Sherabad Solar PV Project

Non-Technical Summary (NTS)

Masdar

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Quality information

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1. Introduction

The Government of Uzbekistan (GoU) is planning the construction of large solar power station in the Sherabad region of Uzbekistan. The new solar power station will produce a maximum of 456.7MW of electricity and will form an important part of for the local and national power supply.

It is important for the GoU to understand how the new solar power station could affect the environment and local communities and they asked independent specialists to undertake an Environmental and Social Impact Assessment (ESIA) of the new solar plant. This Non-Technical Summary (NTS) presents the key findings of the Environmental and Social Impact Assessment for the solar park, both positive and negative. The ESIA considers the construction and operation of the solar plant, transformers and an overhead power line connection to the national grid.

The aim of the ESIA involved an assessment of the existing environment; review of the relevant legislation; stakeholder engagement including public participation and consultation; identification of potential environment impacts during the pre-construction, construction, operation and decommissioning phases of the Project; and development of an appropriate management framework for the mitigation of negative effects associated with the proposed Project.

Based on the ESIA findings, the following conclusions have been reached and recommendations made:

- Sherabad solar PV plant will produce local, clean energy which will reduce Uzbekistan's use of fossil fuels required to drive thermal power plants. Thermal power plants are costly and release carbon dioxide into the air, making a significant contribution to changes in the global climate. The Project contributes directly to Uzbekistan's low carbon pathway strategies.
- Positive impacts of the proposed Project are expected due to the financial contribution the project will make to the regional and national economy during construction and operation. It is also hoped that the project will increase local employment and training during construction and operation.
- The Solar Plant has the potential to cause some level of negative environmental and social impact as it is described in the Section 4.
- The majority of potential environmental impacts are considered to be minor and will be reduced through by the use of simple management controls that will be applied during the construction and operation of the solar plant.

Figure 1-1. Project Location

1.1 Project Background

The Government of Uzbekistan aims to develop up to 12 gigawatts (GW) of solar and wind projects by 2030 through the development of privately financed and operated renewable energy projects. The Asian Development Bank (ADB) has been advising the Government of Uzbekistan on procurement and structuring of the Sherabad Solar Project. The first solar photovoltaic (PV) plant, with 100 megawatt (MW) peak capacity, developed through Scaling Solar Program by the World Bank is being constructed in Navoi region at the time of publication of this report.

This report covers the development of a 456.7 MWac solar PV project in Sherabad District, Surkhandarya region of Uzbekistan, referred to as “the Project”. The Project site area is approximately 631 ha. The Project will also comprise a 50.5 km overhead transmission line from the on-site substation to the existing substation.

The generation of a minimum 456.7 MWac of renewable energy, which is expected to provide clean energy to approximate 500,000 households in the Surkhandarya region.

Table 1-1. Key Project characteristics

Location	Sherabad District, Surkhandarya region, Republic of Uzbekistan
Installed capacity	456.7 MWac
Solar PV Site area	Approx 631ha
Overhead grid connection line	50.50 km 220 kV Steel lattice towers
National grid substation	Surkhan substation is located in the Jarkurgan district

2. The Project

2.1 Project Location

The solar Project site is located in the Sherabad district of Surkhandarya province. The site location is demonstrated in the previous Figure 1-1, which shows the Project site for the solar PV Area (green), and the overhead transmission line route (red). The Project site area is approximately 631 ha. Additionally, there will be a new transmission line which is 50.5 km long and passes through agricultural land, running across Sherabad, Kizirik and Jarkurgan districts of Surkhandarya province. The existing Surkhan national grid substation is located in the Jarkurgan district and will be connected to the project via the new transmission line.

Regionally, the Sherabad population amounts 193,200 people, consisting of 44,439 families who live in 34,364 households. The project land is mainly used for the arable cultivation and the area in and around the proposed transmission line is used for the livestock / animal grazing. The site is proposed to be accessed from the minor road at Talashkan through the village.


Figure 2-1. Project Site (left) and Overhead Line (right)

2.2 Overview of Solar Photovoltaic (PV) Technology

The In general terms, solar PV technology converts the sun's energy into electricity using a series of solar panels, inverters and transformers to connect to the electricity grid.

The performance of a PV module will decrease over time due to degradation. Degradation rate depends on the environmental conditions in the local area and the technology of the module.

Modules are either mounted on fixed-angle frames or on sun-tracking frames. Fixed frames are simpler to install, cheaper and require less maintenance. However, tracking systems can increase yield by up to 20%. Tracking, particularly for areas with a high direct/diffuse irradiation ratio, also enables a smoother power output.

PV modules and inverters are all subject to certification, predominantly by the International Electrotechnical Commission (IEC). New standards are currently under development for evaluating PV module components and materials.

The performance ratio of a well-designed PV power plant will typically be in the region of 77% to 86% (with an annual average performance ratio of 82%), degrading over the lifetime of the plant. In general, good quality PV modules may be expected to have a useful life of 25 to 30 years.

The main components of the solar PV Project are:

- Solar PV modules: These convert solar radiation directly into electricity.
- Inverters: These are required to convert the DC electricity to alternating current (AC) for connection to the utility grid.
- Module mounting (or tracking) systems: These allow PV modules to be securely attached to the ground at a fixed tilt angle, or on sun-tracking frames.
- Step-up transformers: The output from the inverters requires a further step-up in voltage to reach the AC grid voltage level.
- The grid connection interface: This is where the electricity is exported into the grid network.

2.3 Project Team

2.3.1 Developer

The Project is being developed by Masdar (Abu Dhabi Future Energy Company PJSC). Masdar has been selected through a competitive tender set up by the Ministry of Investment and Foreign Trade, the Ministry of Finance, and the Ministry of Energy with assistance from the International Finance Corporation (IFC).

Masdar is a global leader in renewable energy and sustainable urban development, with headquarters in Abu Dhabi. Over the past decade, Masdar have pioneered commercially viable solutions in clean energy, sustainable real estate and clean technology in the UAE and around the world.

2.3.2 ESIA Consultants

The Developer has commissioned AECOM to lead the Project ESIA study, ESIA consultation and ESIA reporting.

AECOM is a global leading engineering and environmental consultancy providing professional technical and management support services to a broad range of markets including power and renewables, with experience supporting more than 15 gigawatts in solar power around the world.

AECOM has partnered with Green Business Innovation, a leading environmental consultancy based in Uzbekistan, who will lead the field surveys and stakeholder engagement for the ESIA.

2.4 Overview of Project Construction and Commissioning Activities

2.4.1 Construction

The construction is planned to start in 2023 and is expected to last approximately 18 months, with first power targeted in 2024. The key stages of construction, from mobilisation of workforce to commercial operation date.

Construction activities will comprise:

1. Site preparation:
    - Temporary fencing of the Site
    - Vegetation clearance
    - Earthworks, including ground levelling (cut and fill), installation of drainage ditches, trenching for cables, construction of internal site tracks. Excavated material will be re-used within the Site for backfilling as much as possible (subject to geotechnical suitability) in order to reduce the need for aggregate to be brought to Site from elsewhere
2. Project infrastructure:
    - Construction of temporary storage areas, administration building, security
    - Construction of transmission line
    - Construction of accommodation camps
3. PV power plant installation:
    - Import of components to Site
    - Installation of foundations and mounting structures
    - Installation of solar panels
    - Installation of other equipment (inverters, substation)
    - Installation of lattice steel towers for the connection to the national grid substation
    - Installation of export cables
    - Connection to national grid substation
4. Commissioning of the PV plant:
    - Mechanical and visual inspection
    - Electrical and equipment testing

- Commencement of electricity supply into the grid

5. Site clean-up and reinstatement.

2.4.2 Operation

Masdar will be responsible for the design, build, finance, operate, maintain and transfer (DBFOMT) of a solar PV power plant. During the operational phase, JSC National Electric Grid of Uzbekistan will purchase the generated electricity as per the Power Purchase Agreement (PPA).

After commissioning, the transmission line will be transferred to JSC National Electric Grid of Uzbekistan for operations and maintenance. JSC National Electric Grid of Uzbekistan will be responsible for the maintenance of the safety protection zone under the transmission line including vegetation management and land use close to the line.

Operation and maintenance of the facility will include:

- Replacement of faulty PV modules
- Repair of inverters and other ancillary equipment
- Periodic cleaning of PV modules depending on soiling and sand/silt accumulation
- Delivery of water and emptying the septic tank
- General upkeep of the territory within the Solar PV Site

A preventive maintenance program will be established for maintenance of the inverters; mounting structures; surge arresters, cables and PV junction boxes; meteorological station; security, fencing and gates; ditches and drainage culverts; and all sub-station components, including services and septic tank.

2.4.3 Project Staffing

Masdar confirm that the typical workforce during the peak construction period 1,146 workers for a solar PV plant of this size. During the early stages of construction, the worker numbers will be low (under 100) but will rise quickly from month 5 when the civils work begins. After the peak level has been reached, the local workforce will gradually be reduced leading up to the start of operations.

The workforce will comprise a mix of highly qualified specialists, technicians and low-skilled personnel. Low-skilled construction workers will receive job-appropriate training before starting work on the Project. This includes basic training on health, safety and environment (HSE), labour management and, where required for specific job profiles, vocational training.

The construction workforce is expected to consist of a combination of nationals and expatriate workers, with the majority being locals preferentially sourced from the surrounding towns and villages. Qualified specialists will be sourced both nationally and internationally, depending on the skills availability.

2.4.4 Decommissioning

A typical design life of a solar PV facility is 20–30 years. The Project components will be continuously maintained throughout the lifetime of the Project. The condition of equipment will be reviewed at the end of the design life to determine whether it remains in a viable condition to continue operation after that time. The facilities may be upgraded or renewed based on the cost-benefit analysis.

The Project will be dismantled once it is no longer economical, and the land plot reinstated to its current state (albeit not reprofiled). Decommissioning of the PV power plant is expected to require 6–8 months to complete.

During decommissioning, all above ground infrastructure will be removed. It is anticipated that the redundant solar PV panels will be either recycled or sold for reuse, depending on market conditions at the time.

Below ground infrastructure such as buried cables will be removed to a depth of 0.5 m and backfilled with topsoil.

The site will be re-seeded with plants consistent with surrounding areas. The success of bio-restoration will be monitored for two dry seasons following decommissioning, and remedial actions will be taken at locations where rates of restoration are below the expected levels.

The decommissioning will abide by the relevant legislation and regulations that are applicable at the time and decommissioning will be planned at least six months in advance.

2.5 Legal and Policy Framework

2.5.1 Uzbekistan's Green Economy Strategy

Uzbekistan's strategy for transition to a green economy in the period of 2019–2030 was approved by the Resolution of the President of the Republic of Uzbekistan dated 04.10.2019 No. PP-4477 (the "Resolution"). This Resolution was adopted to ensure fulfilment of obligations under the Paris Agreement on climate change signed by Uzbekistan on April 19, 2017, as well as the implementation of the Action Strategy for five priority areas of development of the Republic of Uzbekistan in 2017–2021.

2.5.2 Requirements of the National EIA Procedure

There are specific requirements as to the content, development procedure and examination of Environment Impact Assessment (EIA) documents. These are governed by the following legislative acts of the Republic of Uzbekistan:

- Law of the Republic of Uzbekistan No 754-XII dated 09.12.1992 "On Environment Protection"
- Law of the Republic of Uzbekistan No 73-II dated 25.05.2000 "On Environmental Impact Audit"
- Regulation "On State Ecological Expertise in the Republic of Uzbekistan", approved by the Decree of the Cabinet of Ministers of the Republic of Uzbekistan No 491 dated 31.12.2001.

2.5.3 International Best Practice Guidelines

The International lenders involved with the Project require projects that they finance to meet the following international standards:

1. The Equator Principles (Equator Principles Association, 2020)
2. IFC Performance Standards (IFC, 2012)
3. IFC Environmental, Health and Safety (EHS) General Guidelines, including wastewater and ambient water quality, waste management and hazardous materials management, noise management, occupational health and safety, and construction and decommissioning guidelines (IFC, 2007)
4. IFC EHS Guidelines for Electric Power Transmission and Distribution (IFC, 2007)
5. Asian Development Bank (ADB) Safeguard Policy Statement (ADB, 2009)
6. European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy, including Performance Requirements (EBRD, 2019)
7. European Investment Bank (EIB) Environmental and Social Standards (EIB, 2022)

These are all specific policies, procedures, strategies and regulations designed for promoting sustainable development. These procedures include a detailed environmental review process prior to final approval of financing for the Project, detailed environmental guidelines, detailed health and safety requirements, procedures for social impact assessment and public consultation and information disclosure and many other issues, associated with project construction, operation and decommissioning.

3. Environmental and Social Assessment Methodology

A number of criteria were used to determine whether or not a potential impact of the Project could be considered 'significant'. Wherever possible, a quantitative assessment of the impacts was undertaken. Where this was not possible, a qualitative assessment of impacts was made by technical specialist, based on existing information available for the site and the surrounding study area, and their experience with other solar PV developments.

The technical specialist who undertook the ESIA study used a number of steps as follows:

- Baseline study: The collection of relevant information on the current status of the environment. This study provides a baseline against which change due to the development is measured.
- Impact prediction and Assessment: Impact prediction involves forecasting the likely changes in the environment that will occur as a result of the development. Impact Assessment requires interpretation of the importance or significance of the impacts to provide a conclusion or recommendation to the decision-makers who will impose conditions that must be satisfied before the solar plant can be built.
- Assessment of cumulative impacts: This assessment will identify those combined impacts which may arise from other existing or planned developments in the area.
- Mitigation: Mitigation involves taking measures to reduce or remove environmental impacts.
- Assessment of residual impacts. This will be the impacts remaining following the application of mitigation measures.
- Monitoring: Follow up monitoring has been described in ESIA Report and includes the monitoring of impacts once the mitigations have been put in place.

3.1 Stakeholder Engagement Programme

As part of the ESIA study, AECOM is carrying out ongoing stakeholder engagement programme. The programme comprises several stakeholder engagement activities which aim to:

- Build and maintain stakeholder relationships
- Gather information on the local environmental and social issues
- Continue to disclose Project information (including any access restrictions, employment and procurement opportunities, and community health and safety issues)
- Monitor and evaluate stakeholder engagement
- Provide stakeholders the opportunity to provide feedback
- Manage grievances from the community and workers.

This section presents a summary of the stakeholder engagement programme, namely in two parts: previous engagement activities and future engagement activities.

The details of the stakeholder engagement programme as well as the applicable regulatory framework, the stakeholder identification and analysis process, and details of the Grievance Mechanism (GM), will be document in the Stakeholder Engagement Plan (SEP), currently under development. The SEP (and the engagement programme) is a ‘live’ document that will be updated as the Project progresses.

Issues identified during the stakeholder engagement process have been recorded in the assessment of impacts and appropriate mitigation has been developed where appropriate.

4. Environmental and Social Impacts

Following the identification of the main environmental and social baseline features, the likely impacts have been predicted. In all cases an assessment was carried out which measured the extent of the impact as a deviation from the baseline conditions. The significance of each impact was categorised and for significant impacts, further mitigation measures have been proposed.

4.1 Key Impacts

4.1.1 Air Quality

Air pollution may arise as a result of dust emanating from vehicle movements and other construction activity. However, this will be a temporary effect that can be mitigated by restricting vehicles to sealed access tracks and the use of dust suppression measures.

The Project impacts may include:

- Dust and engine emissions created by construction activities (i.e. earthworks, demolition and operation of machinery) could influence the local ambient air quality.
- The release of exhaust emissions to the atmosphere could have an effect on the local ambient air quality.

The rural nature of the site, the expansiveness of the landscape and the limited amount of traffic present mean that vehicle emissions are not predicted to be significant. As a result, the air quality assessment considers only dust emissions.

The potential impact during construction is considered to be Medium adverse, on the basis that two residential receptors are approximately 100m from the site boundary and construction vehicles would pass closer to and from site. The implementation of Good International Industry Practise pollution prevention measures is considered very likely to reduce the impacts. However, additional mitigation measures are required. The following key mitigation measures can reduce the impact to Low:

- Identifying strategies to manage dust on the road during the execution of the Project.
- Provision of designated wash down area to spray and wash wheel spokes, tires and around the wheel opening of all vehicles entering and exiting the construction compound.
- Use of properly maintained vehicles and construction equipment with emission controls.
- Communicate project risk to local communities and address concerns accordingly. Monitor any complaints filed (via grievance mechanism) from local stakeholders as an additional tool to monitor dust management measures.

4.1.2 Archaeology and Cultural Heritage

The Project is not deemed to have a direct adverse impact on any international or nationally recognised cultural heritage. No significant archaeology or cultural heritage assets are currently known from within the Solar Array area. It is not located in an area of known archaeological potential –although it has a south-facing aspect, there are no presently identified remains from this upland valley. Known remains in the surrounding region focus on river valleys, prominent strategic positions, caves and rock shelters. The area has been subject to previous ploughing, which may have levelled any earthworks and resulted in minor damage to any underlying archaeological deposits.

The impact is assessed as Medium prior to additional mitigation measures being implemented. The following mitigation measures can reduce the residual impact to Negligible:

- Training workers on the importance of archaeological and cultural resources and how to deal with them through toolbox talks.
- In case of chance find, the work should be halted and the area protected and the matter reported immediately to the Department of Culture for appropriate action.

4.1.3 Biodiversity

4.1.3.1 Avifauna

The proposed project site is not located on a major flyway or in a geographical feature that would concentrate migrating species. Survey work has confirmed that the Project site is not important for breeding or migrating species, including species of international and national conservation concern.

Construction impacts are likely to include habitat loss as well as disturbance impacts in the Project and adjacent areas. If site clearance and construction activities should occur during the bird breeding season (typically March-August for most species) this could result in the destruction of and/or damage to nests to ground nesting birds, including Egyptian nightjar, black-bellied sandgrouse, crested lark and isabelline wheatear, none of which have been identified as Priority Biodiversity Features (PBFs)[1]. The existing habitat within the Solar PV and most of the Overhead Line route is Modified Habitat as defined in PS6.The degraded nature of the project site and the relatively small number of birds encountered mean that there is not likely to be a significant impact on resident bird species.

[1] PBF is a term used in the EBRD's Performance Requirement 6 relating to biodiversity conservation, and includes species classed against specific criteria including those identified as Vulnerable, Endangered or Critically Endangered on the IUCN Red List, or at the national/regional level.

Habitat loss associated with construction is unlikely to result in a significant impact to migrating birds as no major attractant features (e.g. lakes / wetlands) will be lost. As a result, there are not anticipated to be any impacts on resting or stopover sites for migrating birds.

As a result, the impacts have been assessed to be the following for bird species:

- Negligible and Low for PBF bird species and not significant for the Solar PV and the Overhead Line, respectively.
- Low for all bird species (non PBF) and not significant for the Solar PV and Overhead Line, respectively.

However, it is recommended the following standard mitigation measures are implemented to ensure the residual impact is Low and not significant:

- Environmental toolbox talks prior to, and during, construction to raise awareness, limit conflict and reduce additional disturbance to fauna and avifauna.
- Bird divertors installed on new overhead lines at sensitive locations.

4.1.3.2 Terrestrial Ecology

Construction of project infrastructure within the Solar PV site will result in direct loss of habitat, which is used by animal species. Project activities during this phase may result in loss of connectivity between habitat areas for faunal species due to construction activities, as well as degradation of this connecting habitat. The most sensitiveperiod for reptiles is likely to be the winter hibernation period when reptiles are less active and usually underground (October-early March for most reptile species).

Animals are likely to be disturbed by the presence of people in the landscape, vehicle movements, noise and vibration from construction activities. The greatest potential for disturbance will be during site clearance and construction phases, particularly during site activities such as access road creation and earth moving, solar farm infrastructure piling and pylon construction.

The Project area is remote from any internationally recognised sites and nationally designated sites recognised sites and there are no potential pathways in terms any significant direct or indirect impacts during the constructionphase.

In terms of the Overhead Line, the works do coincide with the Karasu River crossing riparian habitat and the Khaudag, which are sensitive habitat areas for reptiles. There is potential for displacement of fauna (including reptiles) as the presence of humans and construction activities may deter animals from using areas adjacent to theconstruction footprint. However, considering the vast extent of similar natural habitat within the wider landscape, any displacement disturbance is expected to be very localised and not significant. Reptiles are generally mobile and adaptable and will be able to find alternative locations, given time to do so.

The impact was assessed on a PBF species: Tajikistan Toadhead Agama and was found to be Medium and significant prior to mitigation. There is a requirement for the project to achieve Net Gains for this Critical Habitat qualifying species. The mitigation measures required to achieve net gain will be detailed within a Biodiversity ActionPlan (BAP) for the species.

The impact was also assessed on another PBF species (Southern Even-fingered Gecko) and on a precautionary basis, the impact is assessed as High and significant. A suite of both standard mitigation measures and species- specific measures will be implemented to ensure impacts are not significant.

There is a requirement for No Net Loss of habitat that supports Southern Even-fingered gecko. A suite of both standard mitigation measures and species-specific mitigation measures will be implemented to ensure impacts are reduced to Low and not significant below:

- Implement robust management measures to ensure good construction practice within the proposed project site.
- Employ an ecologist during construction to oversee implementation of the BMP.
- Record sightings of Houbara bustard and Sociable lapwing within the vicinity of the site.
- Tortoise holes cut in selected parts of the perimeter fence to enable free movement.

4.1.4 Geology and Soils

The main impact on soils during construction will be the potential for soil contamination from spills and leaks and increase in vulnerability to erosion. Soil compaction and loss of limited vegetation present increases in the soils' vulnerability to erosion. Soils will be particularly vulnerable when wet (i.e. during snowmelt or heavy rain), when vehicle traffic is likely to cause the greatest damage.

Where roads are un-surfaced, rutting and gully erosion eventually make the roads impassable so that vehicles drive off the track and the area affected by erosion continually widens. Soil compaction and loss of limited vegetation present increases in the soils' vulnerability to erosion. Soils will be particularly vulnerable during the rainy seasons, when vehicle traffic is likely to cause the greatest damage.

Electrical equipment (transformers, inverters, electrical switchgear) heavy duty equipment and ancillary buildings (office building, meteorological towers) are usually earthed by means of surface mats. The existence of a very low strength layer of soil up to a depth of around 2.10 meters, suggests the likely existence of partial collapsible areas that could develop until reaching the surface. It is considered that collapse behaviour can take place within this superficial unit in different areas of the PV parcel. Consequently, it is not advisable to rely on the strength of this soil to support any foundation but to go through it and lay foundations on underlying sandy and gravelly layers. This will be confirmed during future studies by the EPC.

As a result, the significance of the impact is assessed as Low. The extent of reduced soil quality due to construction activities is considered local, and the duration assessed as being temporary and short-term. The following key mitigation measures can reduce residual impact to Negligible:

- Run-off and erosion control features included in all civil designs by contractor.
- Demarcate storage and staging areas and store all materials, equipment and vehicles in these areas to reduce soil damage.
- Vehicles confined to demarcated roadways.
- Store all materials within designated areas of temporary storage facilities and provide supplies to clean-up of minor spills.

4.1.5 Hydrology and Hydrogeology

4.1.5.1 Surface Water

There are no permanent waterbodies within the Solar PV Site. Gullies, running through the site in west to east direction, have been caused by surface run-off. There are two permanent watercourses near the Solar PV Site boundary.

Surface water may be subject to reduction in quality should proper mitigation not be implemented. The watercourses adjacent to the site currently provide drinking water for livestock.

During construction, earthworks, road construction and use of heavy vehicles could alter surface drainage patterns. The removal of vegetation and compaction of soils will reduce infiltration and surface run-off will increase. The risk is greatest during severe precipitation events, which are most likely to occur in spring. The increased volume of water flowing into drainage channels is likely to cause additional soil erosion. Surface run-off will also contain higher concentrations of suspended sediments during construction than would otherwise be the case. Other potential sources of pollution during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater.

As a result, the significance of the impact is assessed as Low. The extent of reduced surface water quality due to construction activities is considered local, and the duration assessed as being temporary and short-term. Nevertheless, Good International Industry Practise pollution prevention measures will be implemented as following to reduce the residual impact to Negligible:

- Buffer distance of 25m applied to the seasonal watercourses and irrigation channels.
- Routes of roads to be selected to avoid existing drainage channels or depressions where possible.
- Culverts or other drainage control features should be installed where crossings of drainage routes are unavoidable and to prevent ponding of surface water on the upstream side.

4.1.5.2 Groundwater

The amount of water required during construction is estimated at 45,840 m^3. The source of water required for construction has not yet been determined but it is recommended that water is delivered by tanker and not from groundwater well.

Local communities within the vicinity of the Project use wells for drinking water.

Potential sources of pollution to groundwater during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater. During construction, sanitary waste will be collected in containers below portable toilets and transported to a registered waste disposal facility for disposal. Storage and handling procedures for oils and other chemicals will be required to minimize risk of pollution.

Potential impacts on groundwater include:

- Accident/ unplanned event: Groundwater could be contaminated through accidental fuel spills.
- Accident/ unplanned event: Depending on the method of waste disposal, impacts could be felt on surface or groundwater, flora and fauna and/ or local communities.

The potential impact during construction is considered to be Low adverse, on the basis that no farmers abstract groundwater for their use. The implementation of Good International Industry Practise pollution prevention measures is considered to make the contamination of groundwater very unlikely. Good International Industry Practise pollution prevention measures will be implemented, reducing the residual impact to Negligible.

4.1.6 Labour and Working Conditions

During the construction phase, there may be occupational health and safety risks to workers from the various operation and maintenance activities expected to take place for the Project. Key risks could include, *inter alia*, collision with vehicles and plant and exposure to a variety of hazards such as electric shock from exposed cables and thermal burn hazards and exposure to chemicals, hazardous or flammable materials.

Labour and working conditions, including occupational health and safety impacts, are considered to be of medium-term duration throughout the construction phase and are expected to be of potential high magnitude and high sensitivity as in extreme cases they could entail permanent impacts (e.g. death or permanent disability). As such, the impacts are considered to be of High impact and appropriate mitigation will be developed.

Pre-mitigation, the impact is assessed as High and significant. The following key mitigation measures can reduce residual impact to Low:

- Comply with 'governing regulations' and international best practise.
- Establish a permit to work system for all high-risk activities (i.e. hot works, confident space, working at high etc.)
- Train employees on the importance of occupational health and safety requirements and develop work instruction.
- Strictly enforce the use of the Personal Protective Equipment to minimise the accidents.

4.1.7 Landscape and Visual

The sensitivity of the site as a landscape receptor is considered to be low. The landscape is not protected and is not considered to be important in a local context. Existing man-made features (including power lines) further detract from the already low landscape quality. Owing to the arid nature of the environment and the fragility the soil often remains un-vegetated, detracting from the landscape character at the local scale.

Visual receptors are considered to be of medium sensitivity. This is because the land at which the Project is located is flat, with very few trees, hedges or fences to obscure visibility, and as such visibility can extend for several kilometres.

As a result, the significance of the impact on landscape character is assessed as Low. Although impacts will be visible in places, the surrounding features are often of a larger scale in height and extent. Therefore, changes can be easily accommodated. The residual impact is predicted to be Low and not significant.

Additionally, the significance of the impact on visual amenity is assessed as Medium. Although impacts will be visible in places, particularly at the cemetery, the surrounding features are often of a larger scale in height and extent. Therefore, changes can be generally accommodated. The following key mitigation measures can reduce

residual impact to Low and not significant:

- Remove in a timely manner all the construction machinery, equipment and vehicles that are not in use and keep them in specific locations within the Project site.
- Conduct demobilization audit prior to EPC leaving site to ensure that site conditions are acceptable for handover to the operations team.

4.1.8 Noise

Noise pollution may result from the large workforce and construction activities, particularly the movement of trucks used to carry material to the site and removal of debris. Some heavy earth moving, and compacting machinery may be required for brief periods during construction but it is expected that much of the civil work will involve manual labour. Work will not take place at night.

The Project impacts may include:

- Truck and vehicle traffic along main transport/access routes will create noise and vibration that may increase ambient noise levels.
- Construction equipment and machinery could create noise and vibrations that may increase ambient noise levels.

The construction of the substation building / transformers and inverters are considered a worst-case construction noise scenario. Typically, associated construction activities within a 200 m distance from noise sensitive receptors have the potential to result in increased construction noise at receptor locations. It is expected that buffer of 100 m may not be maintained between site boundary fence and residential receptors on the southern boundary of the site. As a result there may be an increase in noise levels at these locations. The potential impact during construction is considered to be Medium adverse, on the basis that residential receptors are 100m from the site boundary. The implementation of Good International Industry Practise pollution prevention measures as listed below is considered to reduce the residual impact to Low adverse:

- Adopt and follow best practicable means to ensure that the quietest available plant and construction techniques are used.
- Where appropriate, micro-siting is to be undertaken to ensure construction noise impacts are minimised and equipment is located as far as possible from noise sensitive receptors (NSRs). NSRs include on-site accommodation.
- Restrict all construction activities to daytime during normal working hours.

4.1.9 Socio-economic Impacts

The following potential socio-economic impacts were assessed:

- Local communities and the local economically active population may develop high expectations of the direct or indirect benefits of the Project, specifically regarding the number of work opportunities available. High expectations for jobs for the local communities will need to be continually managed from the early stages to avoid unrealistic Project expectations. The overall impact significance on community expectations of the Project is Low. This is an adverse impact and the ongoing consultation and dissemination of Project information through the SCA and LRP process will be included in the Stakeholder Engagement Plan. This impact will be continuously managed throughout the construction phase (and ongoing operation phase) applying the following key mitigation measures to reduce the residual impact to Low:
    - Develop Local Recruitment and Employment Plan to encourage & maximize local workers, vulnerable persons and women in the workforce including retention and promotion.
    - Communicate employment estimates, timeframes and skills requirements clearly to the community.
- There are three communities located near the Solar PV Area, but based on engagement findings they do not make use of the site. Herders occasionally use the Solar PV Area during the spring months, however all interviews with Makhallas and herders around the site suggested that the Project area is of inferior quality to the surrounding grazing land of which there is an abundant amount.

- Most of the land required for the overhead transmission line falls into households whose leaseholds are used for the purposes of commercial farming. Therefore, regarding economic displacement, the overall impact significance is Medium and specific mitigation in the form of cash compensation and livelihood restoration has been developed. Post-mitigation, the residual impact is expected to be Low.

- A boundary fence line shall be installed at the start of construction activities to prevent the entry of unauthorised personnel into working areas to maintain public health and safety. From the moment the fences are erected, local people from the area will lose access to footpaths inside the Project site. This shall result in longer time periods being required to move between locations when the footpaths are generally used. The change in land use in the Project area may result in change in local livelihoods mainly as a result of the reduction in available grazing area and reduction in income. The impact from a loss of public access to footpaths inside the project area is assessed as Low adverse, primarily because the local farm users will need to adapt and readjust to their new timings and distances compared to baseline conditions. There is currently no mitigation proposed. The residual impact is identified as Low.

- The impact from reduced access to grazing and pastoral land will commence at the start of construction as working areas are fenced off to prevent unauthorised entry inside the site boundary. The change in land use in the Project area may result in change in local livelihoods mainly as a result of the reduction in available grazing area and reduction in income. Site clearing and grading will affect farming activities in the area. Transportation of waste from the site and materials and equipment by road may disrupt local livelihoods. No physical resettlement will be required therefore there is no need to undertake a Resettlement Action Plan. Within areas where construction works are ongoing, spatial impacts to access to grazing and pastoral land (in contrast to distance and time-altering impacts from the mobility impact above) will occur arising from a loss of access to grazing and pastoral land. At this stage the number of people using the land in the Project area and therefore the number of people who will be affected by loss of access to this land is unknown. The receptor's sensitivities is predicted to be Medium, depending on their access to alternative land. This will need to be investigated further in the SCA/LRP. All people interviewed said the land is of such poor quality and herders don't use it much. Based on the information available the impact is assessed as Low adverse, pre-mitigation. This impact will be continuously managed throughout the construction phase (and ongoing operation phase) applying the following key mitigation measures to reduce the residual impact to Low:

    - Implement measures to ensure access to local villages is not adversely affected by the fencing of the Project area. Appropriate signage should be erected around the site.

    - Area from north to south will be maintained open during construction and operation, this includes access to the graveyard which has been excluded from the site.

- Community H&S may be at risk from worker migration and the presence of workers in the Project area, resulting in a potential change in the disease profile of the local population. A more robust social baseline study will expand on communicable disease morbidity, crime incidence and risks of sexual exploitation. Additionally, local workers may be exposed to potential COVID-19 risks where they are employed on the workers' camp. In turn this could result in further spread of COVID-19 back to the local community. The potential impact during construction due to increased presence of workers and interaction with local communities is considered to be Medium adverse pre-mitigation. This impact will be continuously managed throughout the construction phase (and ongoing operation phase) applying the following key mitigation measures to reduce the residual impact to Low:

    - Workers accommodation designed in compliance with the IFC/ EBRD Guide for Workers Accommodation and will not be based on site but rather use existing accommodation available

    - Health screening and quarantine if necessary, carried out in accordance with Covid-19 MP.

    - Identify opportunities to support local public health campaigns that focus on prevention of communicable diseases.

- In addition to the expected workforce, during the construction phase, private security personal shall be used to provide general security at construction working areas to ensure that there is no entry of unauthorised personnel and that construction equipment is safe and secure. There is the potential for security personnel to use excessive force that results in intimidation or even physical damage, acting as a trigger event to further potential conflicts and Human Rights risks. The potential impact from increased presence of security personnel during construction is considered to be Medium adverse, pre-mitigation. This impact will be

continuously managed throughout the construction phase (and ongoing operation phase) applying the following key mitigation measures to reduce the residual impact to Low:

  - Ensure that Project security is aware of the Project's goals to establish good relationships with local stakeholders; the grievance mechanism for communities to voice concerns; and receives human rights and cultural sensitivity training to ensure the respect and protection of the local community.
  - Include policy requirements to prevent Gender Based Violence and Harassment (GBVH) of community members by the construction workforce.

- Baseline data has found that the three are generally relatively high levels of physical, sexual, economic and social violence in Uzbekistan, including sexual exploitation, domestic violence; gender disparities in higher and technical education; and a high female unemployment rate accompanied by a low proportion of women in leadership positions, particularly in for rural communities. Project workers could use their financial status to engage in sexual exploitation of local people, including vulnerable women and girls. This could be in the form of prostitution or other forms of transactional sex where money or gifts are used to exploit local people, including those who are vulnerable due to poverty and children. Project workers could exert domestic economic abuse over their family members, and particularly female spouses, because of the wages that they will earn during their Project employment. The receptor of this impact will be the children, women resident in communities located within the Project AoI, who have a High vulnerability. The potential impact during construction is considered to be Major adverse, pre-mitigation. It is expected that the introduction of specific measures to prevent and address GBVSEH, will reduce this to Minor.

4.1.10 Traffic and Transportation

It is estimated that up to 15,000 total vehicle movements will be expected to be carried out to/from the Project site. These numbers reflect what is anticipated to be required during the construction phase and may slightly decrease in number. It is anticipated that the Project traffic will use a combination of national roads and motorways which are of low sensitivity, However, local roads near the Project AoI experience limited vehicle traffic and are used by pedestrians, bicycles, animals, vehicles for personal use (e.g. cars, small trucks) and livestock. Furthermore, it has been noted by international agencies that Uzbekistan has relatively poor road safety records with the majority of fatalities being drivers and pedestrians The increase in traffic flow of larger vehicles, resulting from Project construction activities, will impact local road users and those receptors living and working alongside local roads in a number of ways:

- Increase in noise, vibration and dust creation;
- Increase in traffic and journey times;
- Disruption to businesses and day to day activities (e.g. livestock rearing);
- Accidental damage to community assets, crops and livestock which may lead to temporary loss of income; and
- Potential injuries to existing road users.

Those receptors living or working directly alongside local roads near the Project site will be more adversely impacted. The potential impact is assessed as Negligible at the national and regional level and not significant pre mitigation. Although no specific mitigation is required, standard good construction practice will be maintained to ensure no increase in predicted impacts during construction. At the local level potential impacts are assessed to be Medium and will require the project to prepare a traffic management plan to mitigate the impact. The plan will include safety measures such as a signals network and driving rules, measures to reduce the creation of dust, and community-related measures such as the use of the Grievance Mechanism for managing and rectifying cases where road users or local residents are injured as a result of Project traffic.

5. Mitigation and Enhancement Measures

The developer will prepare an Environmental and Social Management and Monitoring Plan (ESMMP) which includes all required mitigation. This will be implemented for the duration of the project. Mitigation measures will

be further developed during the preparation of the ESMMP, in line with National Environmental and Social Legislation, and International Standards and Guidance.

The impacts of the construction and operation activities of a Solar PV on air quality, noise, biodiversity, soil and ground/surface water quality, socio-economic profile can be mitigated through the adoption of best-practice construction methodologies, effective environmental management (e.g. control plans and emergency response procedures) and routine monitoring (e.g. environmental site audits, air quality and noise monitoring).

The mitigation measures presented will, for the most part, reduce potential and residual impacts to within acceptable or negligible impacts levels for all environmental and social parameters. There are only a few medium residual impacts related to impacts during operational phase related to archaeology and cultural heritage, terrestrial ecology and socio-economic profile that cannot be mitigated to negligible/low levels. The socio-economic profile includes impacts on land and livelihoods from land occupied by the project area, impacts from local employment during operation and impacts on the national and regional economy.

However, adhering to international best practice and guidance can minimise the potentially adverse impacts of the project. Furthermore, a SCA and LRP are currently being undertaken and the results would reduce the residual impact.

6. Next Steps

The general recommendation from the ESIA study is that the proposed Project should proceed but in order to ensure the environmental and social sustainability of the proposed Project, it is recommended that the developer implements the following:

- Further detailed design to be completed by the EPC Contractor and this may require further assessment of impacts.
- Implement the Project ESMS and CESMP to mitigate negative impacts and enhance the positive impacts. The CESMP requires that the proposed Project follows the recommended mitigation measures and livelihood and community benefit enhancement strategies.
- Project will carry out a skills audit and develop a Local Hiring Policy that would identify and prioritise local community employment opportunities to ensure gender equity in human resource recruitment.
- Implement the Stakeholder Engagement Plan and commit to a pro-active and continuous stakeholder engagement process to address emerging project issues and to continue the enlightenment of the community on Project benefits. Community engagement should be undertaken in close collaboration with the local administration (local representatives and the county leadership).