMP on site during construction phase of the project.
30.	Will the sub-project have an impact on religious monuments, structures and/or cemeteries?		✓		
31.	Have Chance Finds procedures been prepared for use in the sub-project?	✓		The PV Solar system will be roof mounted however, in case any trenching is required on ground there is a possibility of finding artefacts and remains of archaeological significance.	In case of findings of archeological or religious site during execution of work on site, the work should be stop and immediately inform archeological department and PMU.  Chance Finds procedure is included as an Annexure B.
32.	Will the sub project have negative impact on the visibility and the aesthetic value of any historical or archaeological site?		✓	Installation of PV System may adversely impact on aesthetic value of the historical site.	The buildings chosen for installing roof mounted systems are unrelated to the archaeological sites. Only the Museum building will have some impact, however it has been ensured that nominal PV system size is placed there.
<b>D. Operational &amp; Maintenance</b>					
<b>Sr. No.</b>	<b>Issues</b>	<b>Yes</b>	<b>No</b>	<b>Impacts Description</b>	<b>Mitigation Measures</b>
33.	Is there any plan of O & M for solar panels after installation?	✓			It will be the contractor's responsibility to implement O&M manual during first two years of the

					operational phase of the sub-project.  Suitable training courses should be arranged for the staff involving in managing the operation of the solar system for capacity building.
34.	What will be the mechanism for record keeping regarding panels to be replaced?				An inventory system will be developed for keeping record of any damage or replaced panels.
35.	What will be the procedure for handling hazardous waste if generated?			The only identified hazardous waste which can be generated on site during operation phase of the solar system is the run-off from panel cleaning activity which will include traces of detergent.	Proper drainage system will mitigate the risk of run-off water from cleaning activity from percolating into the ground water bodies.
36.	What will be the process of cleaning the solar panels?				Auto cleaning system with water pumps and nozzles will be installed by the vendors for the maintenance and cleaning. 1 to 2 persons will be required for maintaining this cleaning system.
<b>E. General Issues</b>					
<b>Sr. No.</b>	<b>Issues</b>	<b>Yes</b>	<b>No</b>	<b>Impacts Description</b>	<b>Mitigation Measures</b>
37.	Is the project in a politically sensitive area?		✓		
38.	Will the sub-project make significant demands on utilities and services?		✓	It is envisaged that existing utilities services are sufficient to	

				complete the installation work of solar system.	
39.	Is the subproject located in an area susceptible to landslides or erosion?		✓		
40.	Is the subproject located near a waste dump?		✓		
41.	Is there health safety plan during construction phase and operational phase?	✓		Health & Safety Plan will be required to undertake the work activities.	<p>Contractor will submit his Health &amp; Safety (H&amp;S) Plan to supervision consultant and PMU and get its approval before commence work on site.</p> <p>The contractor's H&amp;S plan should collate in light of WB Health Safety Guidelines.</p> <p>H&amp;S Plan should be enforced on site and supervised by the competent person from the contractor.</p>

## **ANNEX C: Location Maps for Solar Panels Installation**

### **Location Map for Solar Panels Installation at Wah Gardens**



### **Location Map for Solar Panels Installation at Taxila Museum**



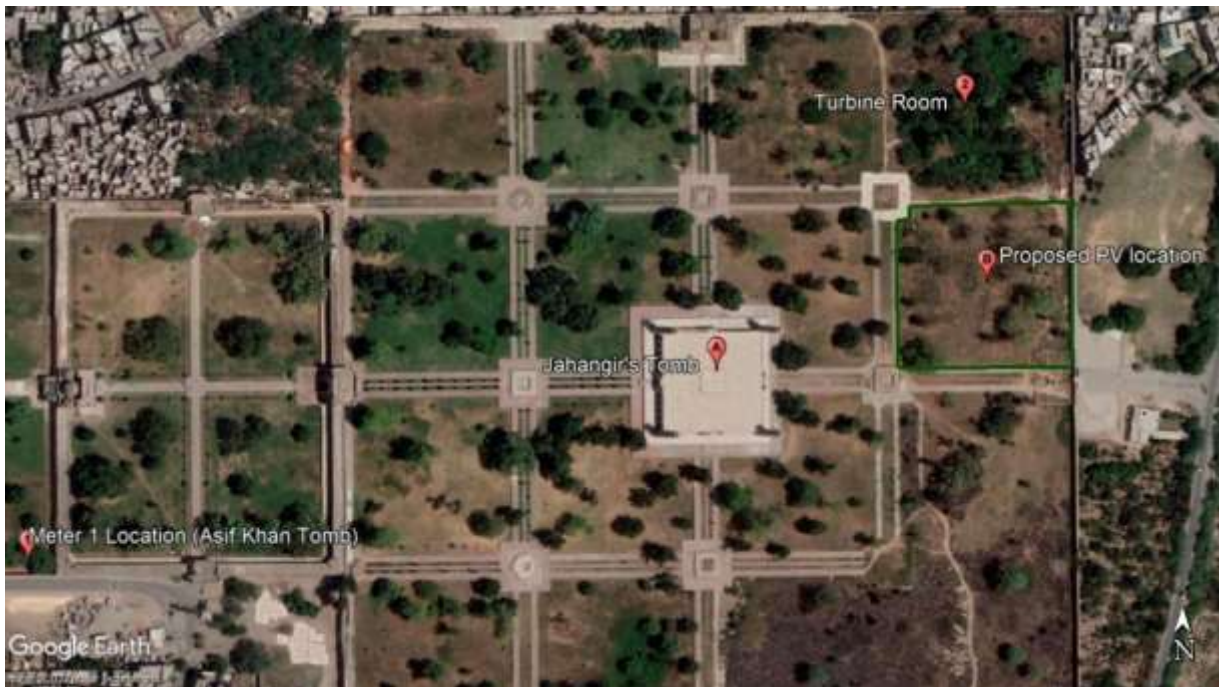
**Location Map for Solar Panels Installation at Rohtas Fort**



**Location Map for Solar Panels Installation at Hiran Minar**



**Location Map for Solar Panels Installation at Jahangir’s Tomb**



**Location Map for Solar Panels Installation at Shalamar Gardens**



**Location Map for Solar Panels Installation at Harappa Museum**





## **ANNEXURE D: Chance Find Procedures**

Chance find procedures which will be used during this sub-project are as follows:

- Stop the construction activities in the area of the chance find;
- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities and the Ministry in charge of Department of Archaeology take over;
- Notify the supervisory Engineer who in turn will notify the responsible local authorities and the Ministry immediately (within 24 hours or less);
- Responsible local authorities and the Ministry in charge of Department of Archaeology would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archeologists of the Department of Archaeology and Museums (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
- Decisions on how to handle the finding shall be taken by the responsible authorities and the Ministry in charge of Department of Archaeology. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage;
- Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the Ministry in charge of Department of Archaeology; and
- Construction work could resume only after permission is given from the responsible local

authorities and the Ministry in charge of Department of Archaeology concerning safeguard of the heritage.

These procedures must be referred to as standard provisions in construction contracts, when applicable. During sub-project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed.

**ANNEXURE E: COVID 19 Precautions**

Communication & Works Department  
Government of the Punjab  
Lahore

**احتیاطی ہدایات برائے (COVID-19) کو روکنا و ناڈائرس انفیکشن**

یہ احتیاطی ہدایات تمام کنسٹرکشن سائٹس پر نافذ العمل محلوں کی اور محکمہ تعمیرات و مواصلات کے کنویکٹرز اور سپروائزرز ان پر عمل در آمد کو یقینی بنائیں گے۔

۱۔ یہ ہدایات، تمام کنسٹرکشن سائٹس جن پر کام جاری ہے، یہ نمایاں طور پر پتھر اور سٹریمرز کی صورت میں آویزاں کی جائیں گی۔

۲۔ تمام ٹھیکیداران اپنی کنسٹرکشن سائٹس پر جسمانی دورہ کر کے چیک کرنے کیلئے ٹیپو گراف کی دستیابی یقینی بنائیں گے

۳۔ کنسٹرکشن سائٹس پر کام کرنے والے تمام عملے بشمول مزدور، ٹیکنیکل سٹاف، ڈرائیور، سپروائزرز سٹاف کا ٹیپو گراف روزانہ کام شروع کرنے سے پہلے چیک کیا جائے گا اور اس پر پکارا کر دکھایا جائے گا۔

۴۔ کسی بھی مزدور یا دیگر عملے میں وائرس کی علامات ظاہر ہونے کی صورت میں فوری طور پر طبی انتظامیہ کو مطلع کیا جائے گا۔

۵۔ ایسے کسی بھی شخص کو جس میں گلے یا ناک کی بیماری مثلاً زکام، کھانسی، نزلہ وغیرہ ہو، کو کام پر آنے کی اجازت نہ ہوگی۔

۶۔ کنسٹرکشن سائٹس پر ہاتھ دھونے کے امکانات بشمول پانی و صابن کی دستیابی متعلقہ ٹھیکیدار کی ذمہ داری ہوگی۔

۷۔ ٹھیکیداران اس بات کو یقینی بنائیں گے کہ صبح کام شروع کرنے سے پہلے تمام عملے صابن سے ہاتھ دھوئے گا۔ اور ہر ایک گھنٹے بعد کام پر موجود ہر فرد اپنے ہاتھ صابن سے دھوئے گا۔

۸۔ جس جگہ پر عملے کام کر رہا ہو وہاں پر گلوہیں لٹے پائی سے روزانہ پیرے کیا جائے گا تاکہ وہ علاقہ جراثیم اور وائرس سے پاک رہے۔

۹۔ جہاں تک ممکن ہو اس بات کو یقینی بنایا جائے کہ مزدور اور دیگر عملے کام ختم ہونے کے بعد گھر جانے سے پہلے صابن سے نہا کر جائے اور کام والے کپڑے وہیں چھوڑ کر جائے

۱۰۔ اگر مزدور یا دیگر عملے کنسٹرکشن سائٹس پر ہی رہائش پذیر ہے تو ان کی رہائش پر مناسب تاحی لحاظ کو یقینی بنایا جائے۔

۱۱۔ کنسٹرکشن سائٹس پر جراثیم کش محلول (Hand Sanitizers / Hand Wash etc) کی دستیابی اور استعمال یقینی بنایا جائے گا۔

**ANNEXURE F: Environmental Management and Monitoring Checklist**

Sr.#	Environmental impacts	Status (Yes or No)	Mitigation Measures Implemented			Reason for non-compliance (If status is “ No” )	Supervision Responsibility (Contractor/Site Sub-engineer)
			Details	Status (Yes/No)	Means of Monitoring (Documents/Pictorial Proof)		
1.	Can the construction works cause soil subsidence and/or Erosion?	Yes/No	Take all measures - such as fixing of protective meshing/wire net, construction of retaining walls, and/or protective walls - to avoid any soil subsidence and erosion.				
2.	Are the contaminants (such as toilet waste) from the construction site being released to the environment?	Yes/No	The existing toilet facilities will be used if available. Otherwise temporary toilet facility either connected with the sewer system, or having appropriate disposal system such as septic tank and soakage pit will be established at the site.				
3.	Are the effluents from the site causing or likely to	Yes/No	<ul style="list-style-type: none"> <li>No sediments or debris will be released/disposed in the</li> </ul>				

	cause additional sediment load in the receiving water?		<p>open/nearby water ways (water body).</p> <ul style="list-style-type: none"> <li>• Appropriate sediment control measures will be taken to prevent sediments from moving off-site and causing excessive turbidity in the waterways.</li> </ul>				
4.	Are the effluents or debris from the site choking or likely to choke the existing sewer or drain?	Yes/No	<ul style="list-style-type: none"> <li>• No sediments or debris will be released / disposed in the drains.</li> <li>• Appropriate sediment control measures will be taken to prevent sediments from entering the drains/sewer.</li> </ul>				
5.	Are the construction activities producing or likely to produce significant quantities of construction wastes?	Yes/No	<ul style="list-style-type: none"> <li>• Waste collection and disposal arrangements/locations will be identified for all major waste types expected from the construction activities.</li> <li>• Construction waste will be disposed properly using the approved method at approved locations by taking</li> </ul>				

			<p>services from TMA<sup>10</sup>.</p> <ul style="list-style-type: none"> <li>• The records of waste disposal will be maintained as proof for proper management as designed/planned.</li> <li>• Wherever feasible, the waste will be reused and/or recycled.</li> </ul>				
6.	<p>Are the construction activities blocking or likely to block any road/access/approach?</p>	<p><b>Yes/No</b></p>	<ul style="list-style-type: none"> <li>• The construction machinery should not be placed in a manner that blocks any roads, paths or local accesses.</li> <li>• The construction material or wastes should be placed in an orderly manner, avoiding blockage of any roads, paths or local accesses.</li> <li>• The unloading of the construction material will be carried out in a manner so as to avoid blockage of the roads/paths/accesses.</li> <li>• Provision of alternate routes is ensured.</li> </ul>				

<sup>10</sup> Tehsil Municipal Authority

			<ul style="list-style-type: none"> <li>• Indicators/signboards regarding alternate routes should be provided at proper distance to avoid accidents.</li> </ul>				
7.	Are the construction activities causing or likely to cause air quality deterioration?	Yes/No	<ul style="list-style-type: none"> <li>• Keep the surroundings free from debris to minimize dust.</li> <li>• There will not be excessive idling of construction machinery/vehicles at site.</li> <li>• Water sprinkling will be carried out in case of excessive dust emissions.</li> <li>• Periphery screens will be used around the work site.</li> <li>• Air quality to be analyzed during execution phase.</li> </ul>				
8.	Are the construction activities causing or likely to cause excessive noise and vibration?	Yes/No	<ul style="list-style-type: none"> <li>• Night time construction will be avoided, particularly the noise generating activities.</li> <li>• The powered machinery (as concrete mixer) will have proper silencers (mufflers). This machinery will be placed</li> </ul>				



			<p>as far from the residential areas as possible.</p> <ul style="list-style-type: none"> <li>• Provision for Personal Protective Equipment (PPE's), ear muffs/ear plugs to workers</li> <li>• Noise level monitoring should be executed near noise producing activities.</li> </ul>				
9.	Are the construction activities causing or likely to cause traffic congestion/blockage on the nearby roads?	Yes/No	<ul style="list-style-type: none"> <li>• The transportation of the construction material will be scheduled to avoid rush hours.</li> <li>• The unloading of the construction material will be carried out in a manner so as to avoid traffic blockage.</li> <li>• Provision of alternative routes is ensured.</li> <li>• Indicators/signboards regarding alternate routes be provided at proper distance</li> <li>• Traffic Management</li> </ul>				

			Plan should be displayed at scheme site.				
10.	Are the construction activity causing or likely to cause negative impacts on the biological resources?	Yes/No	<ul style="list-style-type: none"> <li>• Tree cutting at the site will be avoided as far as possible. Compensatory tree plantation will be carried out at the site if tree cutting is necessary. Planting of ten trees for every single tree cutting.</li> <li>• Mark and cordon off any large tree in the vicinity of the construction activity, protect its root system, and avoid any damage to it.</li> </ul>				

<p>11.</p>	<p>Are there any safety hazard concerns for the workers or the nearby population?</p>	<p><b>Yes/No</b></p>	<ul style="list-style-type: none"> <li>• All works to be carried out in a safe and disciplined manner. Workers will use appropriate personal protective equipment (PPE) as needed.</li> <li>• Appropriate safety railings/fencing will be installed where needed.</li> </ul>				
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			<ul style="list-style-type: none"> <li>• No un-authorized access to the site will be allowed.</li> <li>• All measures will be taken to protect the nearby population, particularly children, from the construction activities, loading/unloading of construction activities, loading/unloading of material, and machinery/vehicle operation.</li> <li>• Appropriate signage will be fixed at the site to inform/educate the workers to follow the key rules, regulations, and safety practices.</li> <li>• First-aid boxes will be made available at the site.</li> <li>• List of important telephone numbers (fire stations, hospitals, police and others) will be placed at the appropriate location at the site.</li> </ul>				
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<p><b>12.</b></p>	<p>Will there be any Infrastructure Losses i.e. loss of land, damage to structures, damage to plants etc. during the construction works?</p>	<p><b>Yes /No</b></p>	<ul style="list-style-type: none"> <li>• No land acquisition is involved</li> <li>• No Public structures are found to be affected in the sub-project area.</li> <li>• No livelihood will be affected by sub-project activity</li> <li>• No shops are found to be affected.</li> <li>• No permanent vendors are observed during social and environmental assessment survey</li> </ul>				
<p><b>13.</b></p>	<p>Will there be any system of first aid provision in case of emergency available during the construction works?</p>	<p><b>Yes/No</b></p>	<ul style="list-style-type: none"> <li>• First aid will be provided immediately to save the life of affected.</li> <li>• Emergency numbers will be displayed at appropriate places</li> </ul>				

14.	Will the construction works likely to produce dust in the air of the nearby community?	Yes/No	<ul style="list-style-type: none"> <li>• Provision for personal protective equipment (PPE's)</li> <li>• Regular sprinkling of water during construction phase.</li> </ul>				
15.	Is there a proper method of storage of fuels and construction materials?	Yes/No	<ul style="list-style-type: none"> <li>• All fuel tanks etc. to be banded, no discharge allowed into the sewerage collection system.</li> <li>• No significant storage of fuels on site is expected during the construction Phase</li> <li>• Ventilated Gas storage cages.</li> </ul>				
16.	Are the construction activity causing or likely to cause transmission of Diseases & HIV/AIDS, COVID 19 prevention & control?	Yes/No	<ul style="list-style-type: none"> <li>• Contractor will create awareness among workers to prevent transmission of diseases between the local inhabitants &amp; the labors engaged for the works</li> <li>• Contractor shall extend necessary support to the appointed agency by deputing the workmen to attend the awareness creation programs.</li> </ul>				

17.	Are the construction activity causing or likely to cause privacy Issues of nearby communities especially, women and children?		<ul style="list-style-type: none"> <li>• Contractors would be trained to address privacy issues behave ethically.</li> <li>• Labors will be strictly asked to respect privacy of local residents.</li> </ul>				
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**Checklist filled by:**

Name: -----

Designation: -----

Signature:

Date:

**Checklist reviewed by:**

Name: -----

Designation: -----

Signature:

Date: